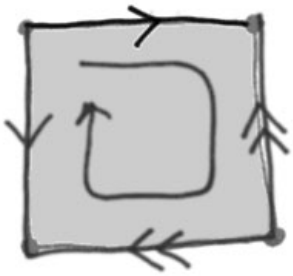
First Exam AA

Surfaces and Knots, Dave Bayer, February 21, 2002

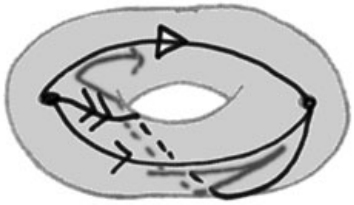
Answer Key

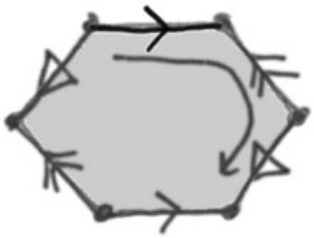
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

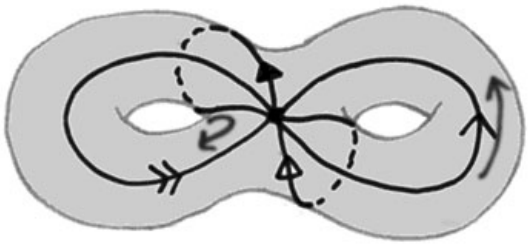
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

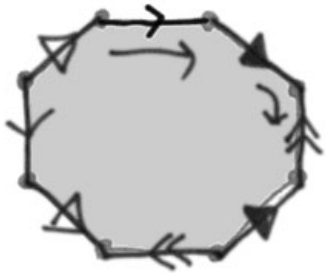




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

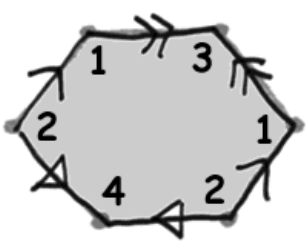
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



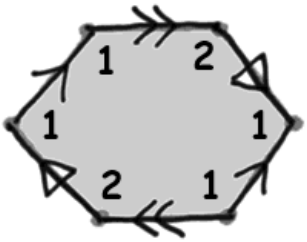


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

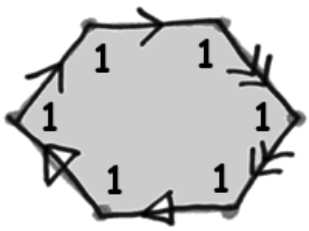
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



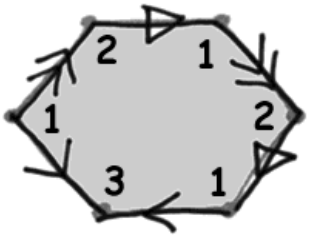
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



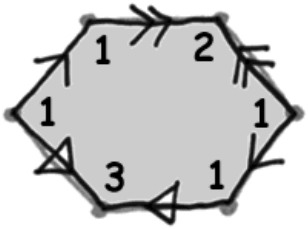
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



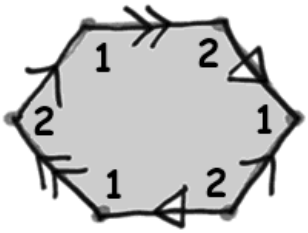
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



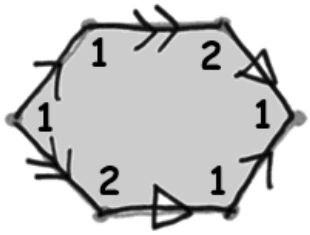
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



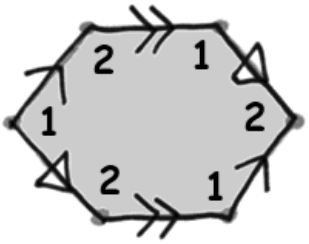
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

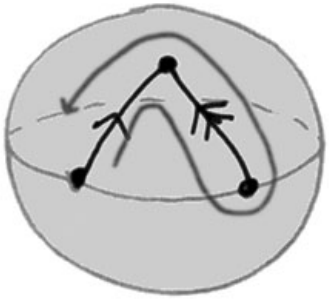
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

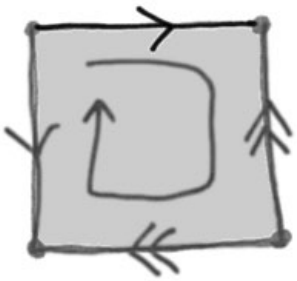
First Exam AB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

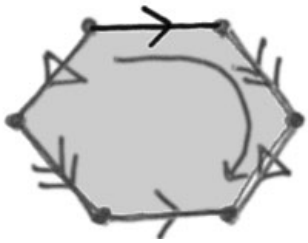
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





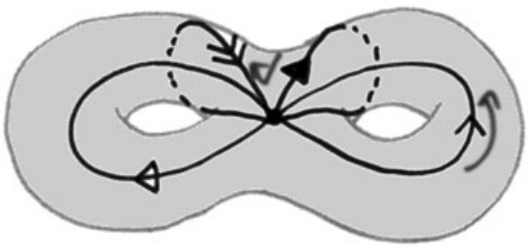
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

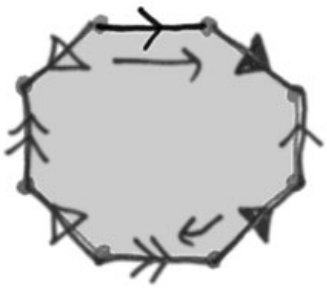
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

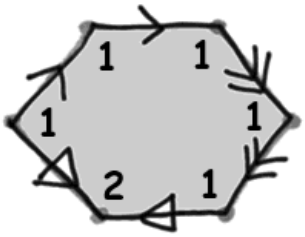
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



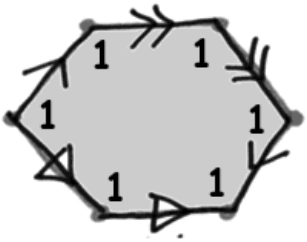


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

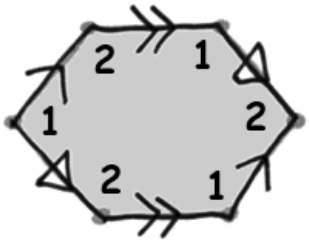
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



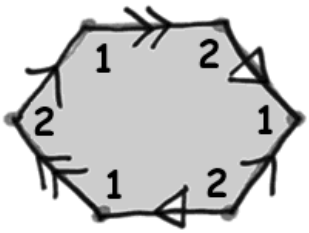
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



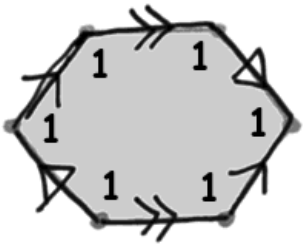
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



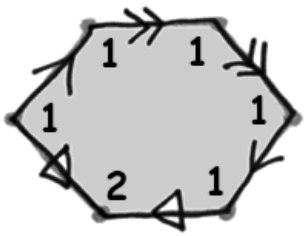
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



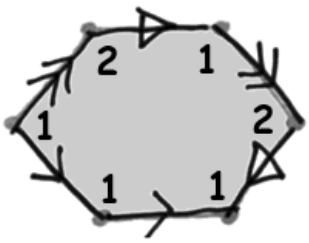
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



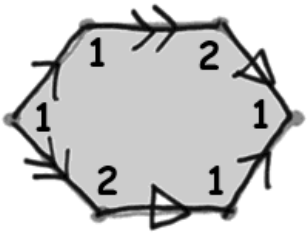
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

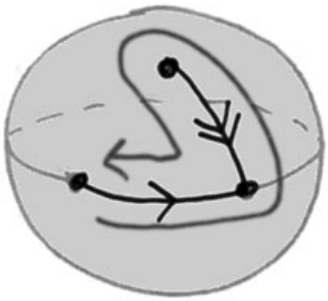
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

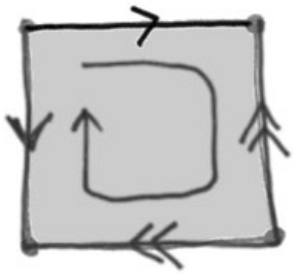
First Exam AC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

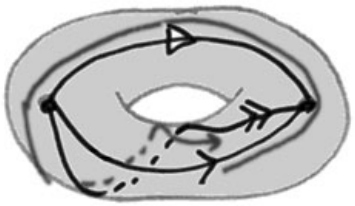
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

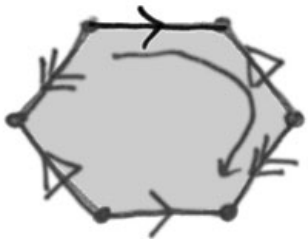




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

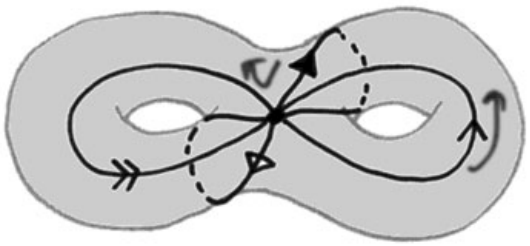
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

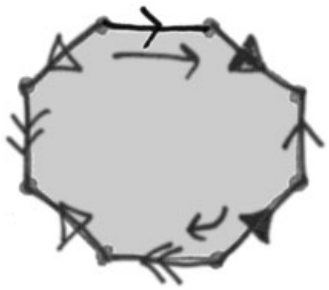




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

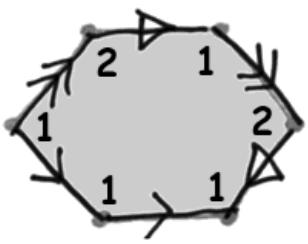
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



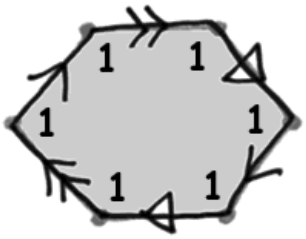


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

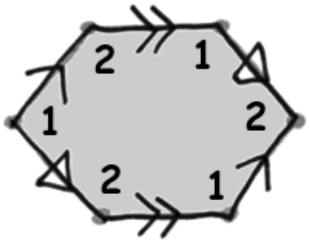
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



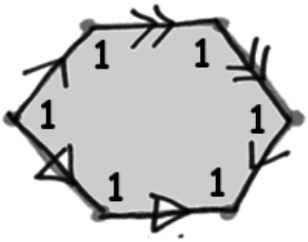
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



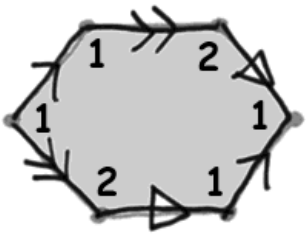
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



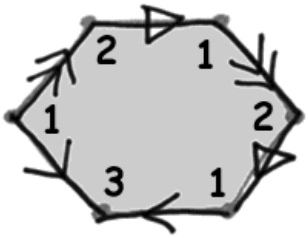
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



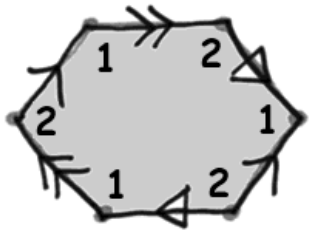
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



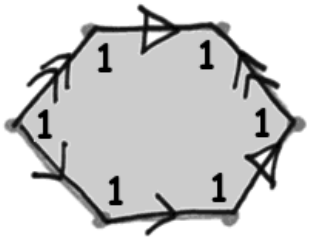
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

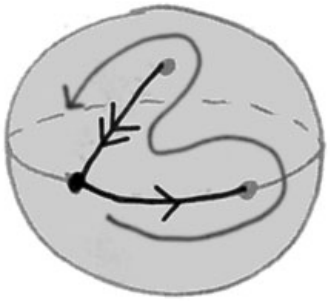
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

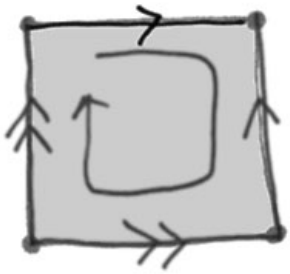
First Exam AD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



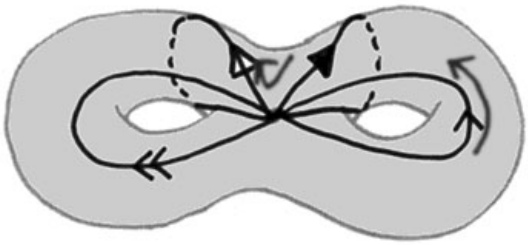


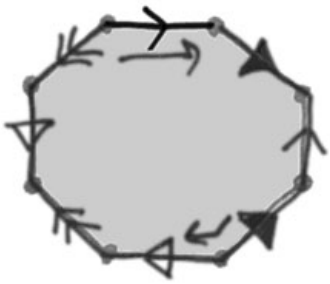
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

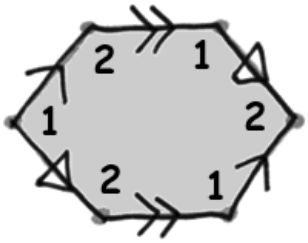
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



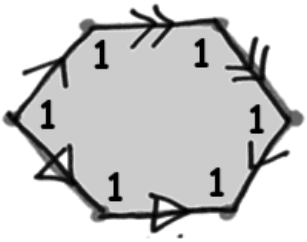


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

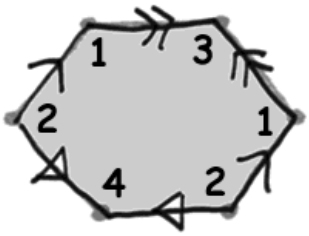
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



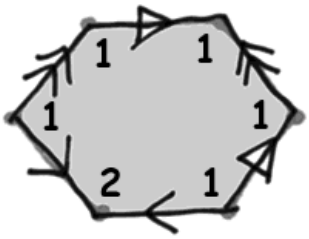
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



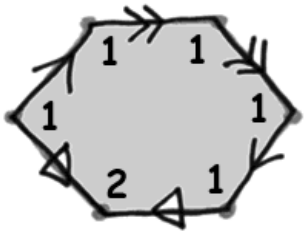
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



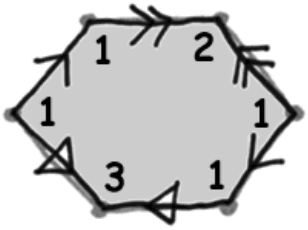
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



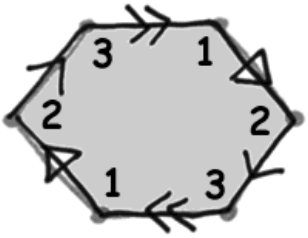
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



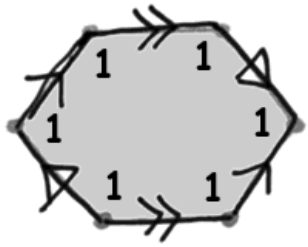
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

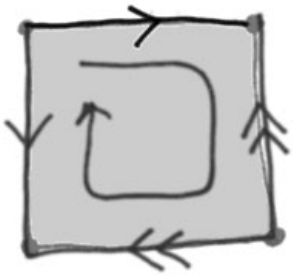
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam AE

Surfaces and Knots, Dave Bayer, February 21, 2002

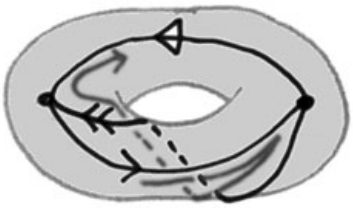
Answer Key

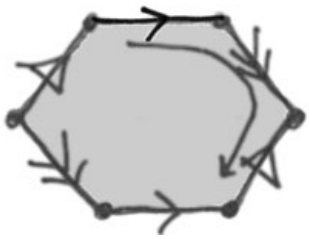
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

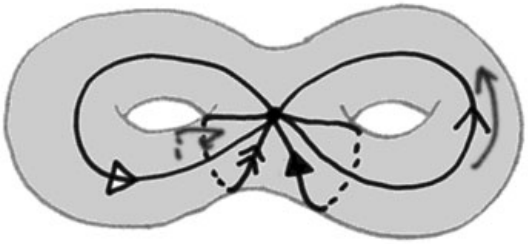
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

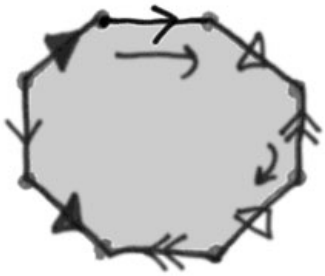




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

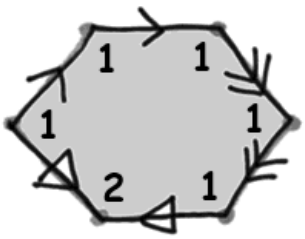
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



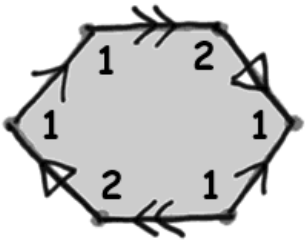


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

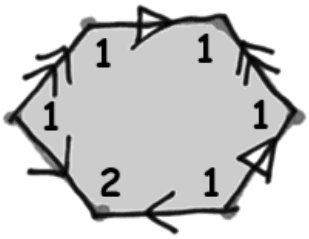
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



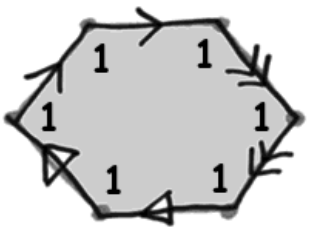
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



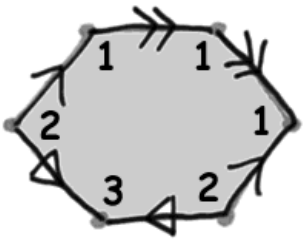
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



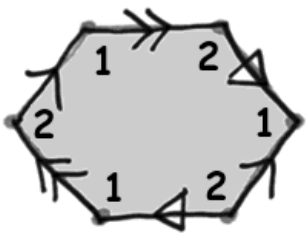
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



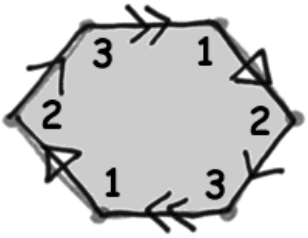
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



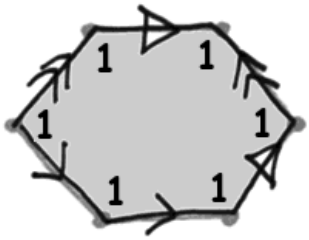
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

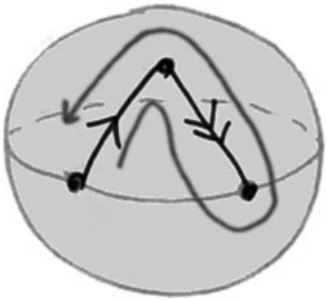
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

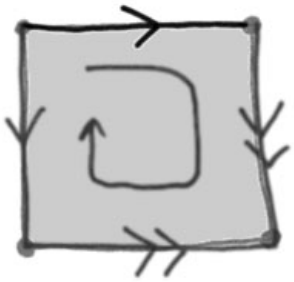
First Exam AF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

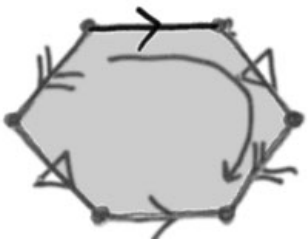
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





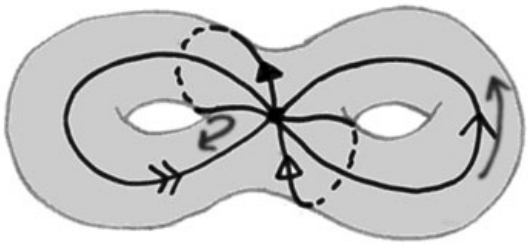
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

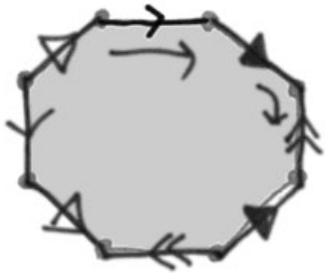
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

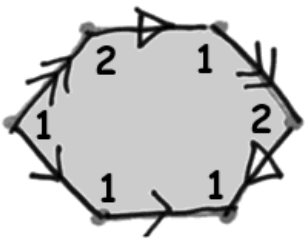
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



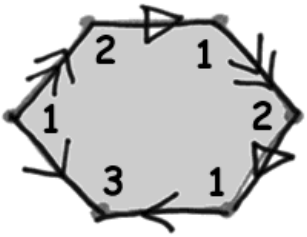


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

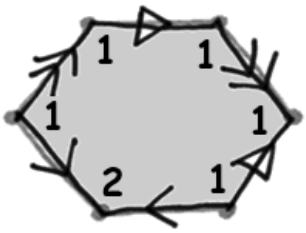
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



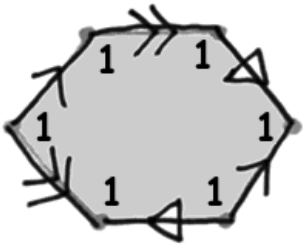
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



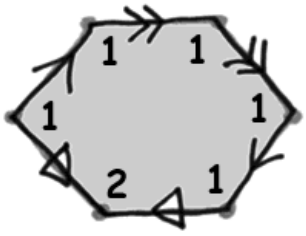
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



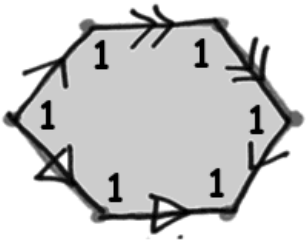
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



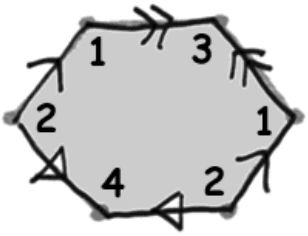
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



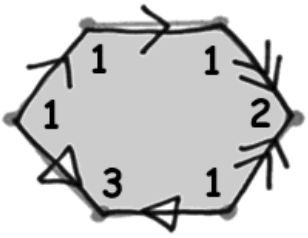
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

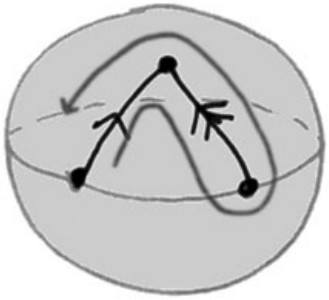
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

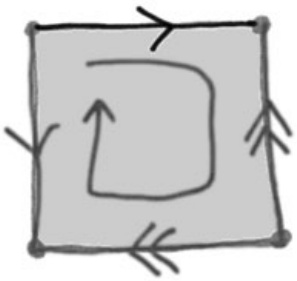
First Exam AG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

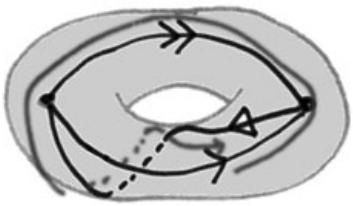
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

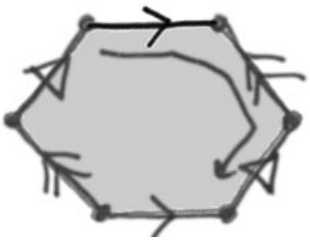




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

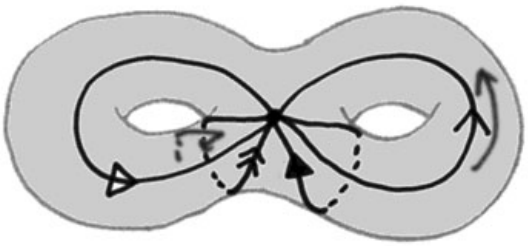
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

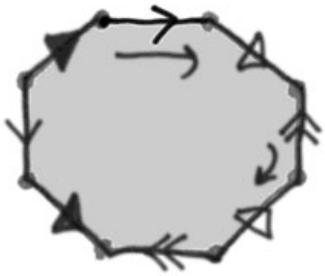




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

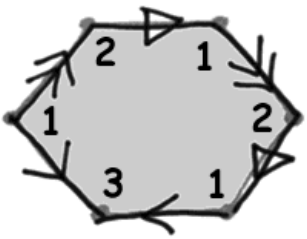
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



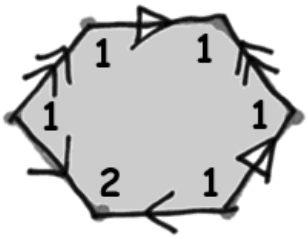


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

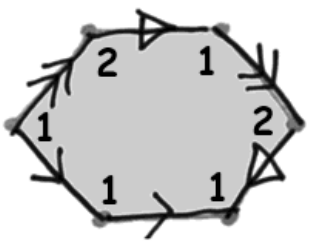
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



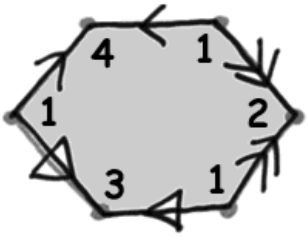
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



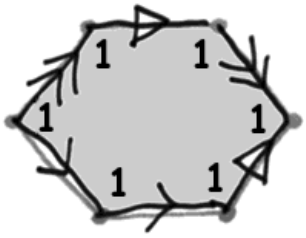
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



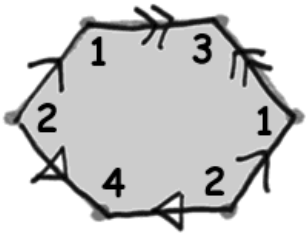
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



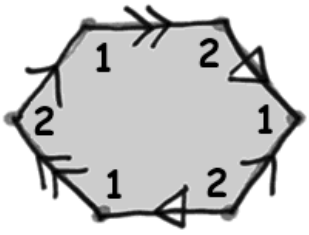
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



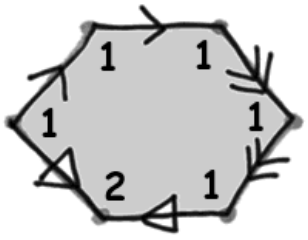
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

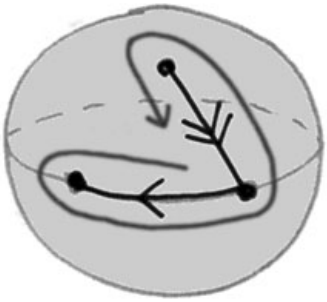
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

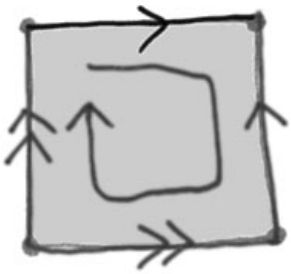
First Exam AH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

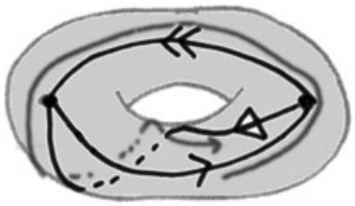
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

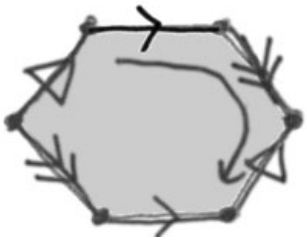




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

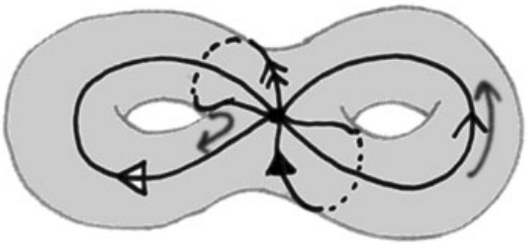
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

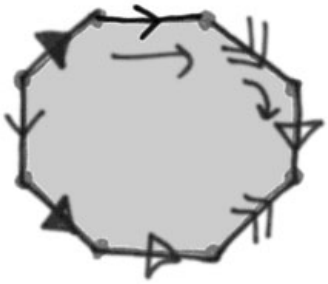




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

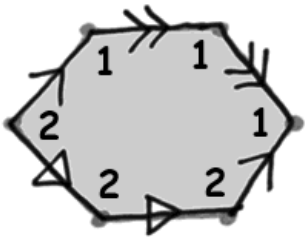
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



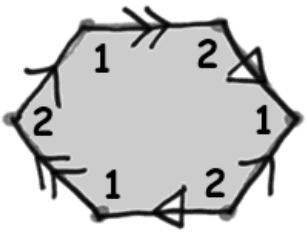


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

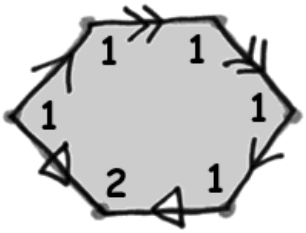
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



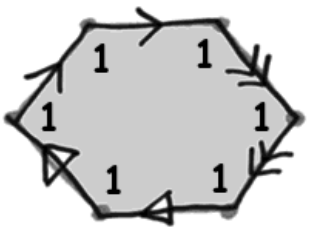
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



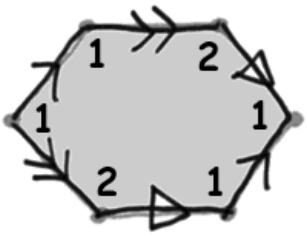
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



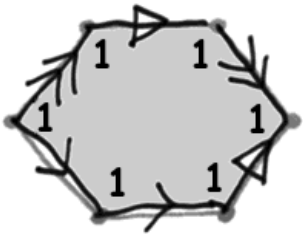
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



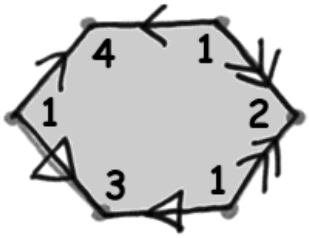
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



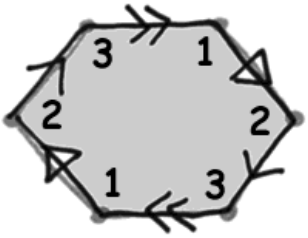
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

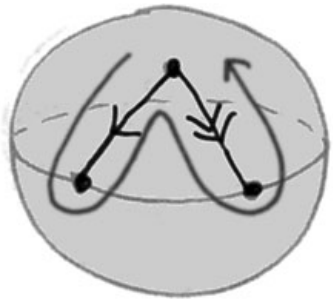
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

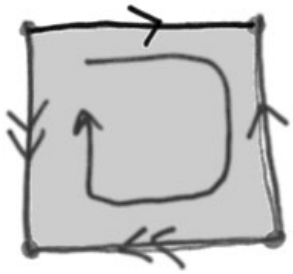
First Exam AI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

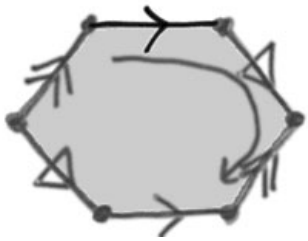
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





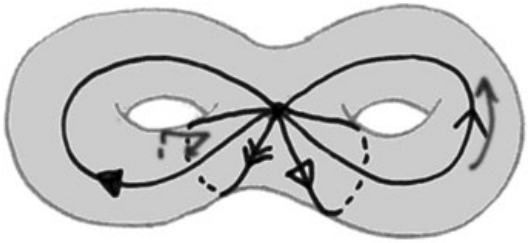
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

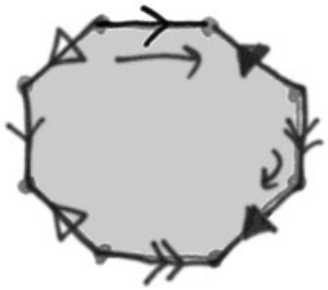
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

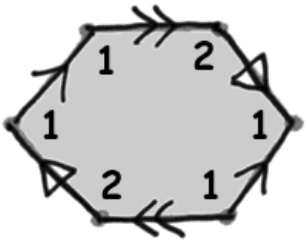
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



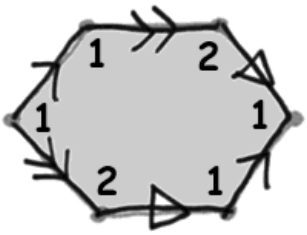


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

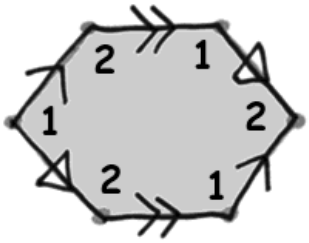
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



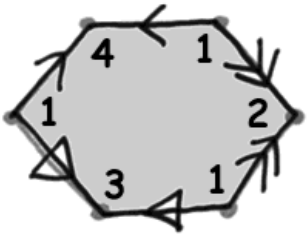
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



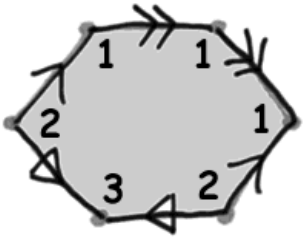
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



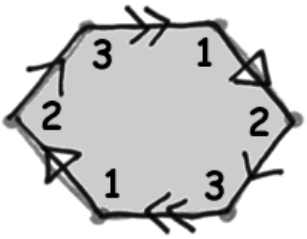
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



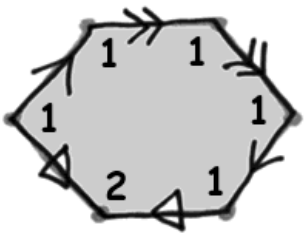
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



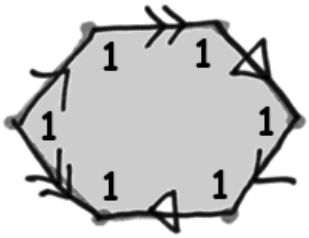
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

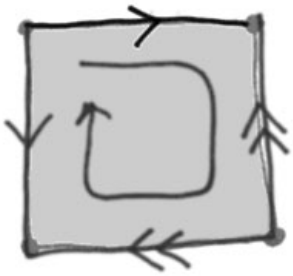
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam AJ

Surfaces and Knots, Dave Bayer, February 21, 2002

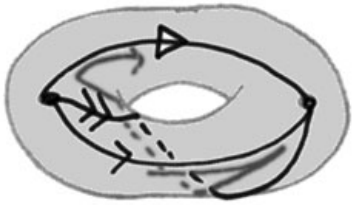
Answer Key

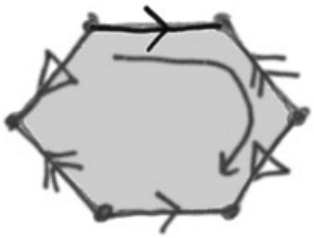
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

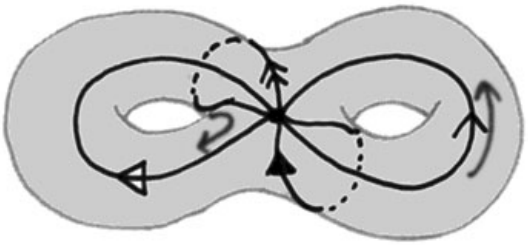
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

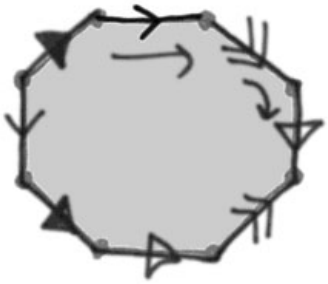




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

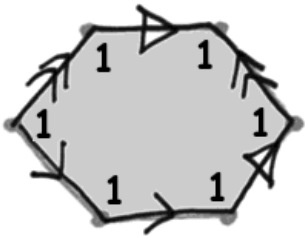
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



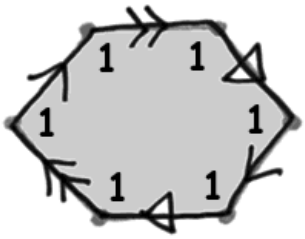


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

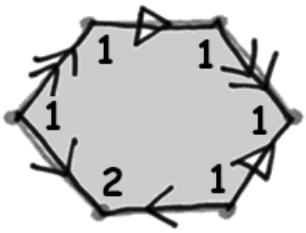
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



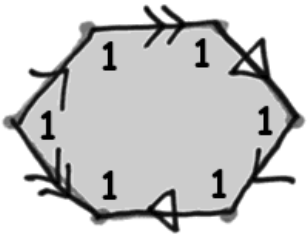
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



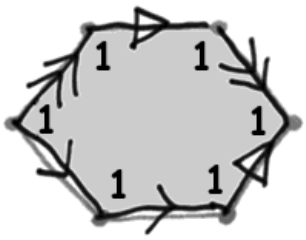
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



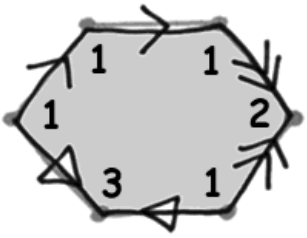
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



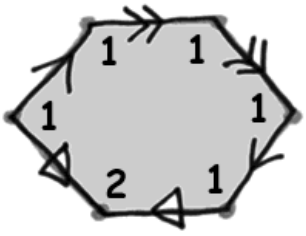
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



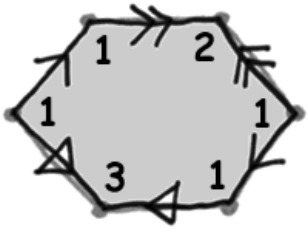
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

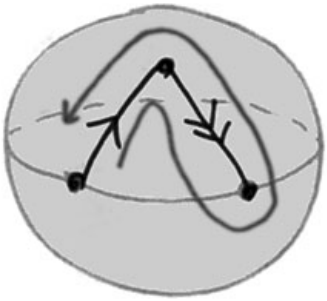
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

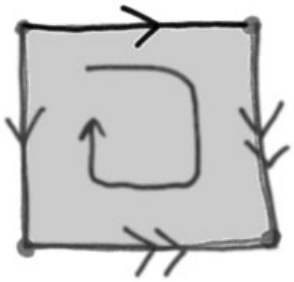
First Exam AK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

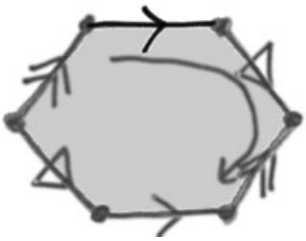
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





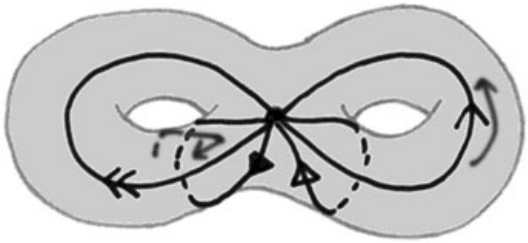
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

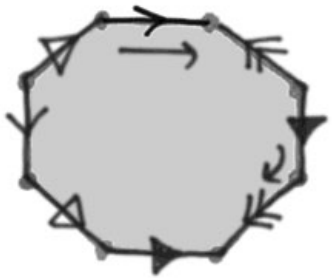
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

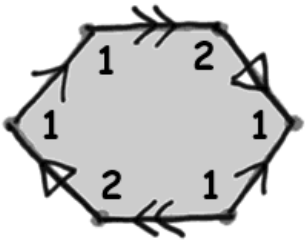
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



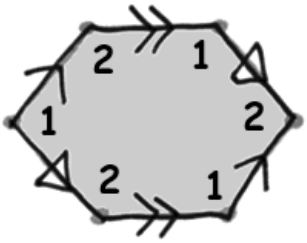


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

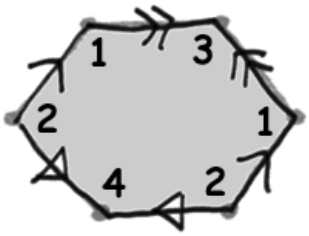
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



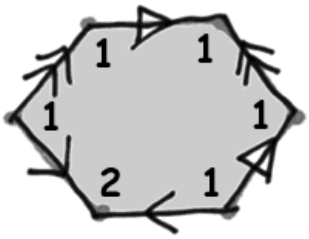
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



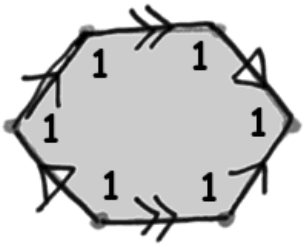
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



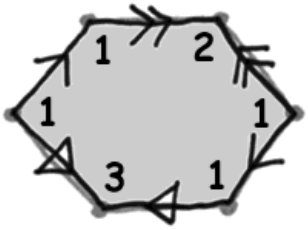
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



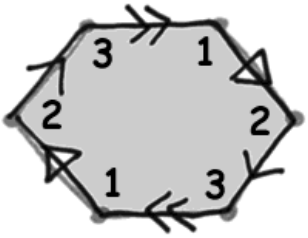
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



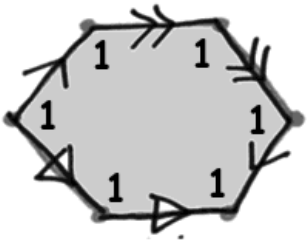
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

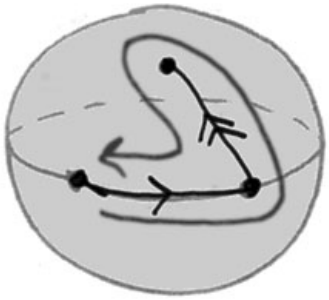
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

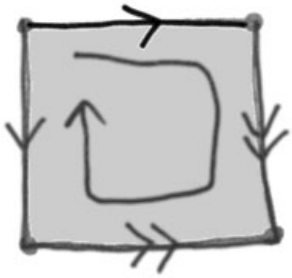
First Exam AL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

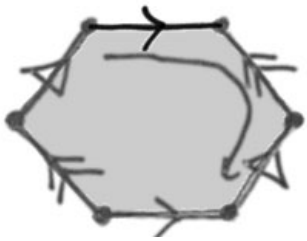
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





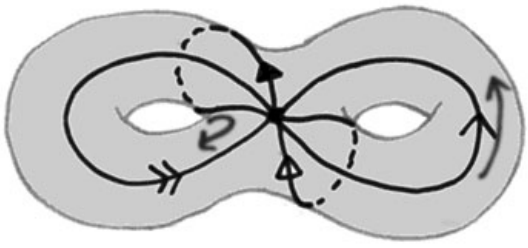
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

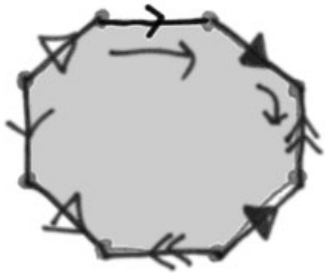
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

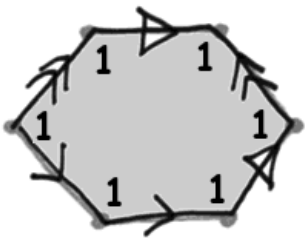
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



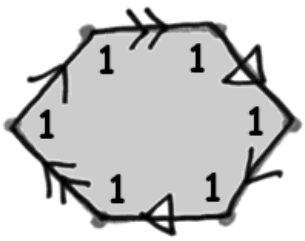


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

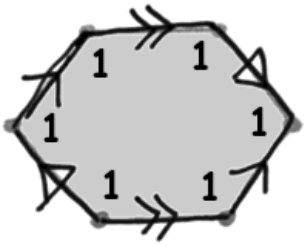
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



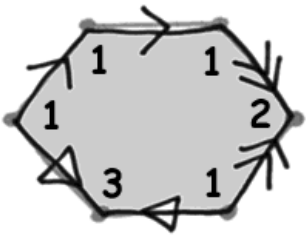
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



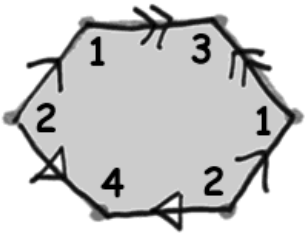
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



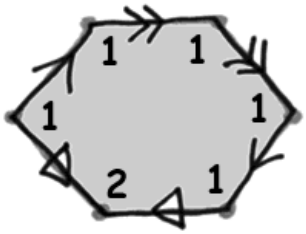
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



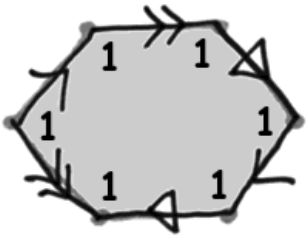
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



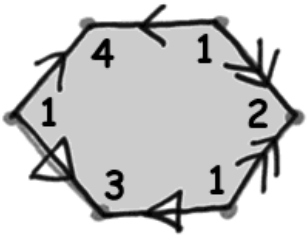
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

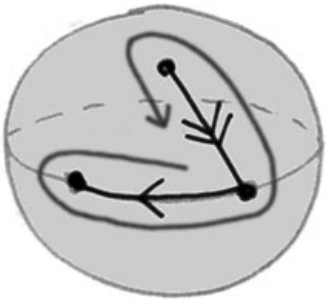
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

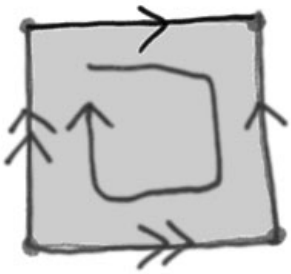
First Exam AM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



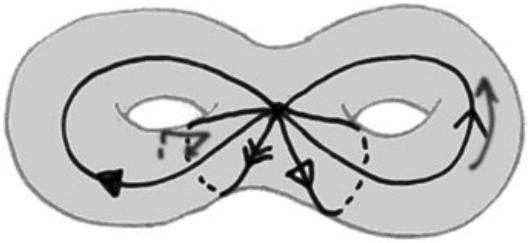


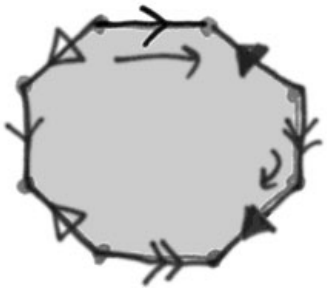
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

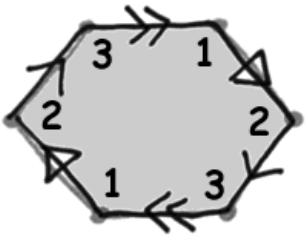
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



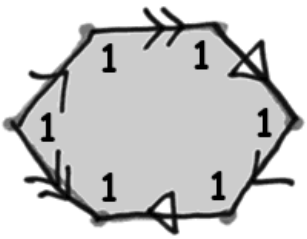


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

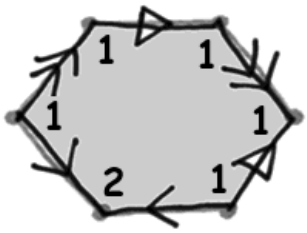
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



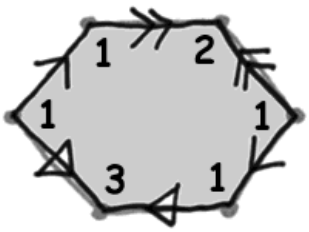
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



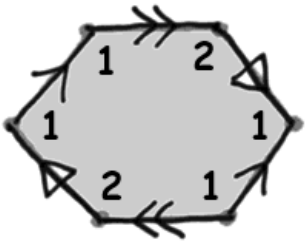
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



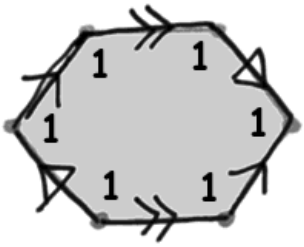
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



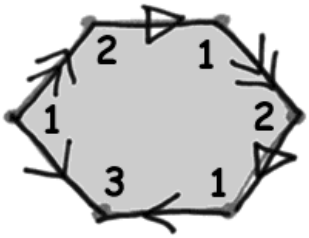
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



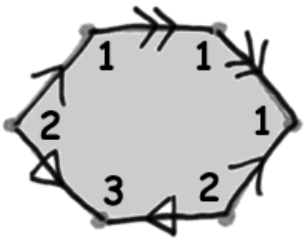
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

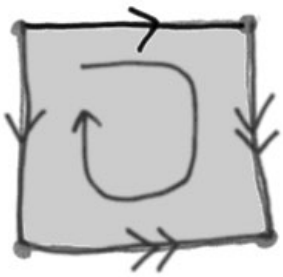
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam AN

Surfaces and Knots, Dave Bayer, February 21, 2002

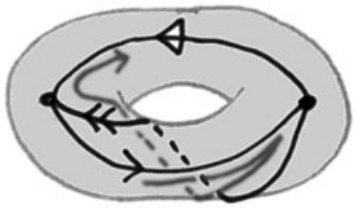
Answer Key

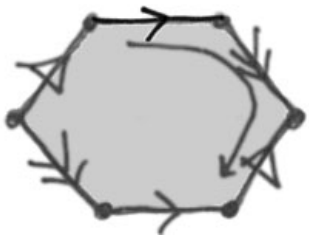
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

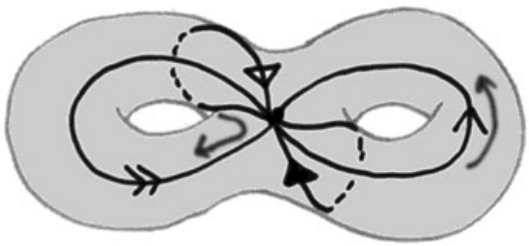
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

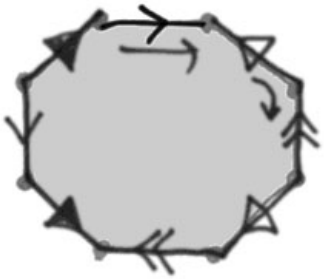




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

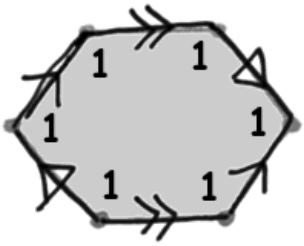
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



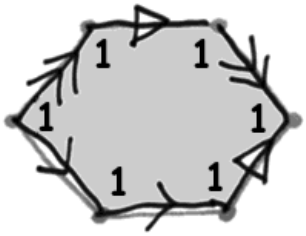


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

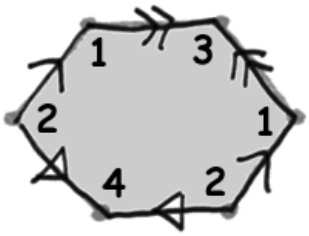
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



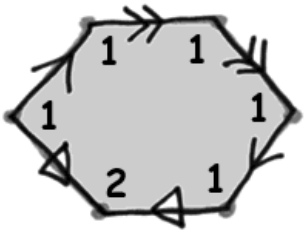
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



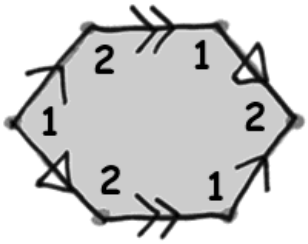
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



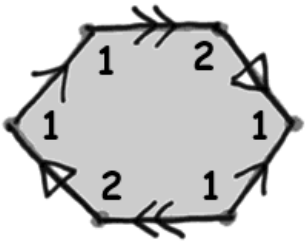
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



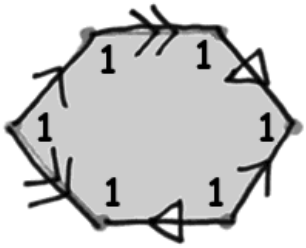
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



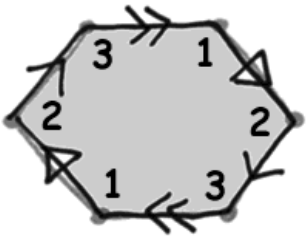
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

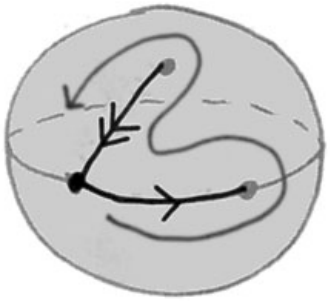
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

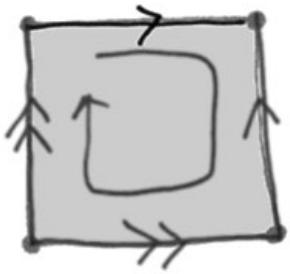
First Exam BA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

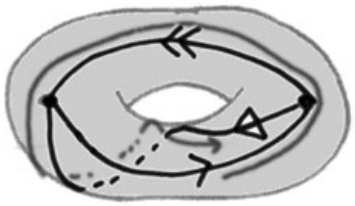
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

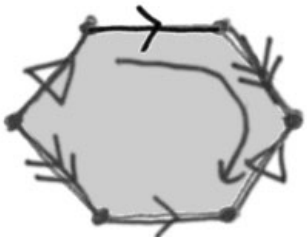




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

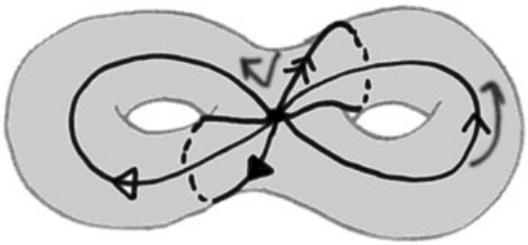
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

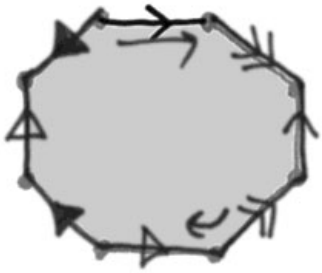




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

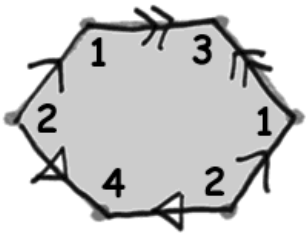
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



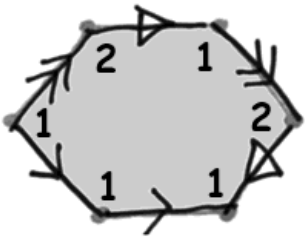


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

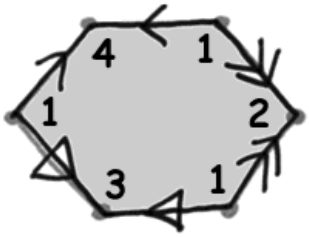
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



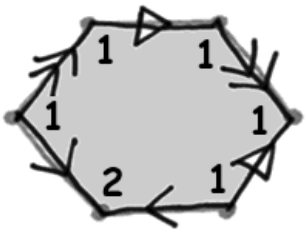
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



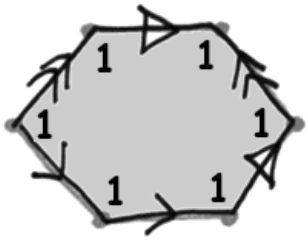
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



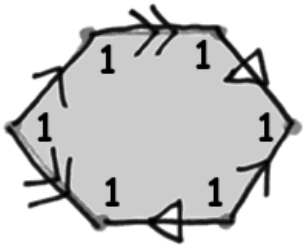
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



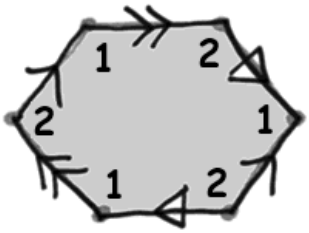
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



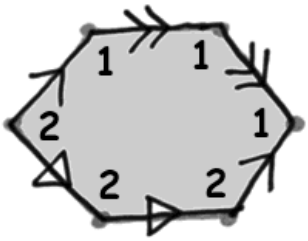
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

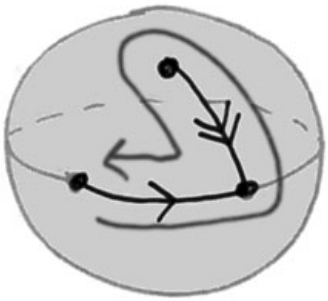
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

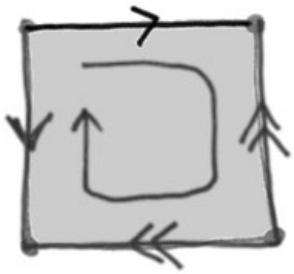
First Exam BB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



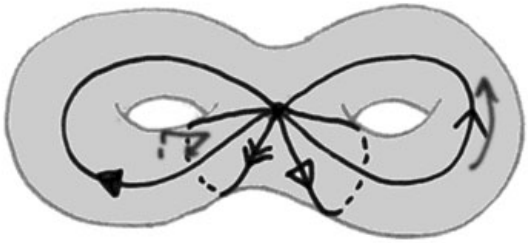


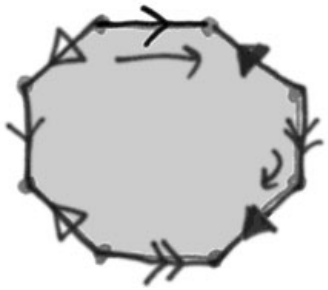
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

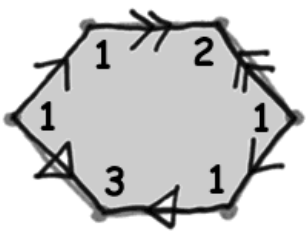
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



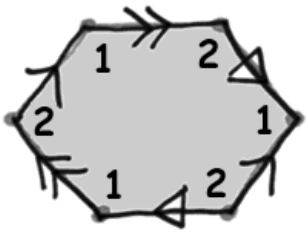


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

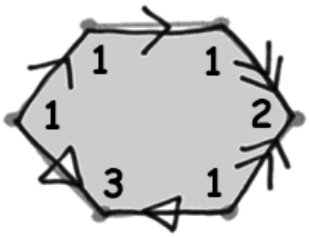
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



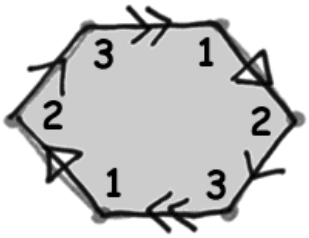
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



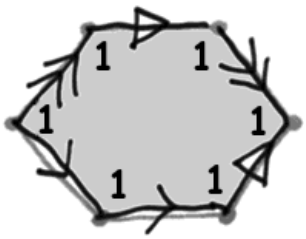
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



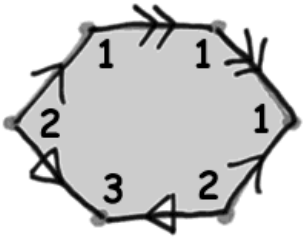
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



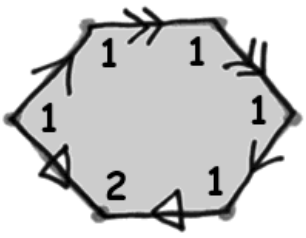
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



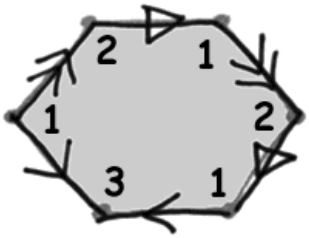
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

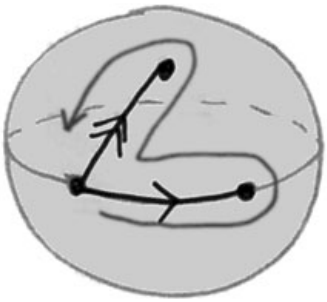
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

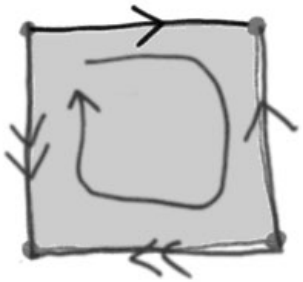
First Exam BC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

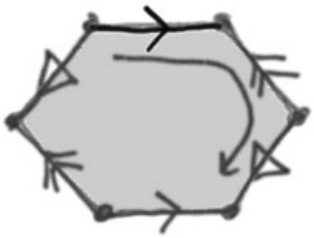
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





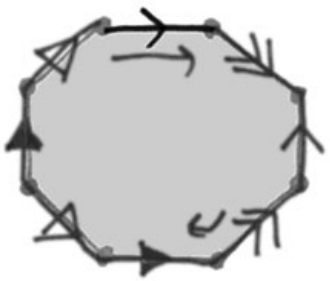
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



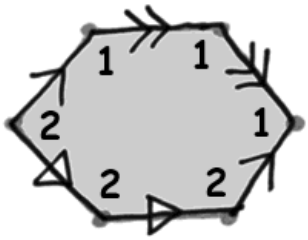
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

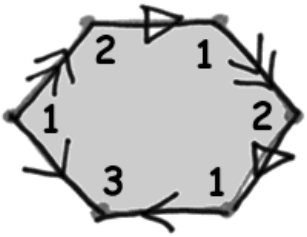


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

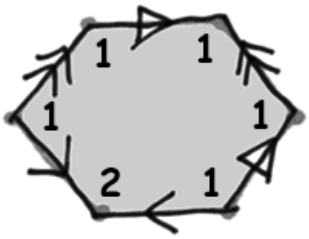
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



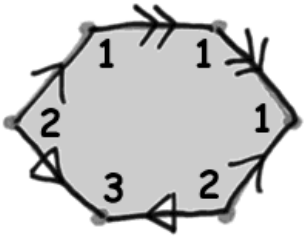
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



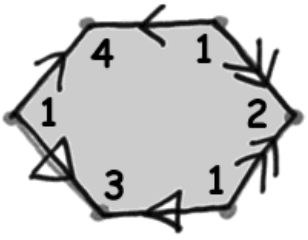
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



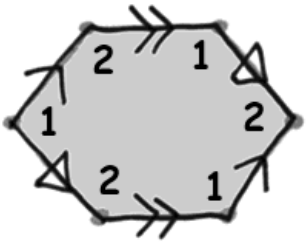
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



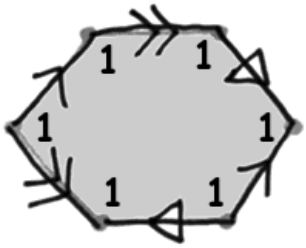
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



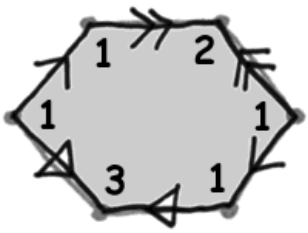
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

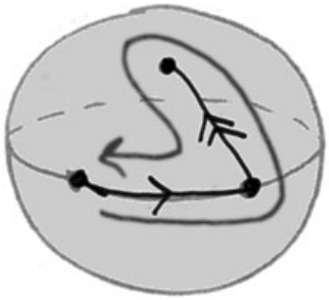
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

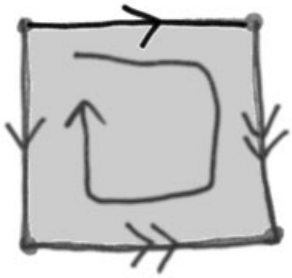
First Exam BD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

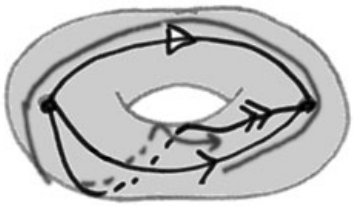
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

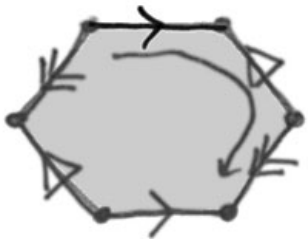




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

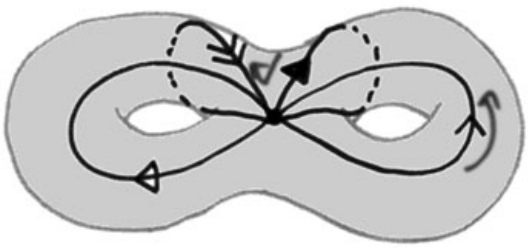
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

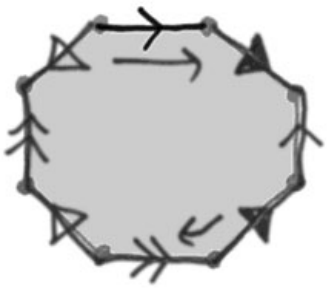




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

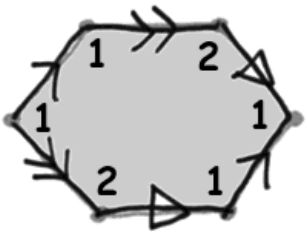
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



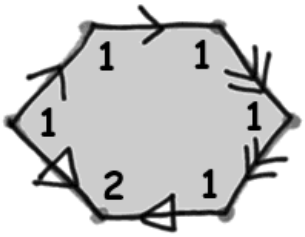


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

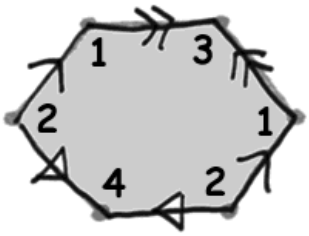
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



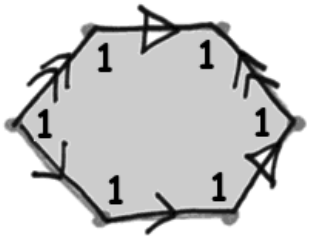
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



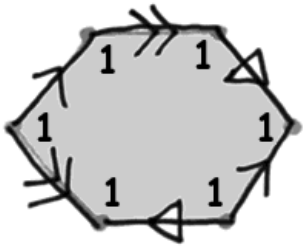
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



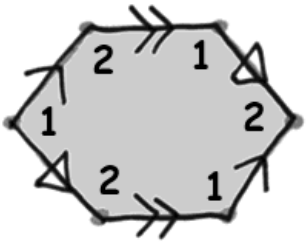
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



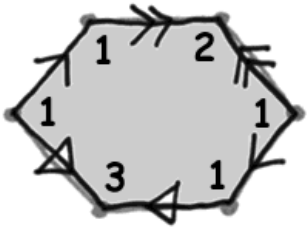
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



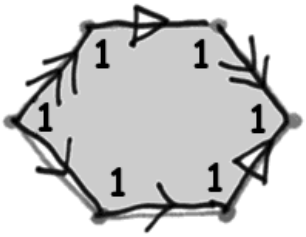
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

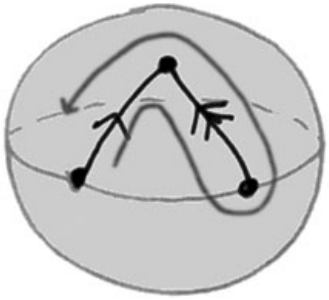
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

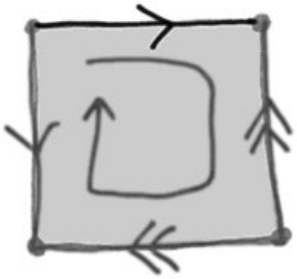
First Exam BE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

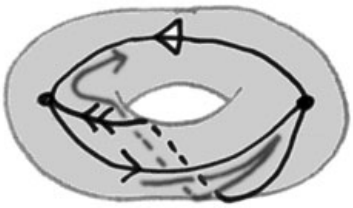
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

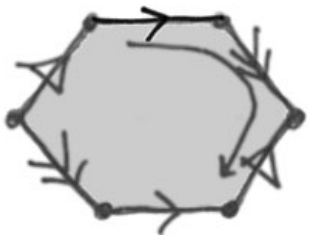




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

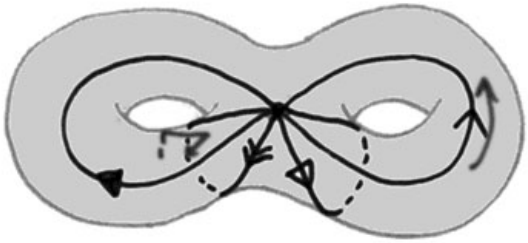
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

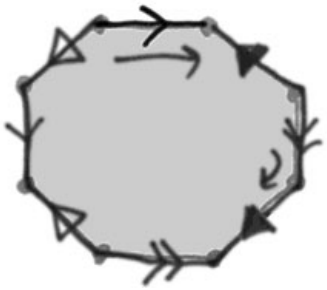




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

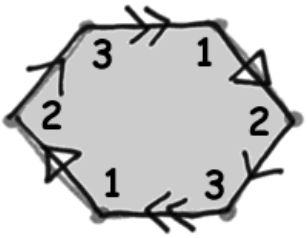
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



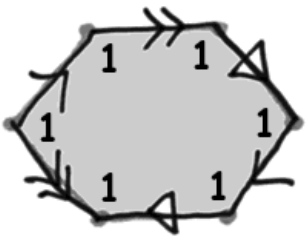


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

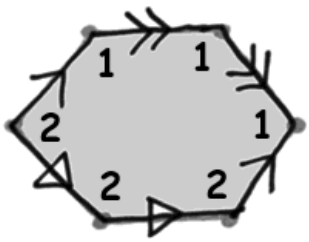
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



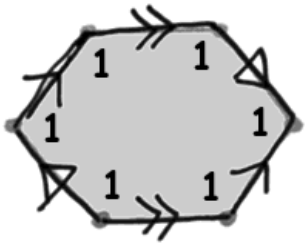
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



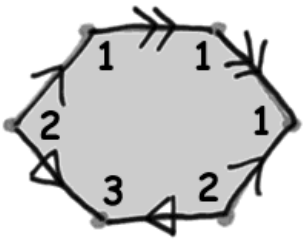
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



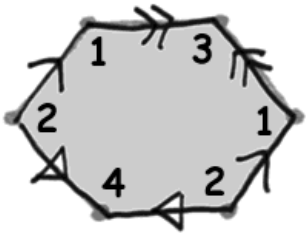
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



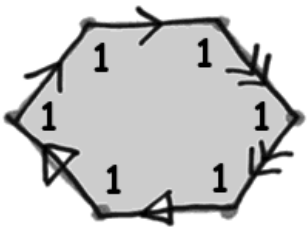
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



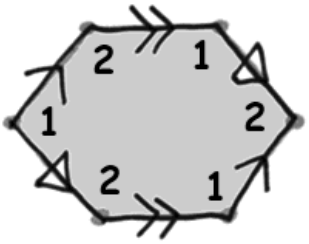
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

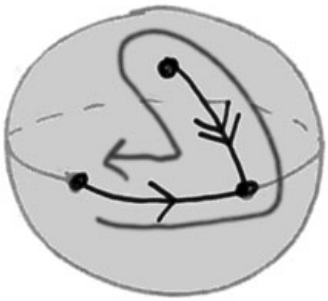
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

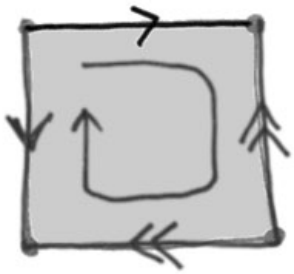
First Exam BF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

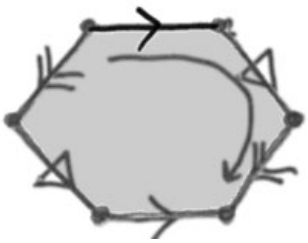
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





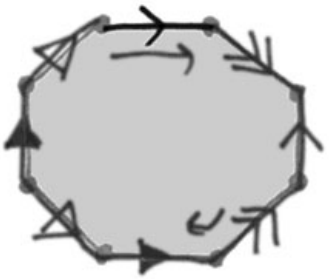
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



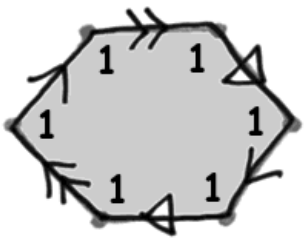
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

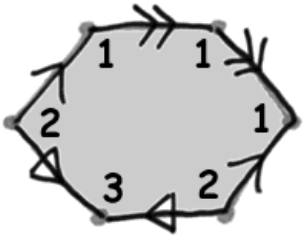


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

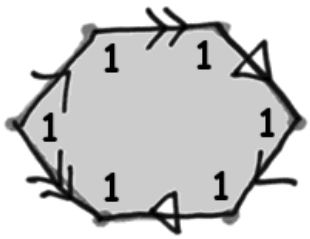
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



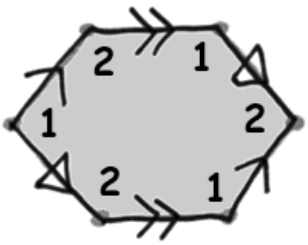
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



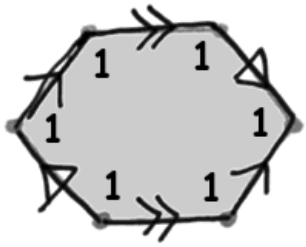
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



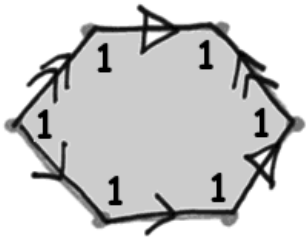
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



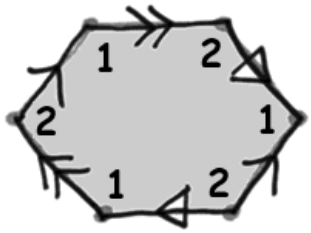
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



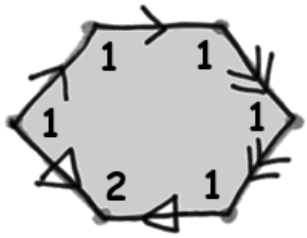
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

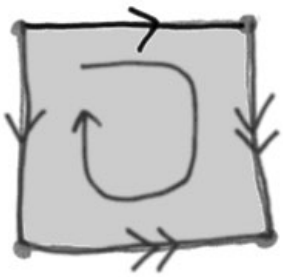
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam BG

Surfaces and Knots, Dave Bayer, February 21, 2002

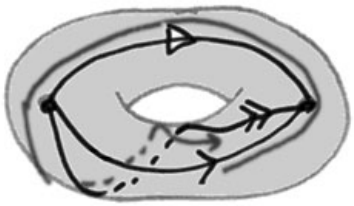
Answer Key

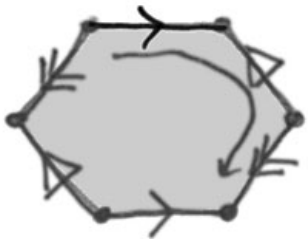
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

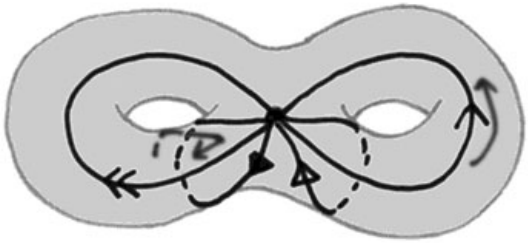
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

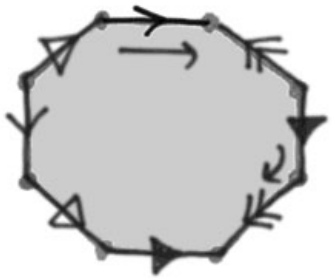




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

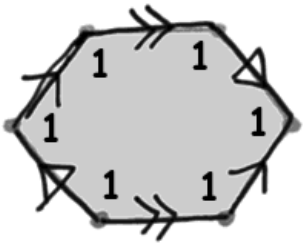
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



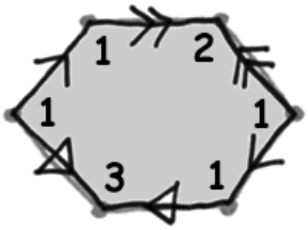


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

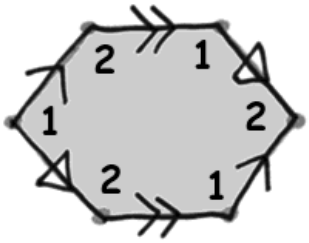
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



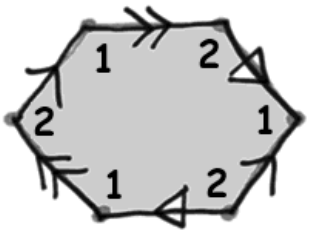
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



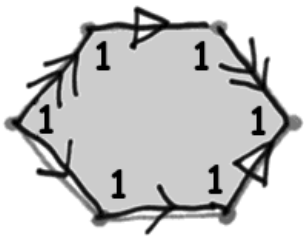
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



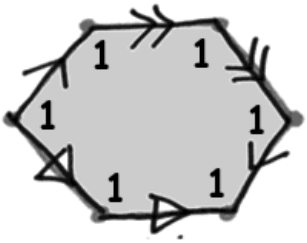
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



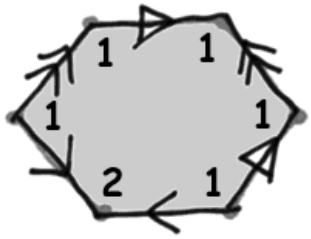
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



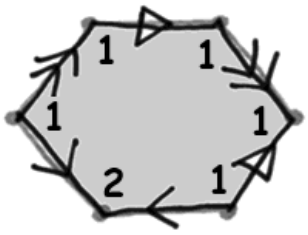
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

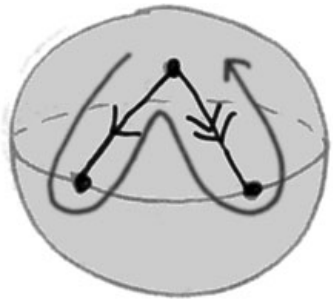
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

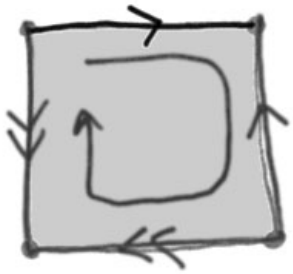
First Exam BH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

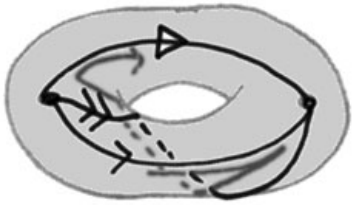
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

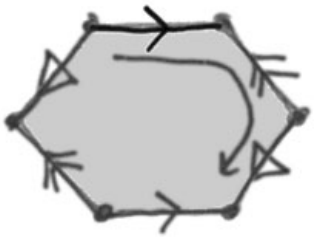




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

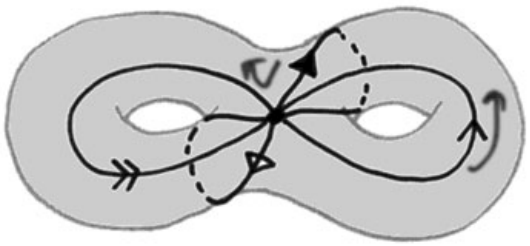
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

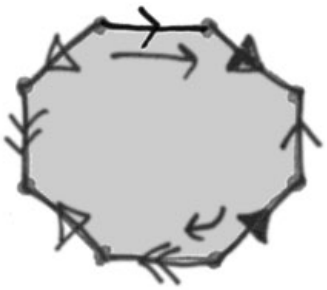




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

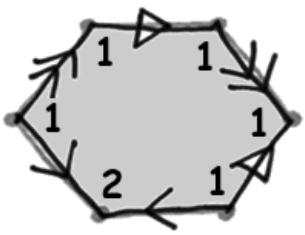
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



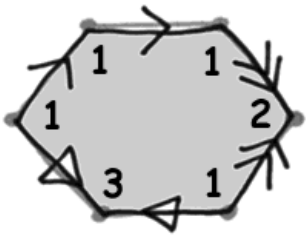


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

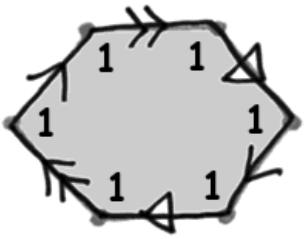
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



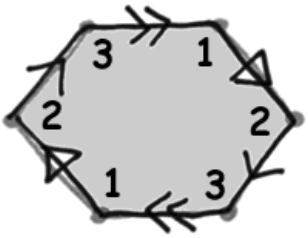
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



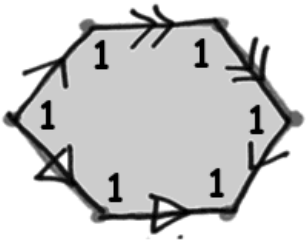
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



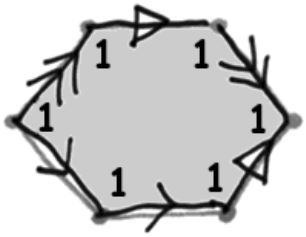
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



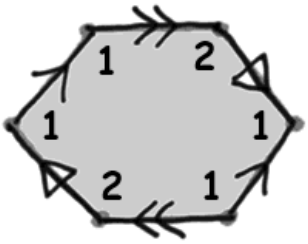
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



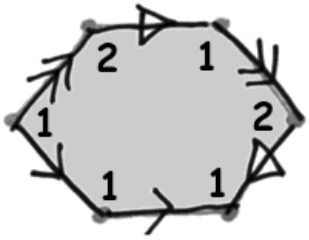
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

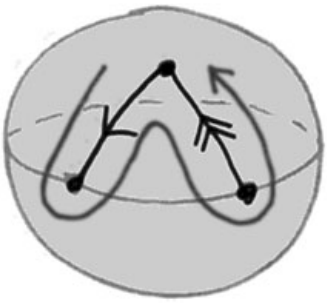
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

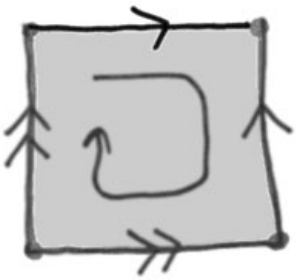
First Exam BI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

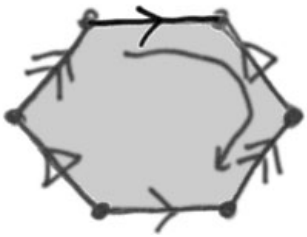
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





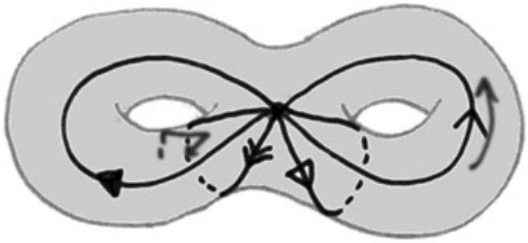
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

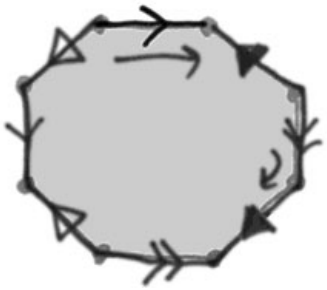
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

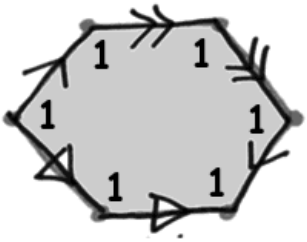
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



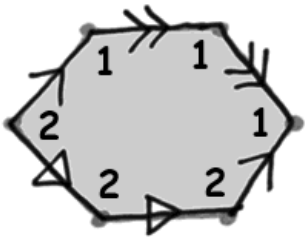


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

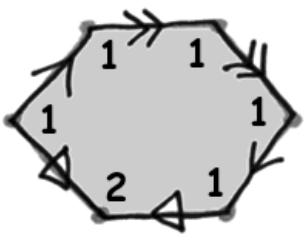
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



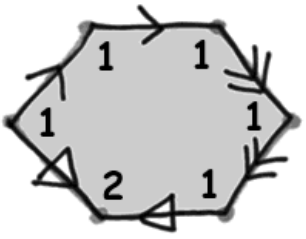
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



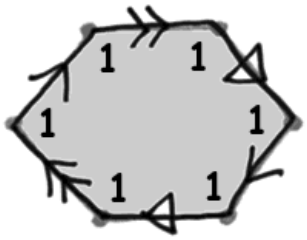
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



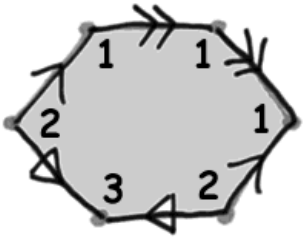
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



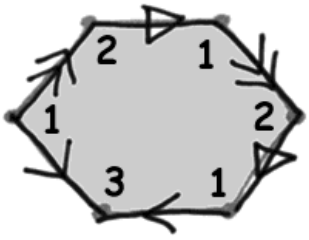
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



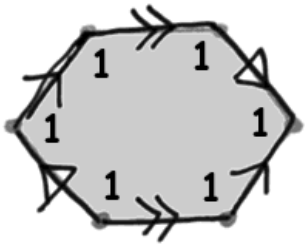
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

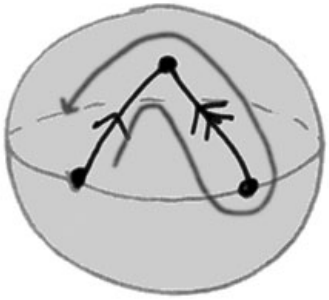
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

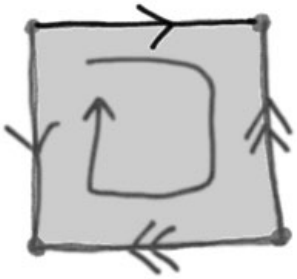
First Exam BJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

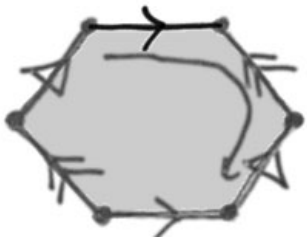
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





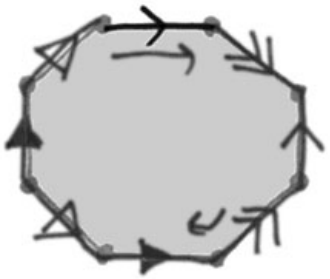
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



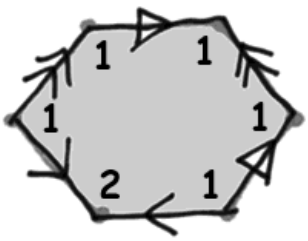
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

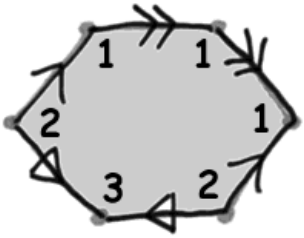


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

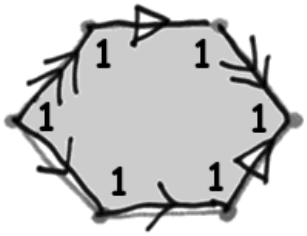
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



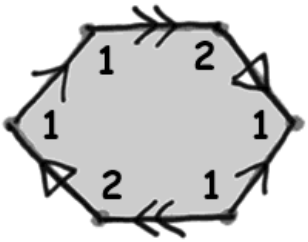
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



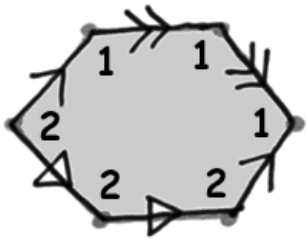
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



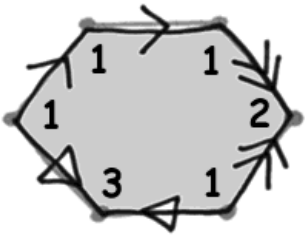
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



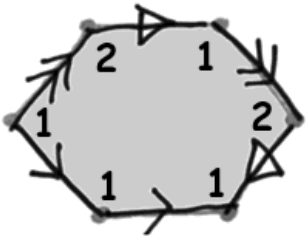
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



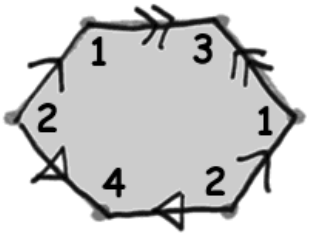
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

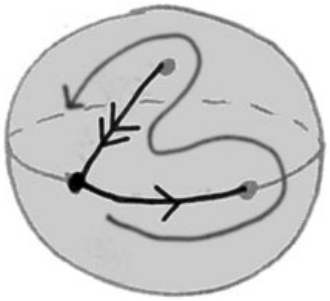
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

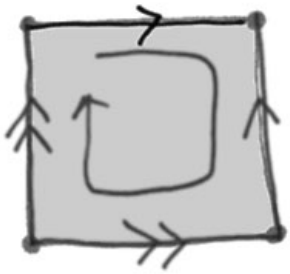
First Exam BK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

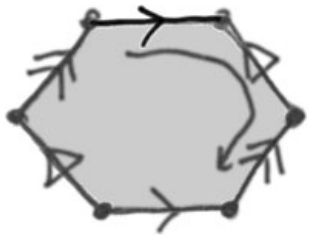
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





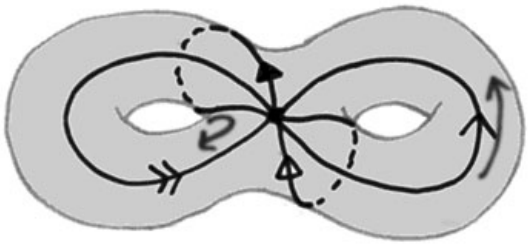
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

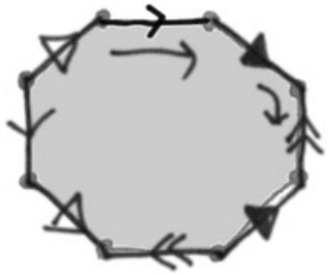
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

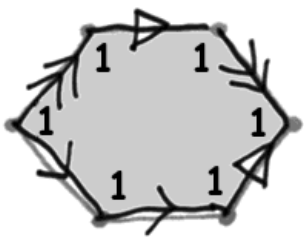
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



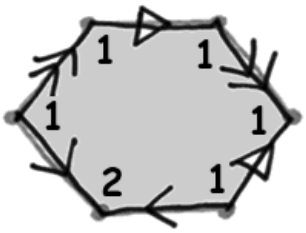


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

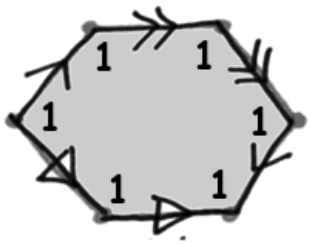
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



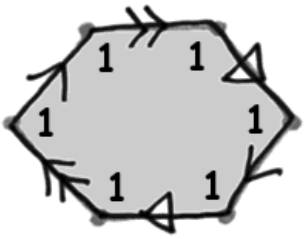
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



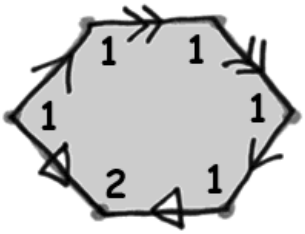
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



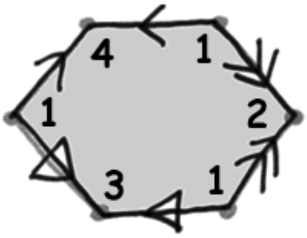
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



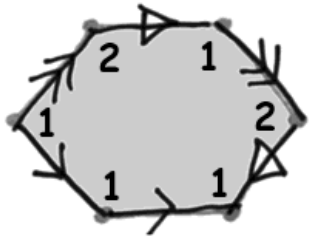
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



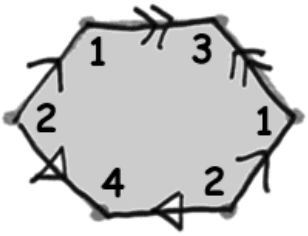
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

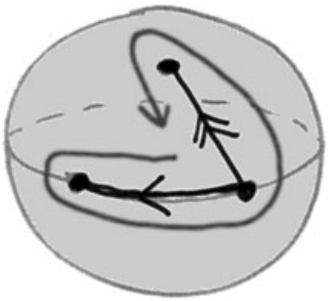
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

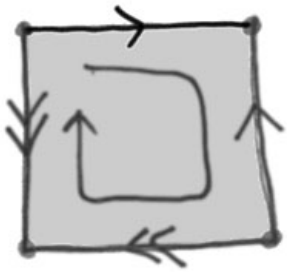
First Exam BL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

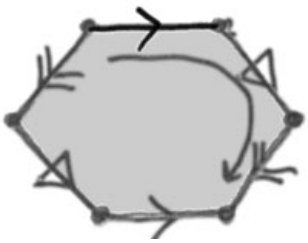
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





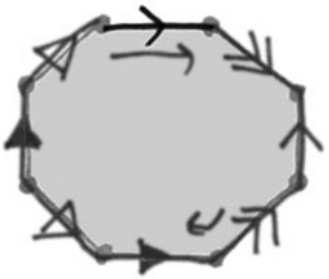
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



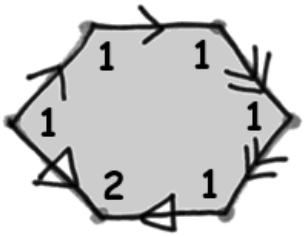
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

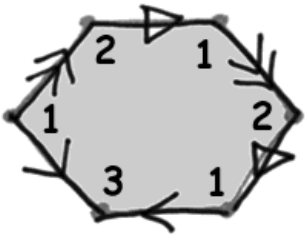


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

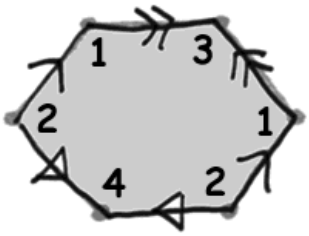
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



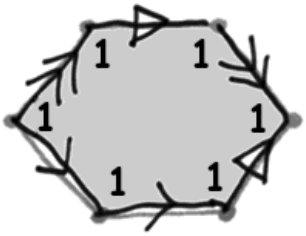
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



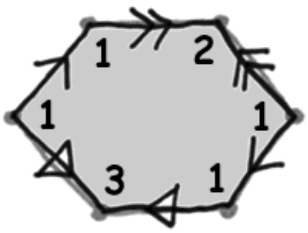
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



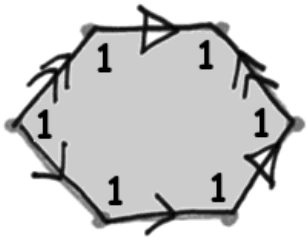
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



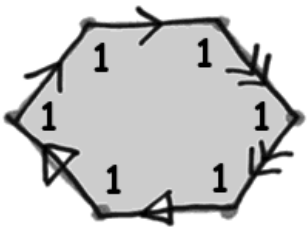
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



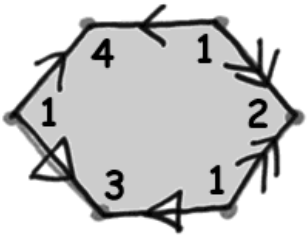
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

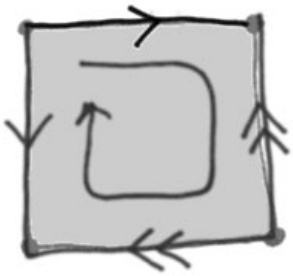
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam BM

Surfaces and Knots, Dave Bayer, February 21, 2002

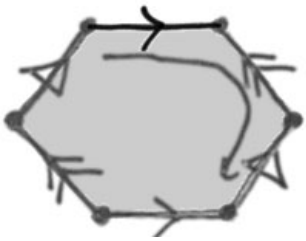
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



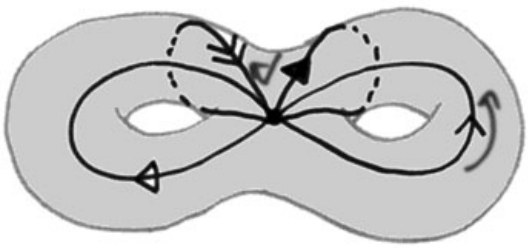
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

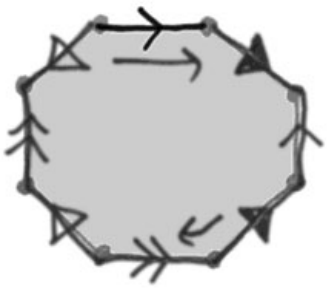
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

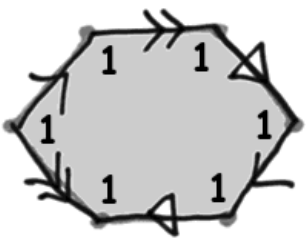
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



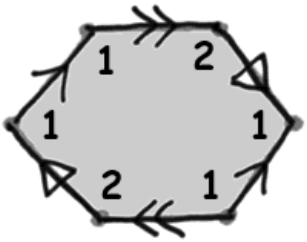


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

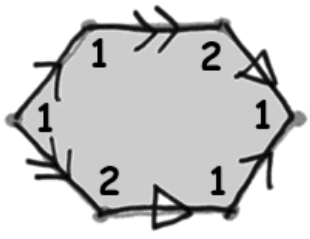
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



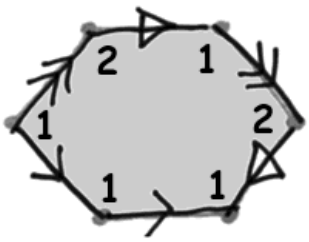
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



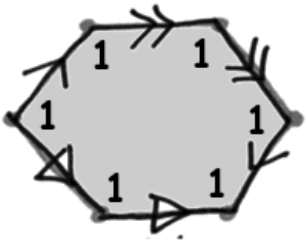
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



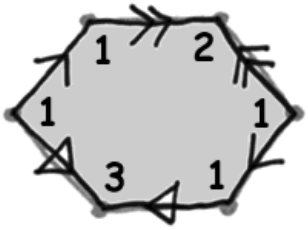
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



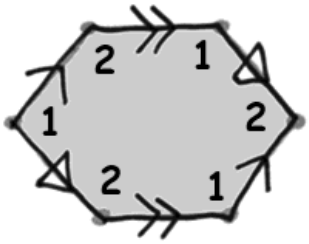
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



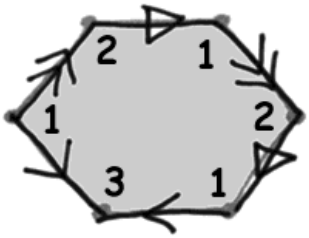
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

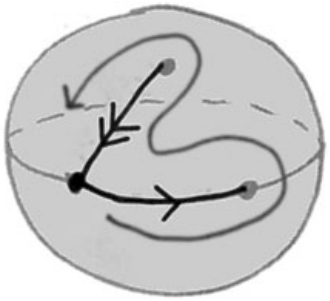
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

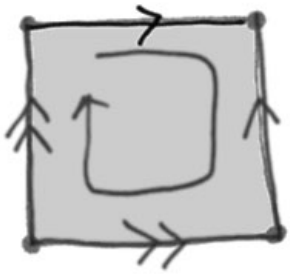
First Exam BN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

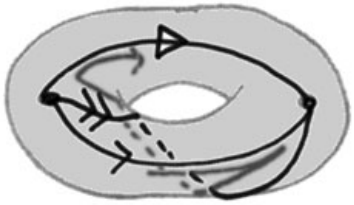
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

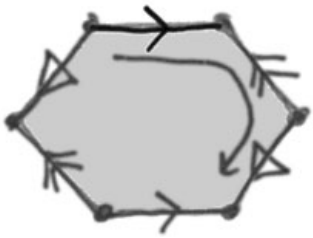




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

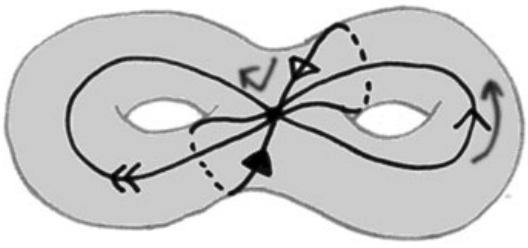
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

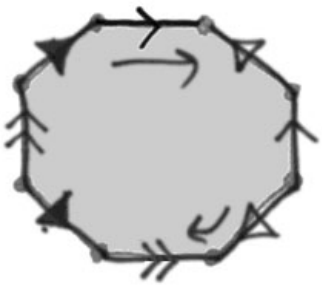




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

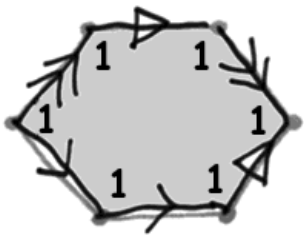
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



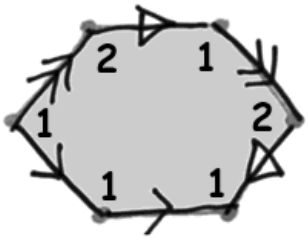


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

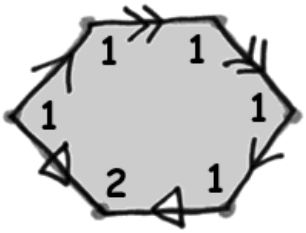
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



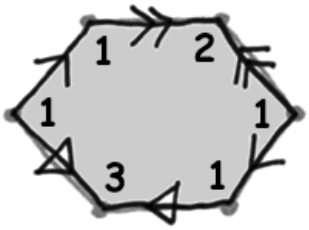
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



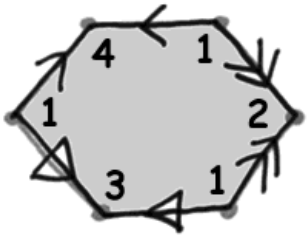
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



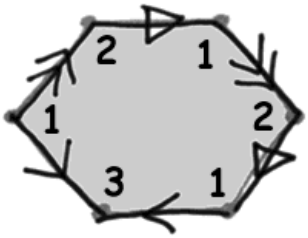
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



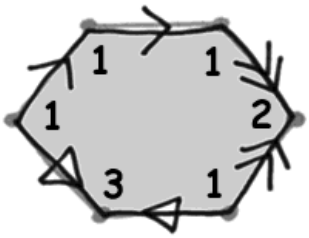
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



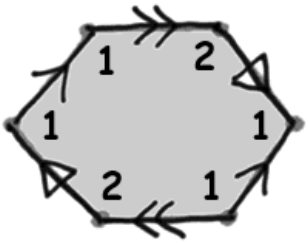
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

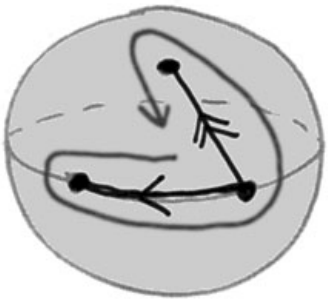
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

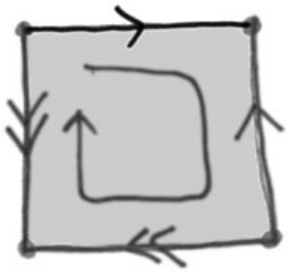
First Exam CA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

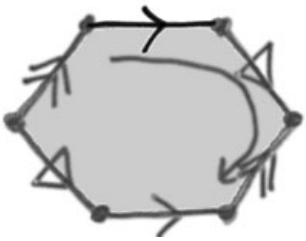
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





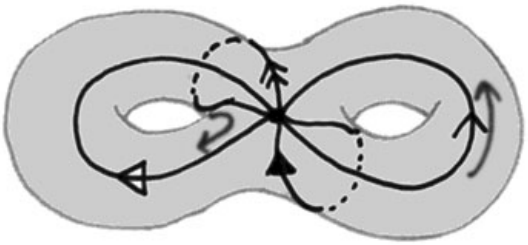
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

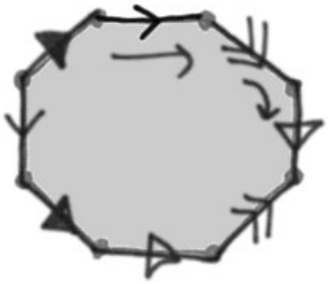
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

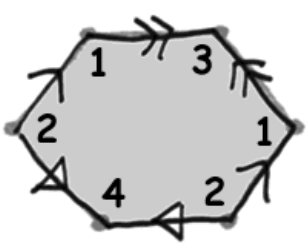
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



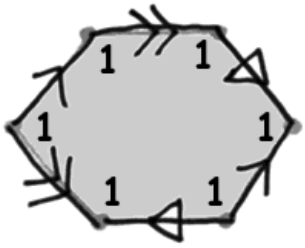


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

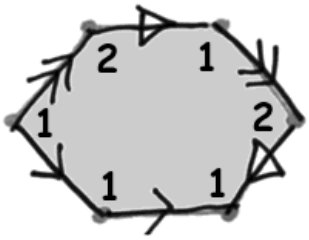
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



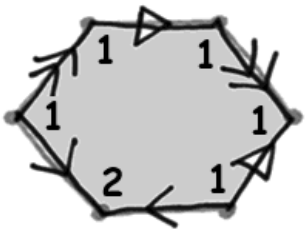
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



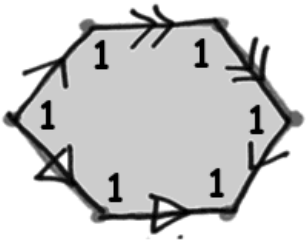
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



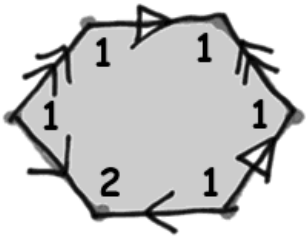
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



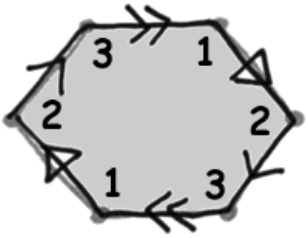
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



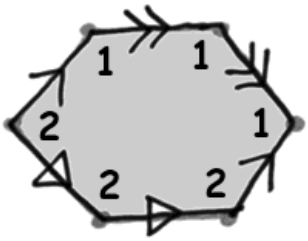
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

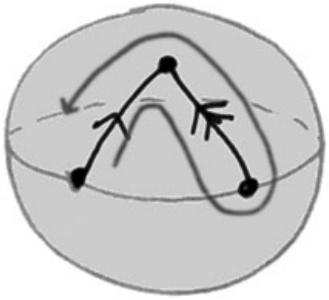
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

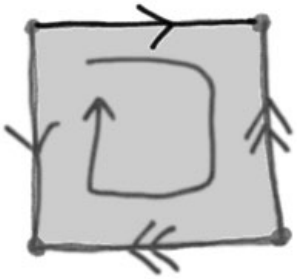
First Exam CB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

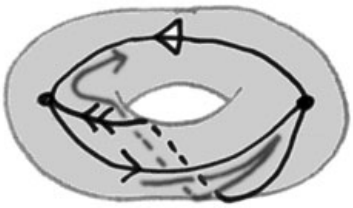
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

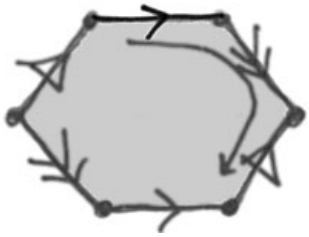




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

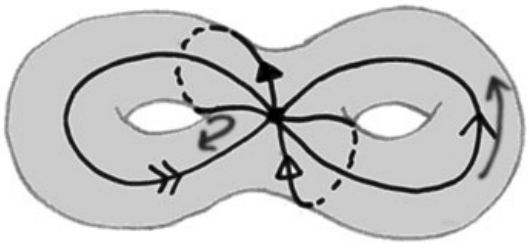
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

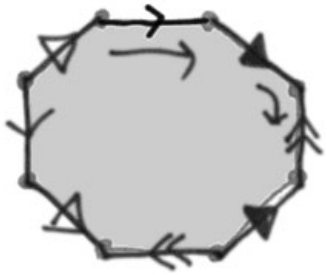




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

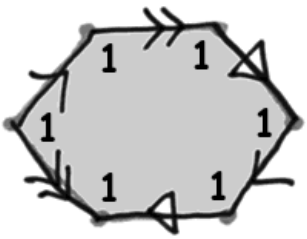
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



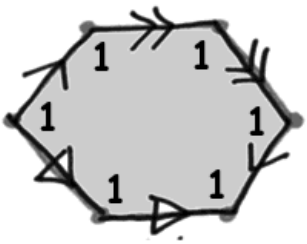


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

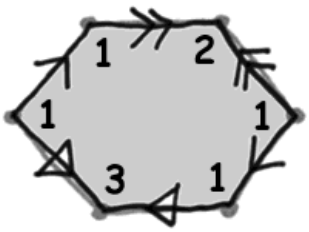
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



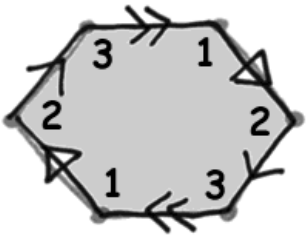
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



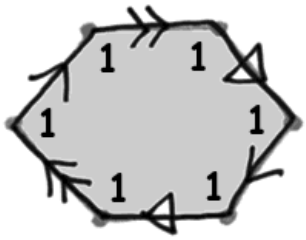
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



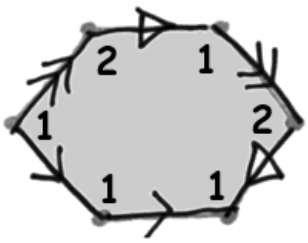
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



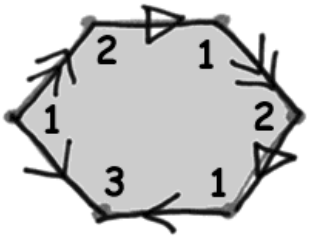
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



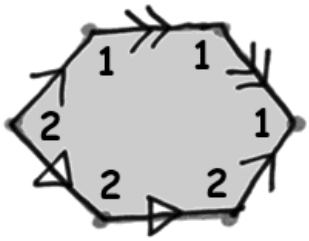
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

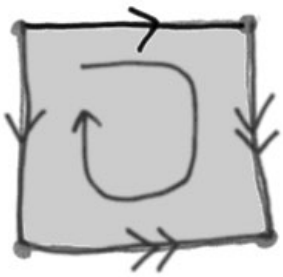
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam CC

Surfaces and Knots, Dave Bayer, February 21, 2002

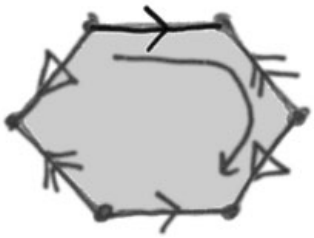
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



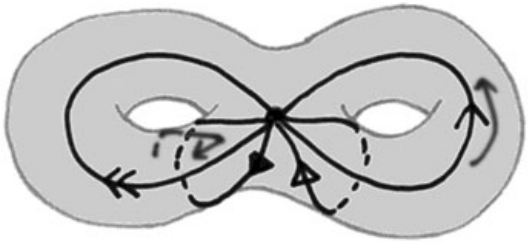
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

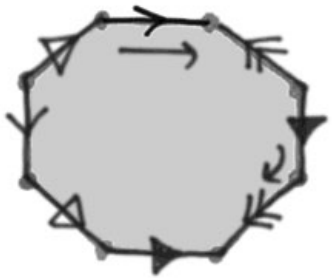
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

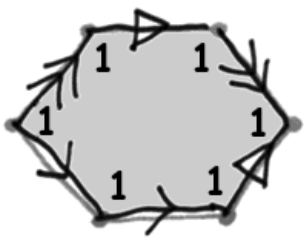
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



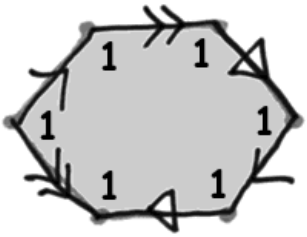


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

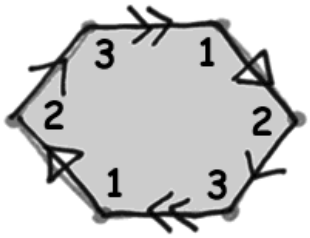
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



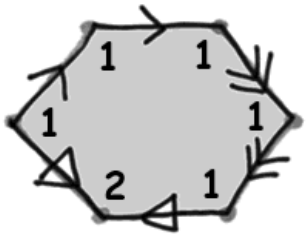
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



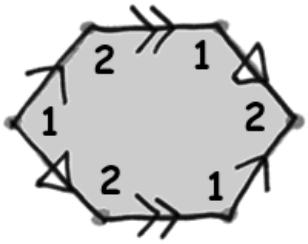
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



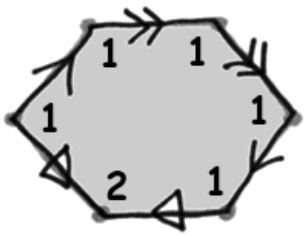
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



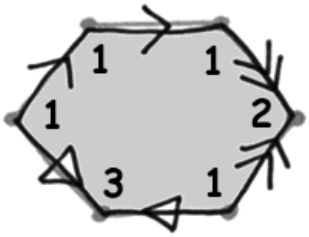
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



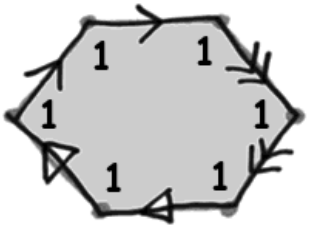
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

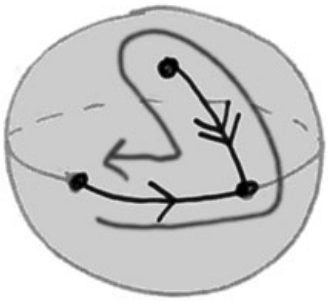
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

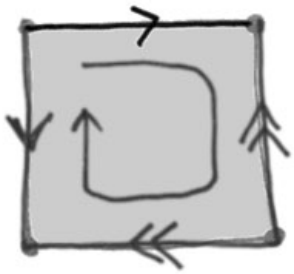
First Exam CD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

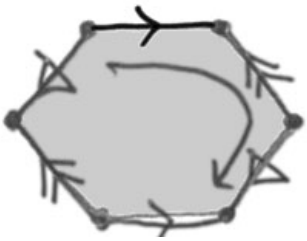
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





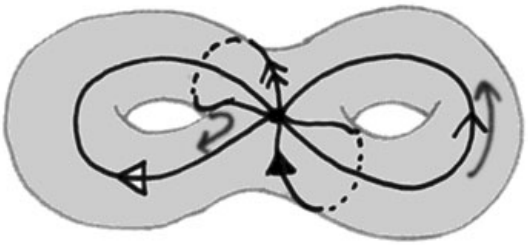
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

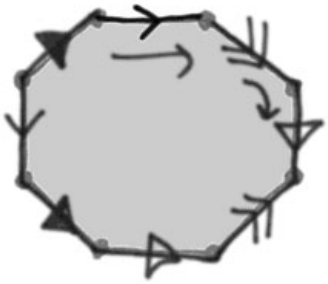
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

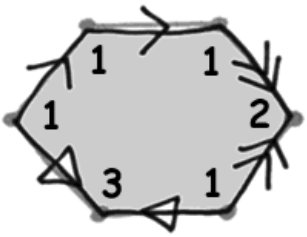
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



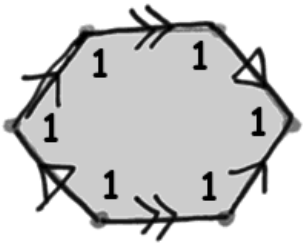


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

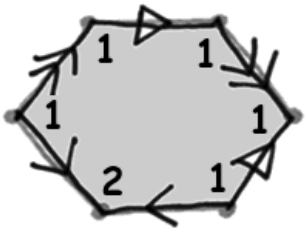
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



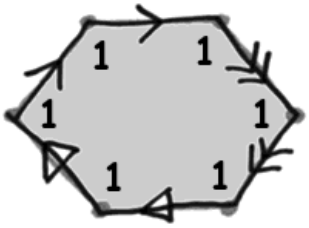
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



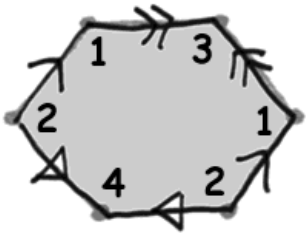
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



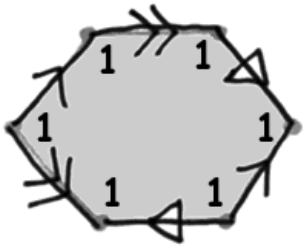
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



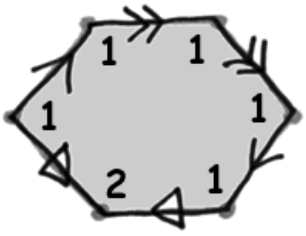
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



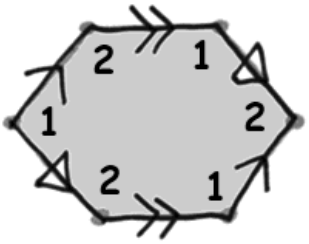
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

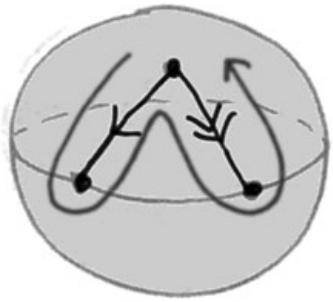
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

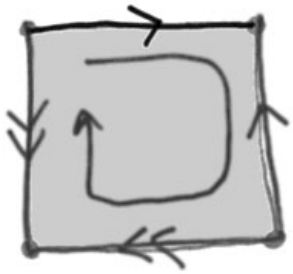
First Exam CE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

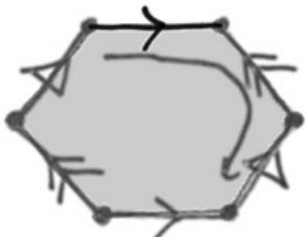
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





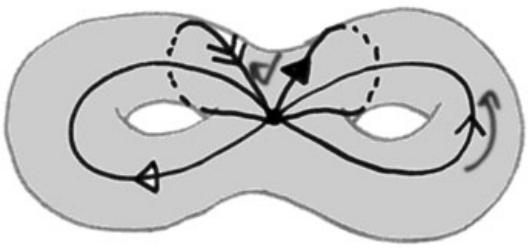
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

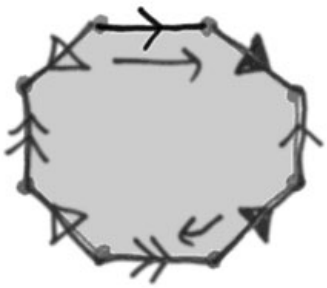
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

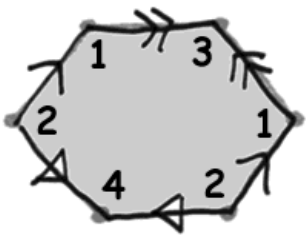
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



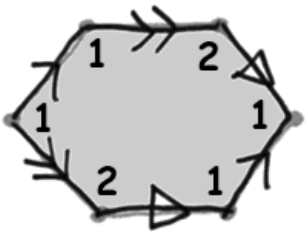


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

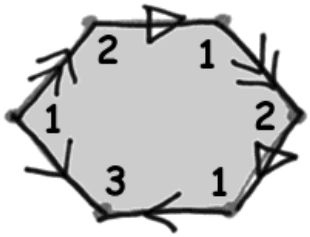
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



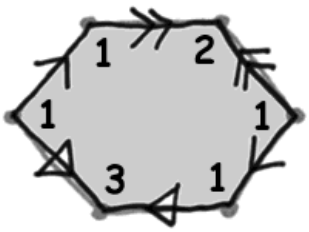
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



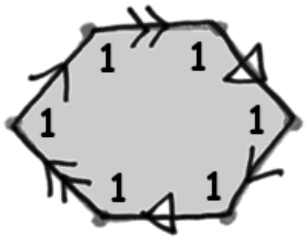
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



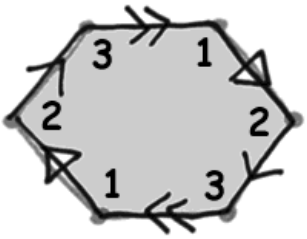
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



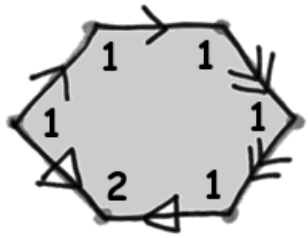
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



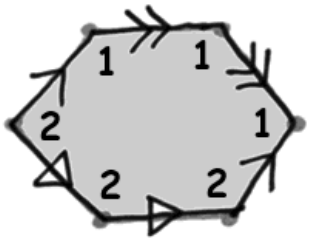
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

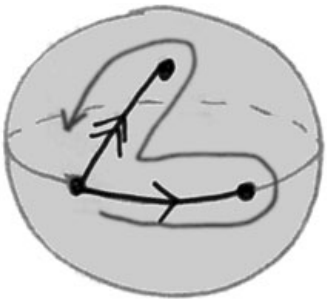
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

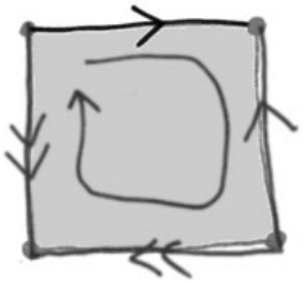
First Exam CF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



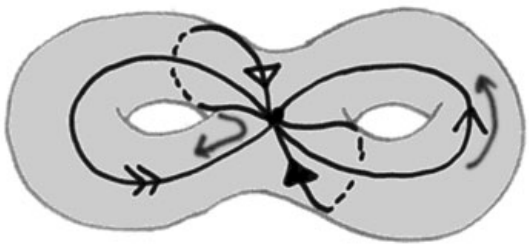


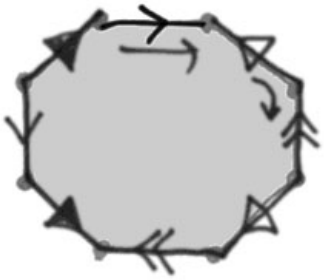
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

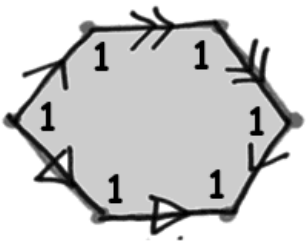
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



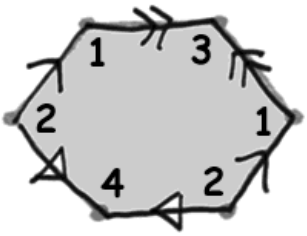


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

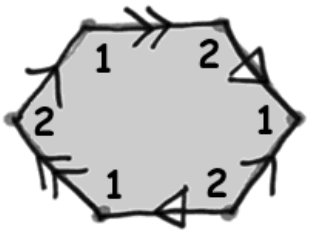
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



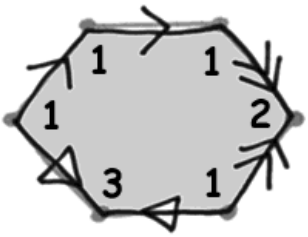
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



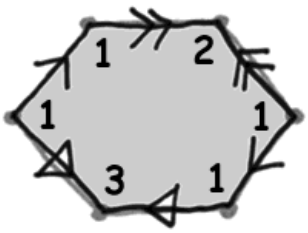
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



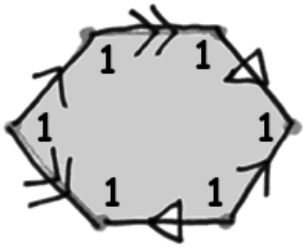
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



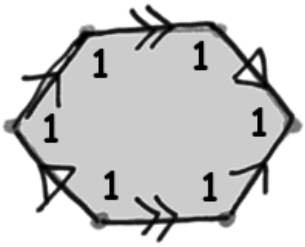
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



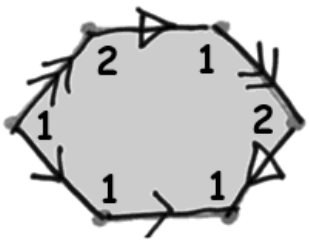
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

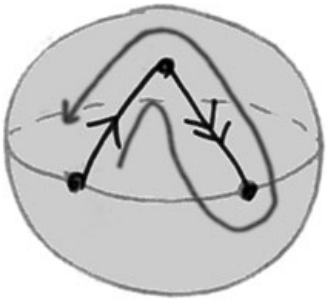
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

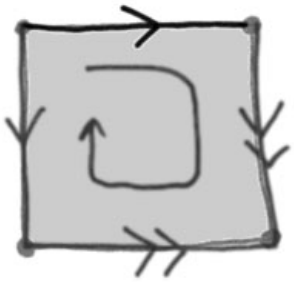
First Exam CG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

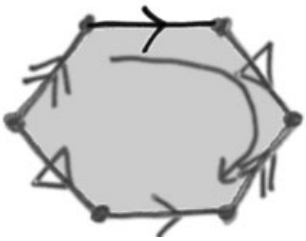
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





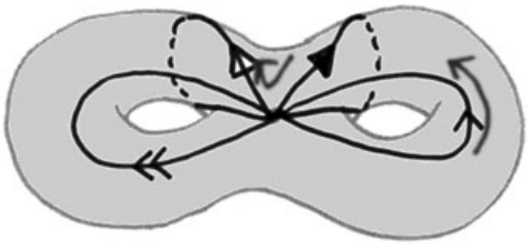
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

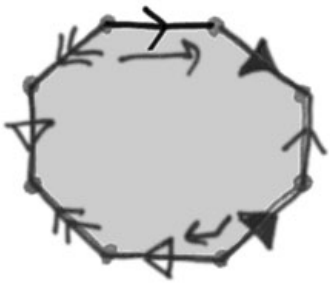
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

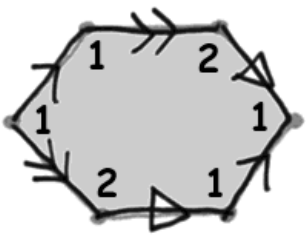
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



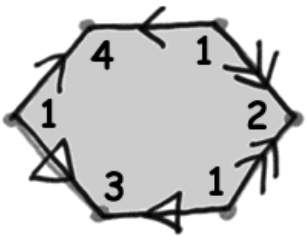


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

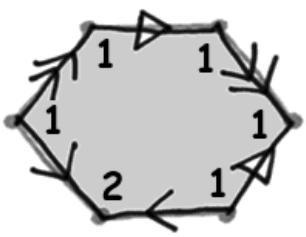
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



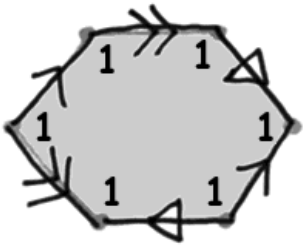
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



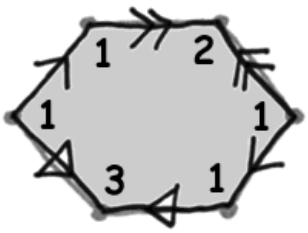
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



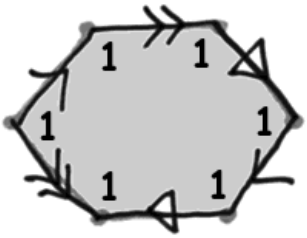
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



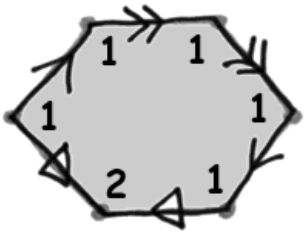
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



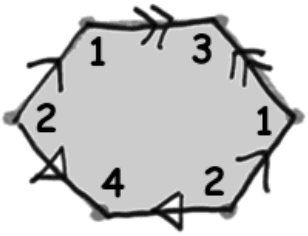
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

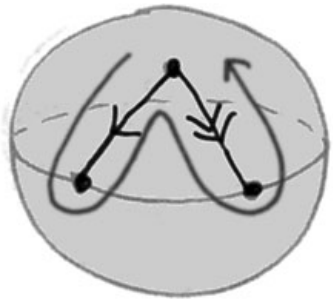
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

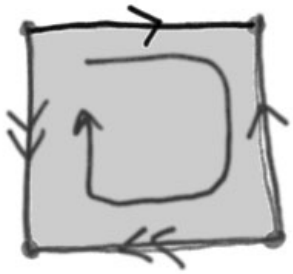
First Exam CH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

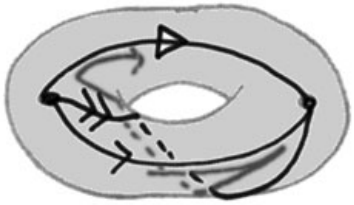
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

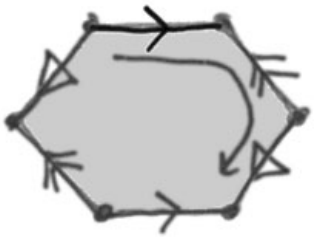




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

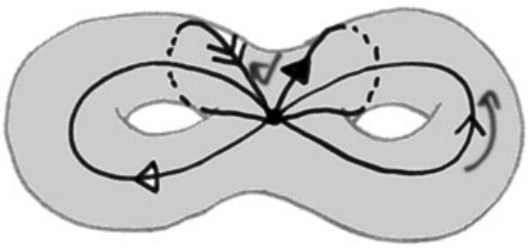
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

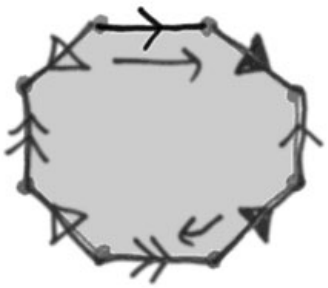




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

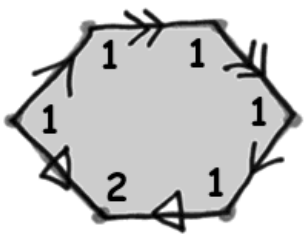
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



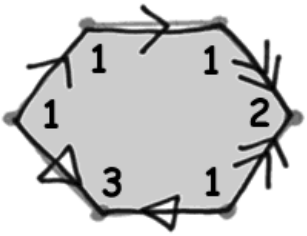


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

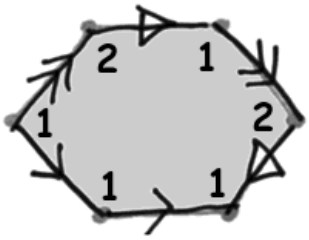
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



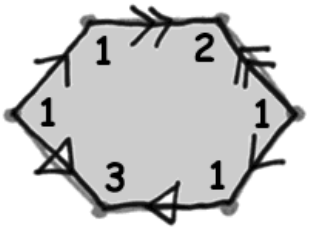
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



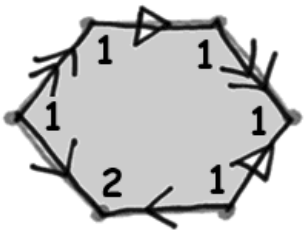
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



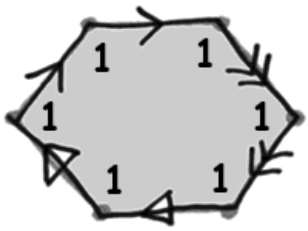
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



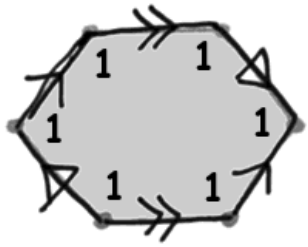
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



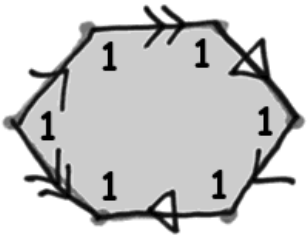
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

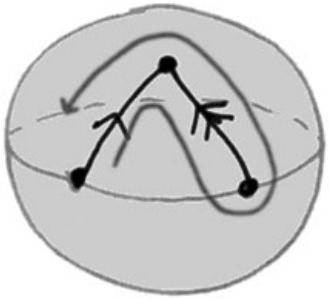
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

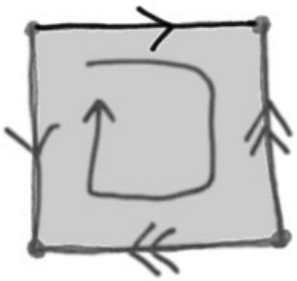
First Exam CI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

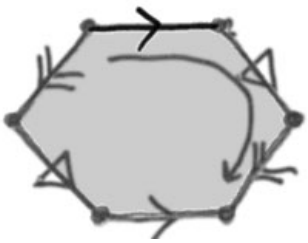
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





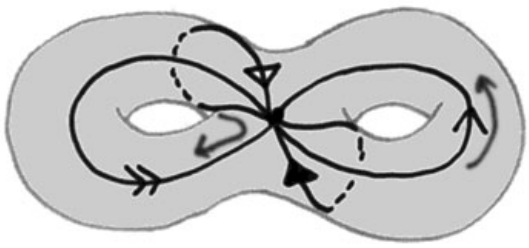
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

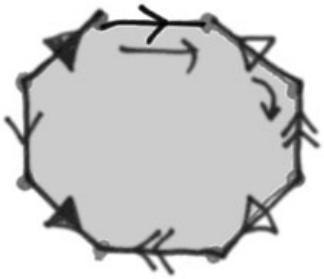
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

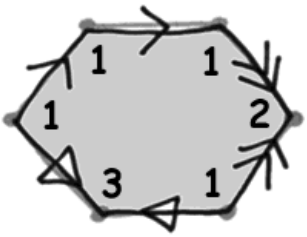
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



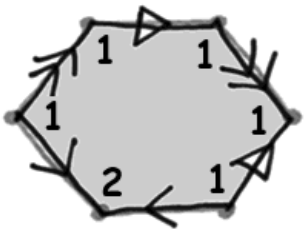


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

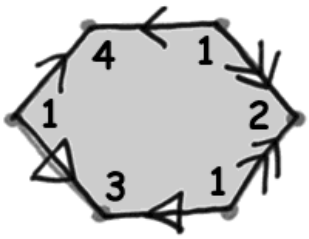
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



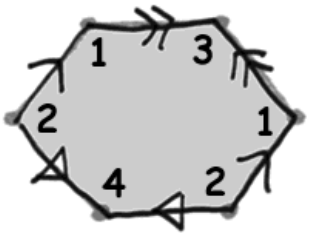
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



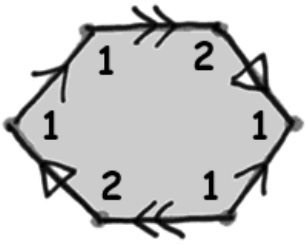
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



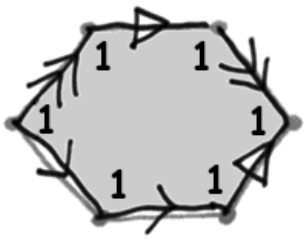
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



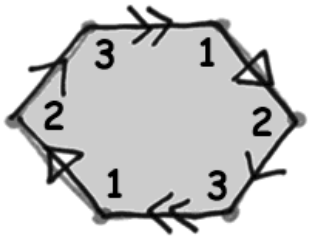
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



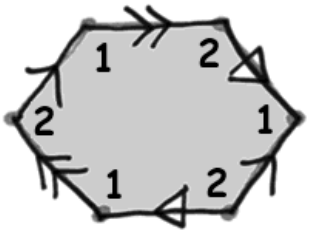
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

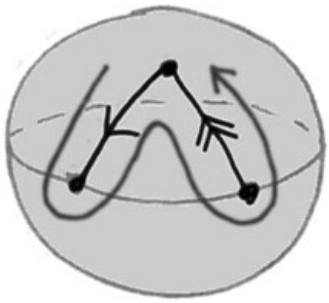
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

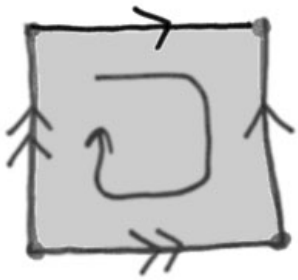
First Exam CJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

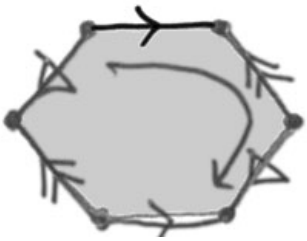
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





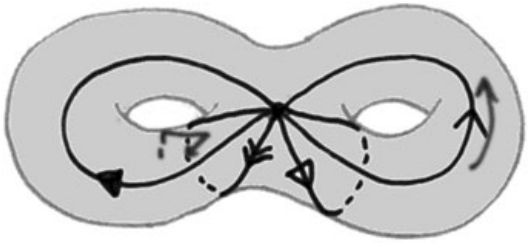
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

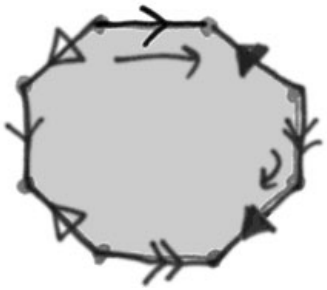
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

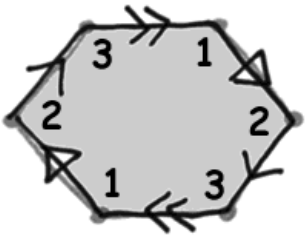
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



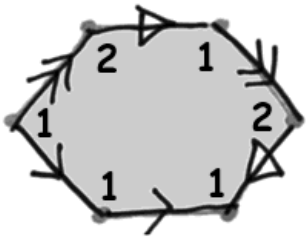


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

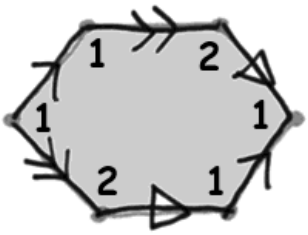
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



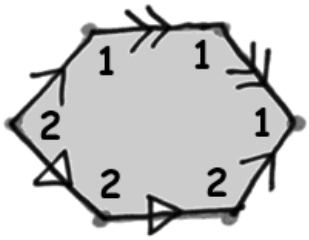
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



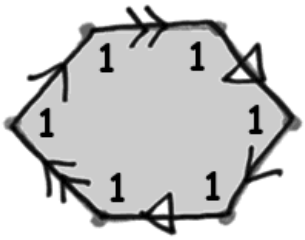
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



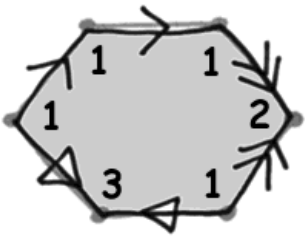
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



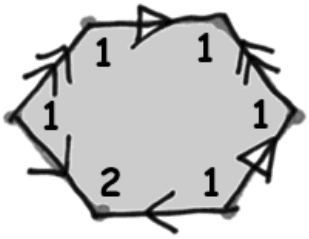
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



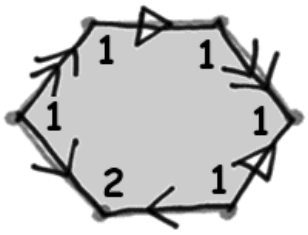
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

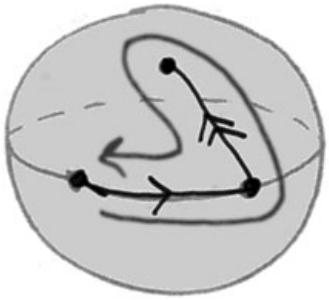
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

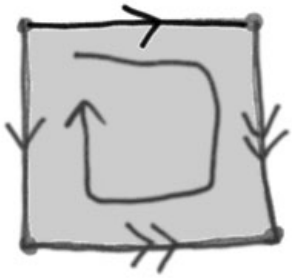
First Exam CK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

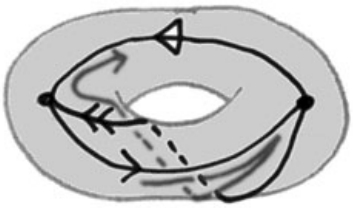
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

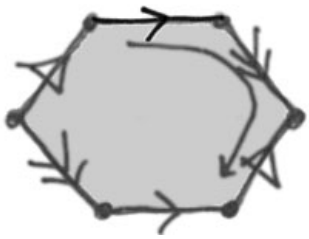




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

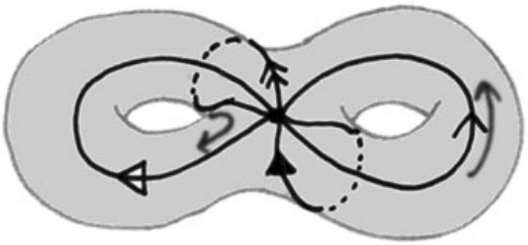
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

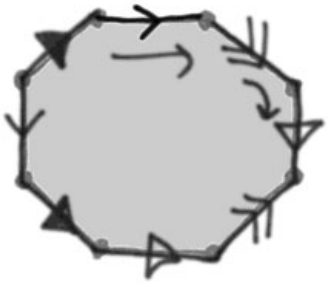




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

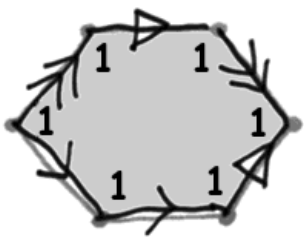
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



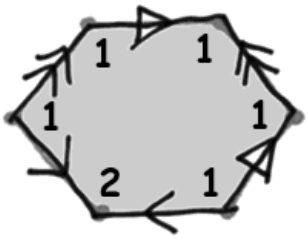


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

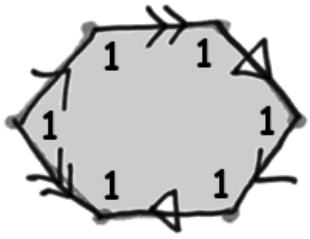
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



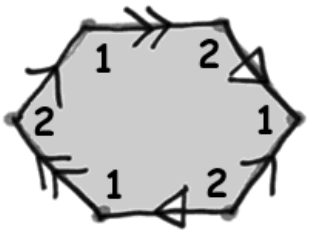
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



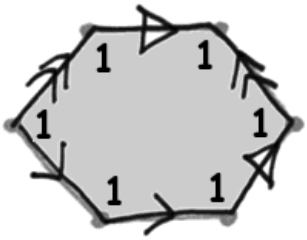
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



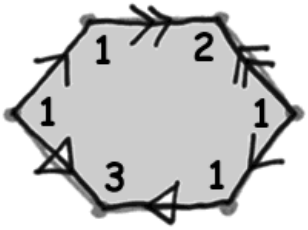
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



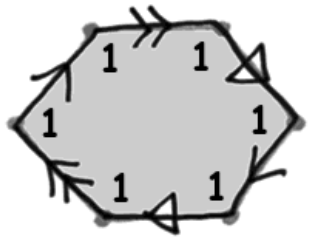
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



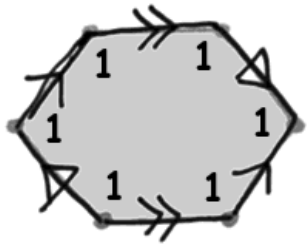
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

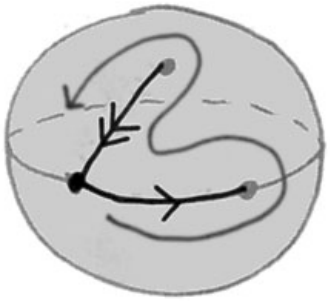
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

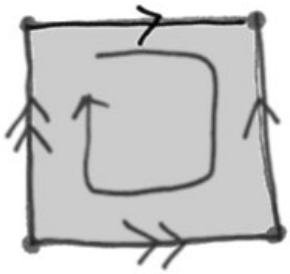
First Exam CL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

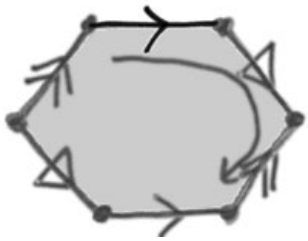
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





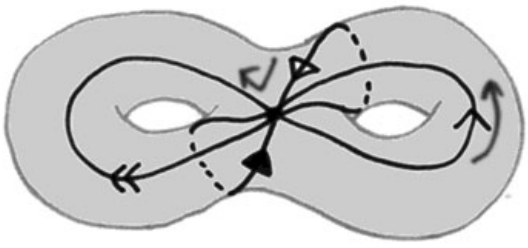
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

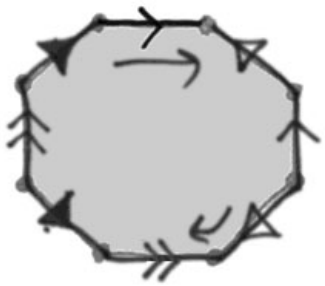
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

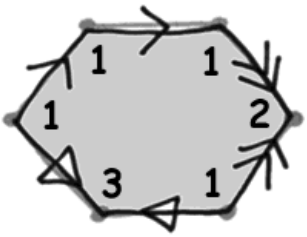
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



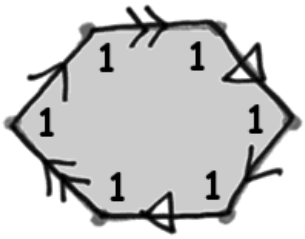


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

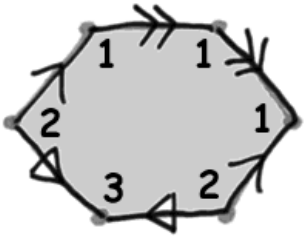
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



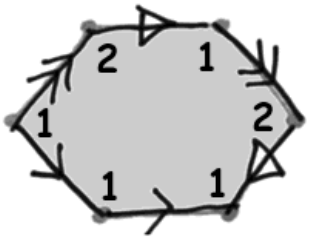
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



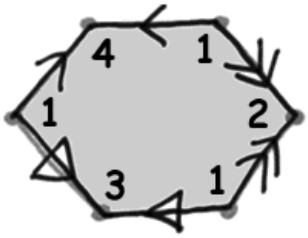
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



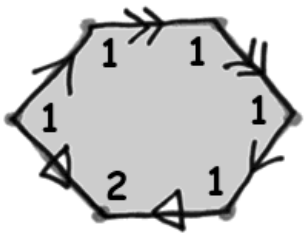
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



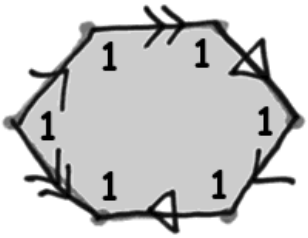
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



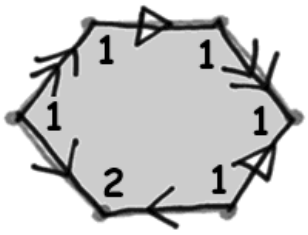
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

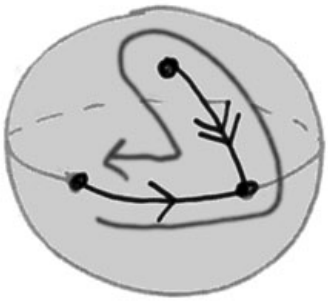
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

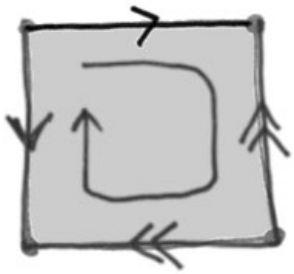
First Exam CM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

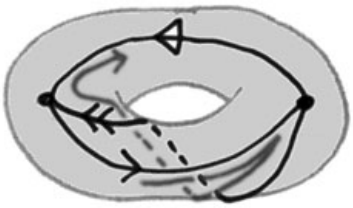
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

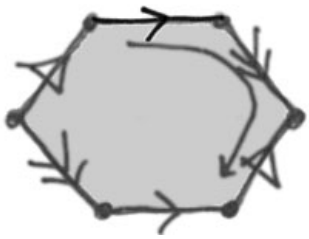




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

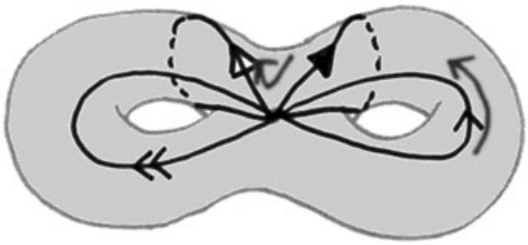
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

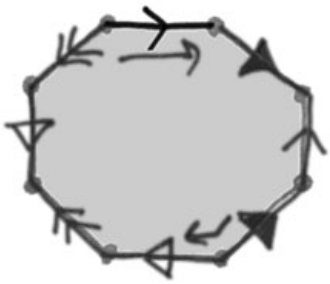




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

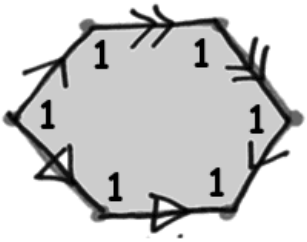
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



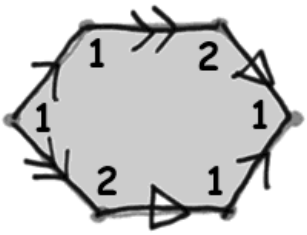


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

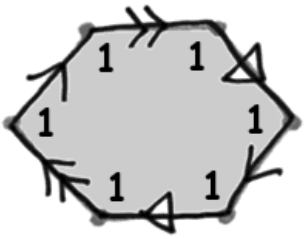
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



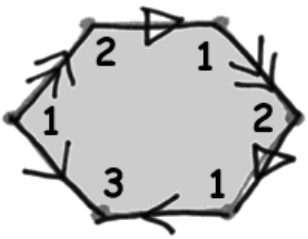
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



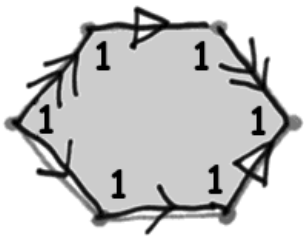
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



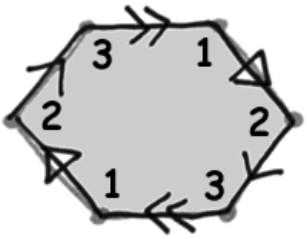
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



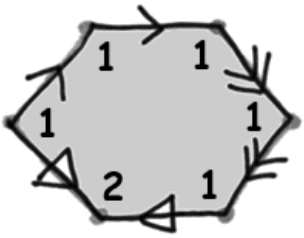
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



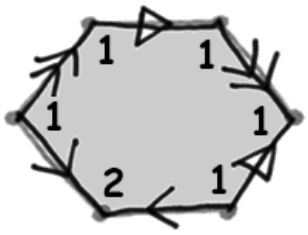
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

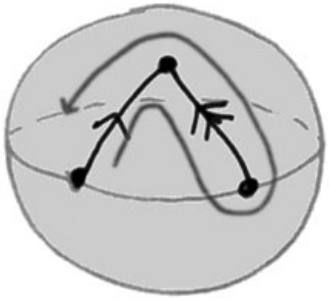
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

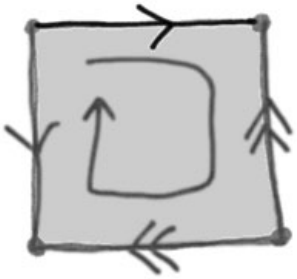
First Exam CN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

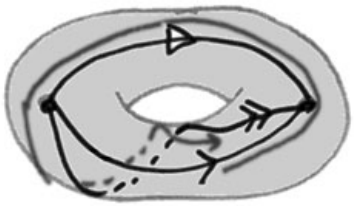
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

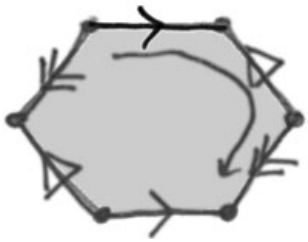




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

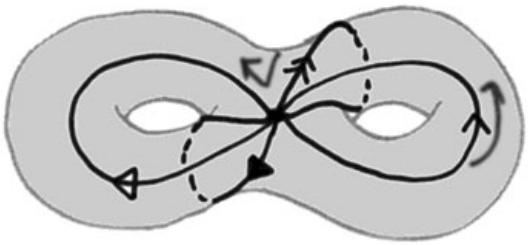
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

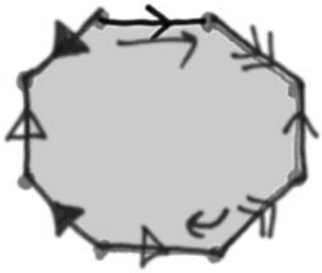




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

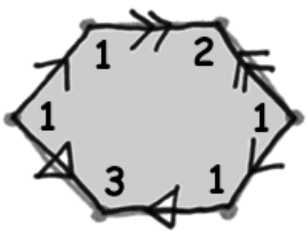
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



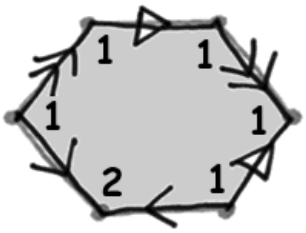


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

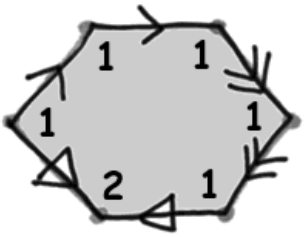
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



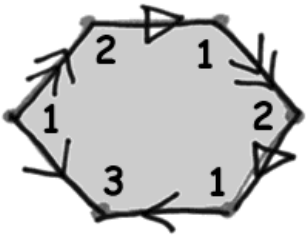
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



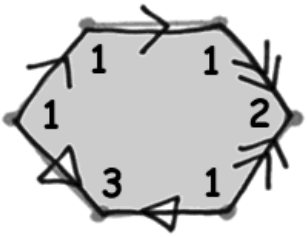
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



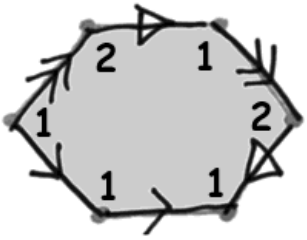
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



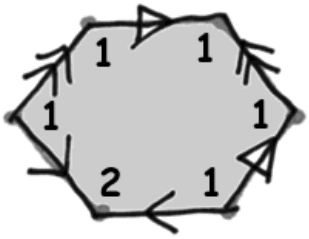
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



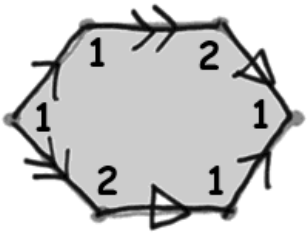
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

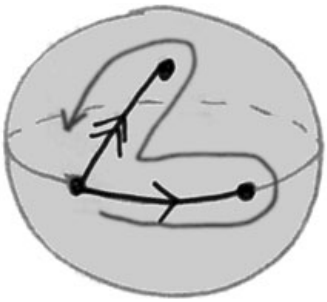
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

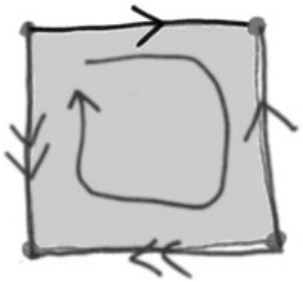
First Exam DA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

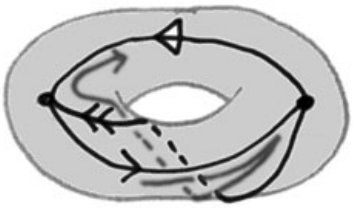
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

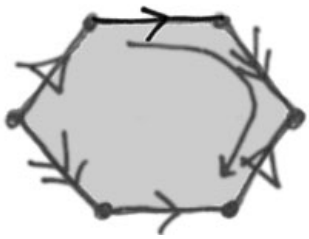




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

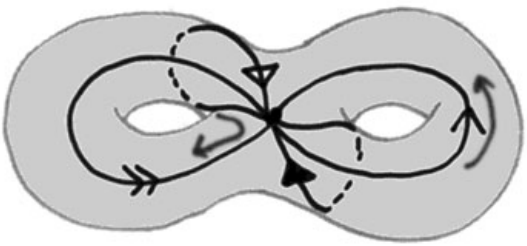
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

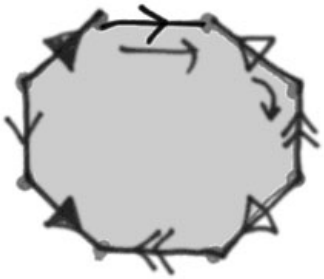




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

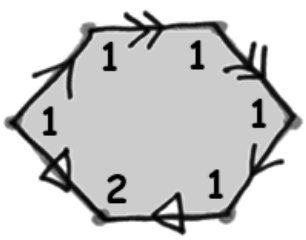
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



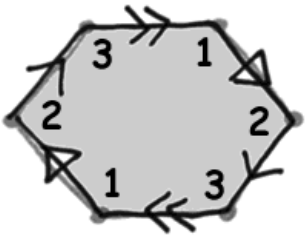


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

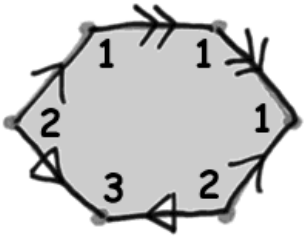
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



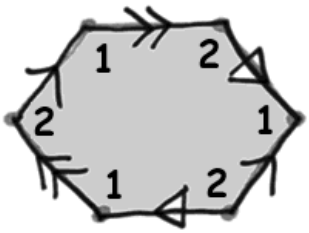
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



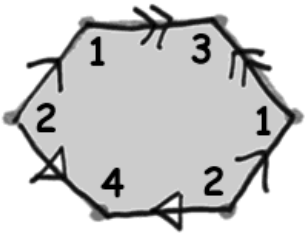
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



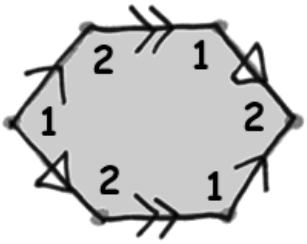
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



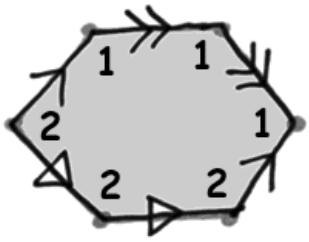
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



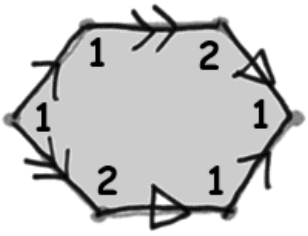
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

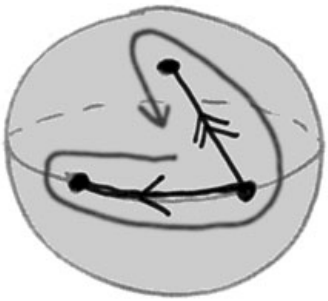
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

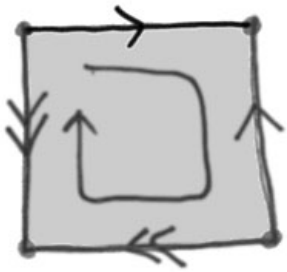
First Exam DB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

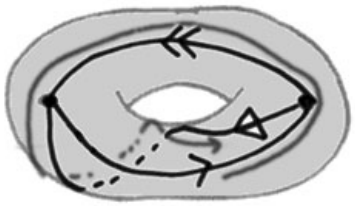
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

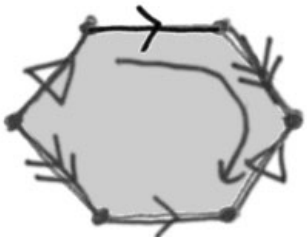




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

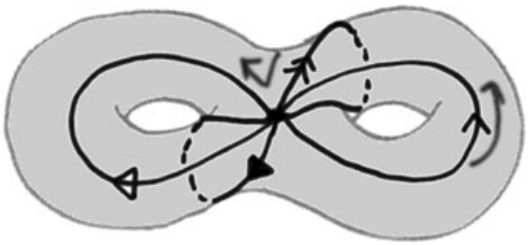
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

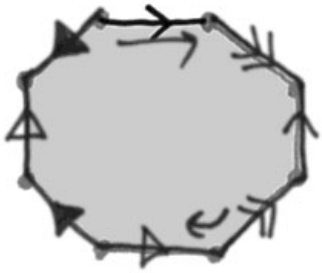




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

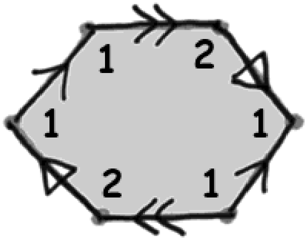
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





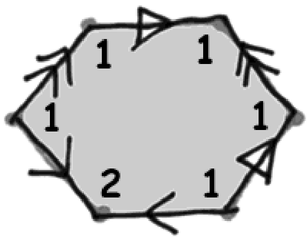
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



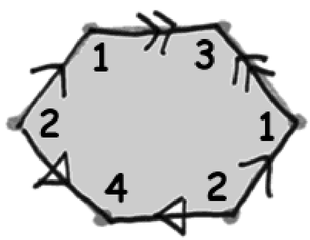
$$\begin{array}{rcl} +\ v &=& 2 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& 0 \end{array}$$

nonorientable



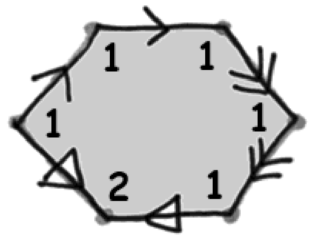
$$\begin{array}{rcl} +\ v &=& 2 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& 0 \end{array}$$

orientable



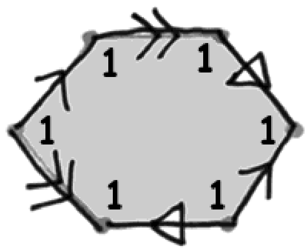
$$\begin{array}{rcl} +\ v &=& 4 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& 2 \end{array}$$

orientable



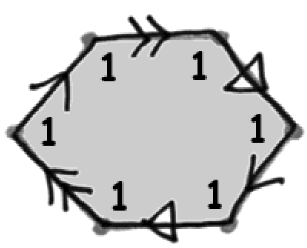
$$\begin{array}{rcl} +\ v &=& 2 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& 0 \end{array}$$

nonorientable



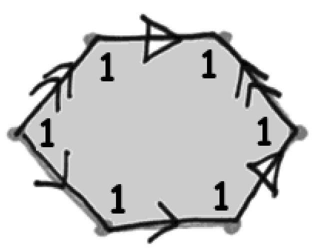
$$\begin{array}{rcl} +\ v &=& 1 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& -1 \end{array}$$

nonorientable



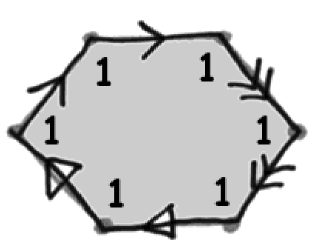
$$\begin{array}{rcl} +\ v &=& 1 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& -1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\ v &=& 1 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& -1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\ v &=& 1 \\ -\ e &=& 3 \\ +\ f &=& 1 \\ \hline \chi &=& -1 \end{array}$$

nonorientable

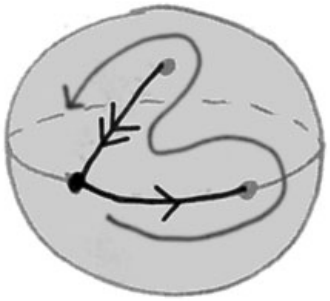
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

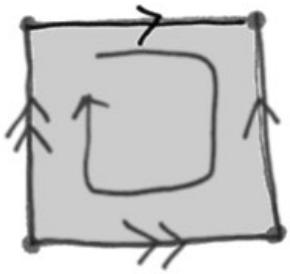
First Exam DC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

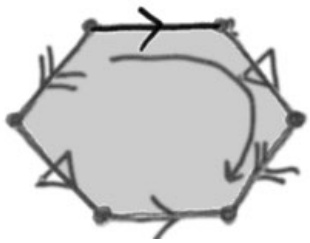
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





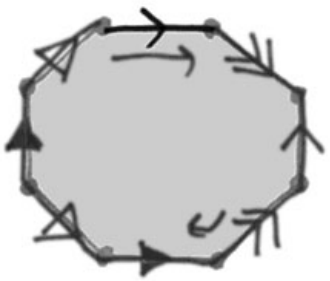
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



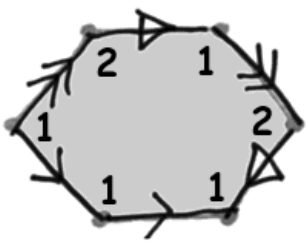
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



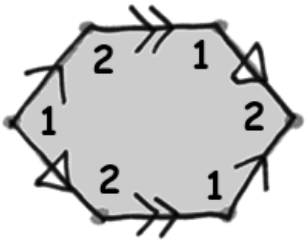
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



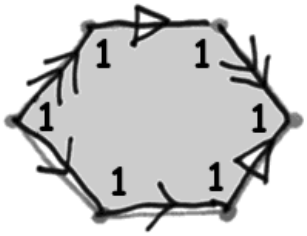
$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

nonorientable



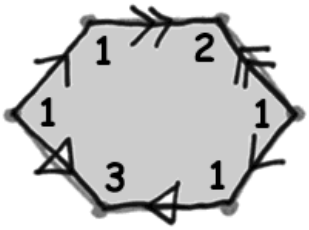
$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

orientable



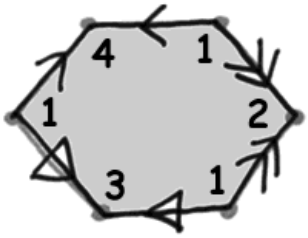
$$\begin{array}{r} +\ v = 1 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = -1 \end{array}$$

nonorientable



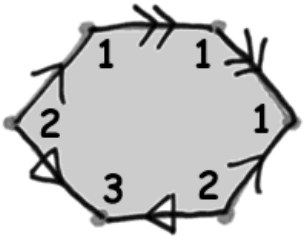
$$\begin{array}{r} +\ v = 3 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 1 \end{array}$$

nonorientable



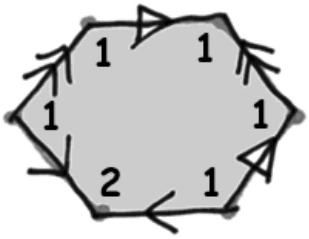
$$\begin{array}{r} +\ v = 4 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 2 \end{array}$$

orientable



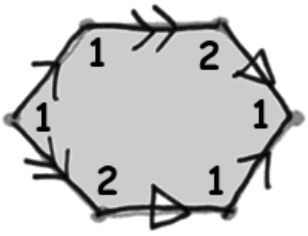
$$\begin{array}{r} +\ v = 3 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 1 \end{array}$$

nonorientable



$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

orientable



$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

orientable

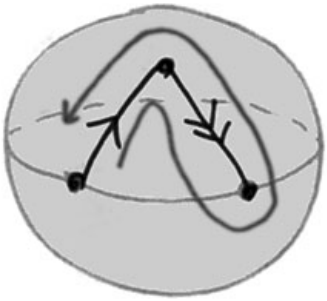
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

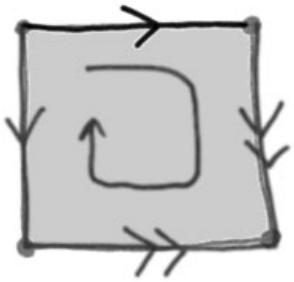
First Exam DD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

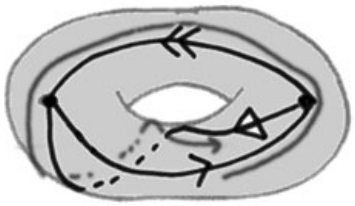
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

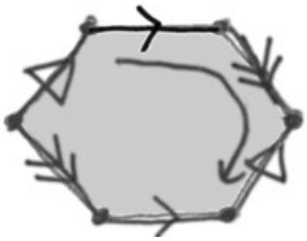




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

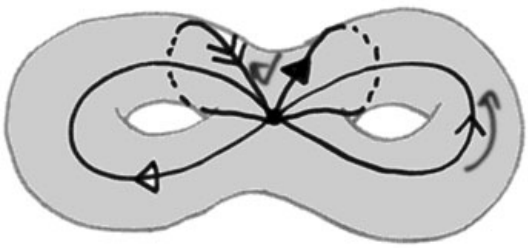
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

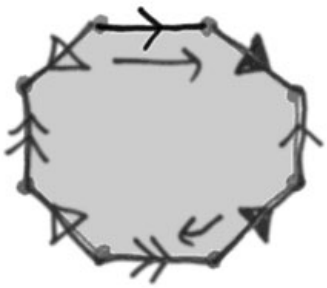




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

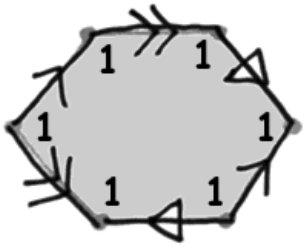
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



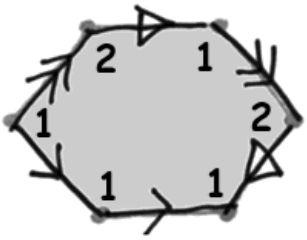


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

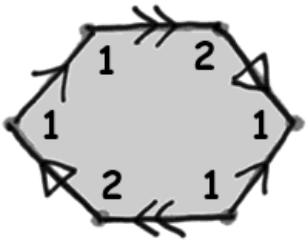
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



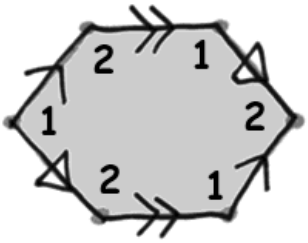
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



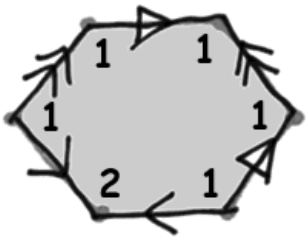
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



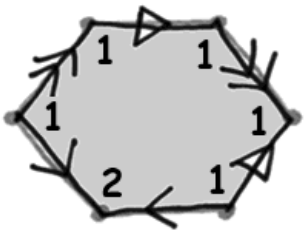
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



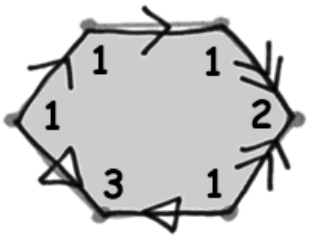
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



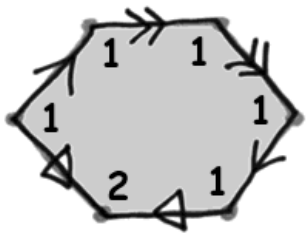
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

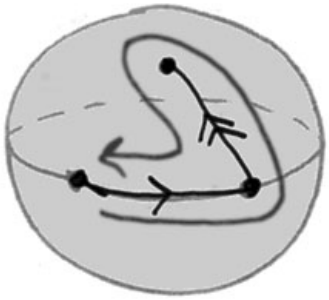
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

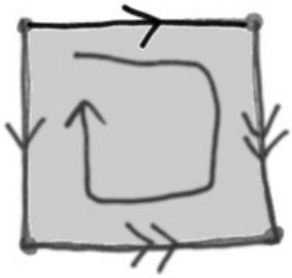
First Exam DE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

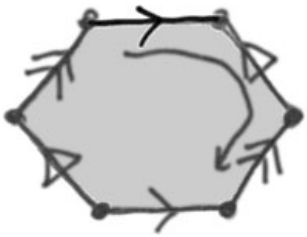
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





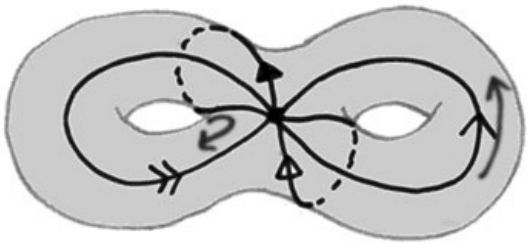
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

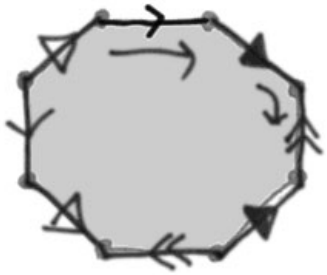
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

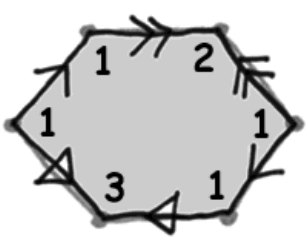
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



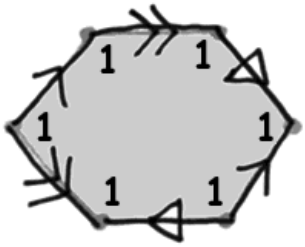


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

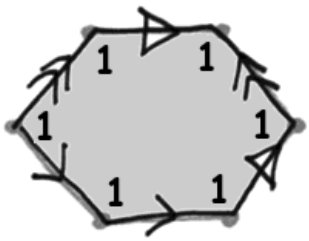
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



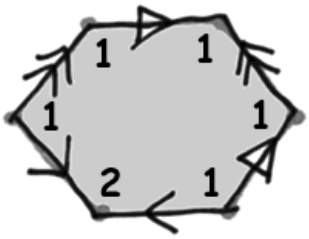
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



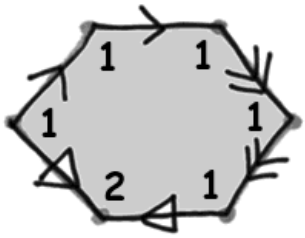
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



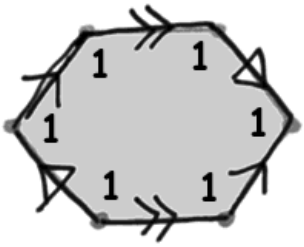
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



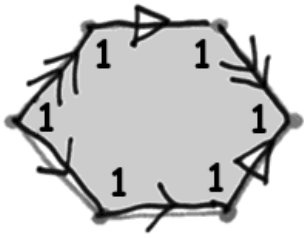
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



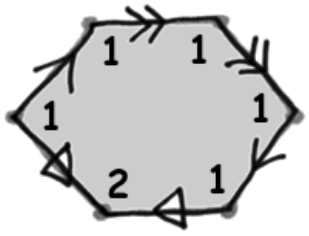
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

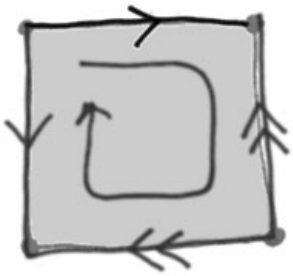
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam DF

Surfaces and Knots, Dave Bayer, February 21, 2002

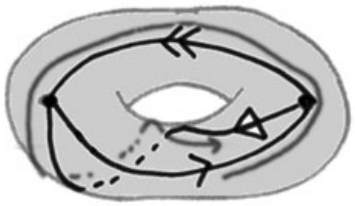
Answer Key

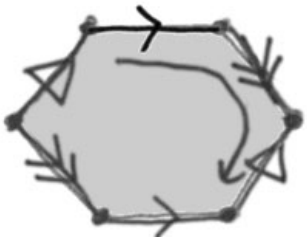
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

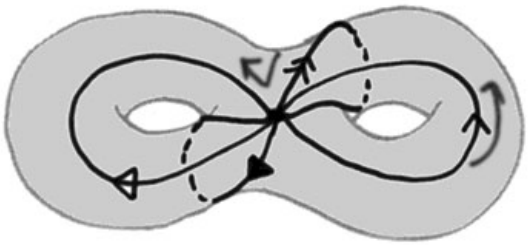
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

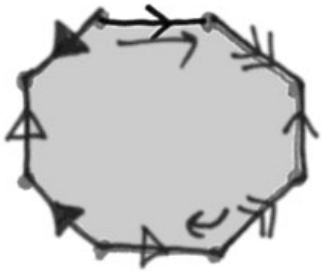




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

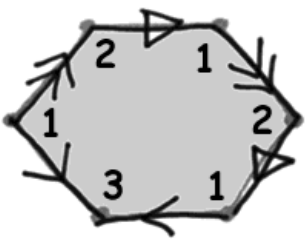
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



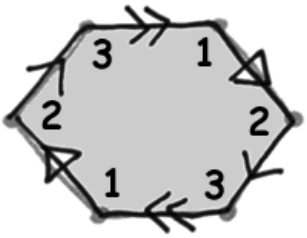


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

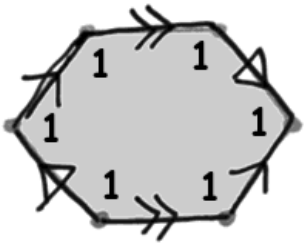
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



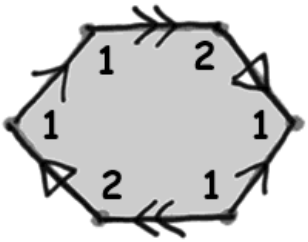
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



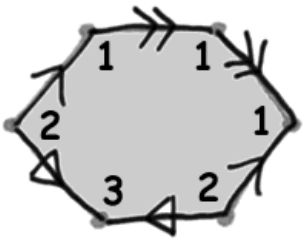
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



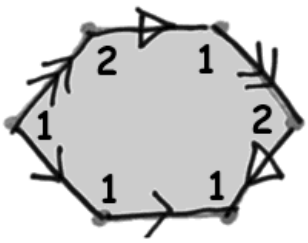
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



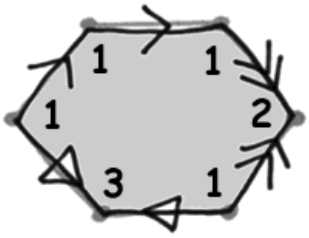
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



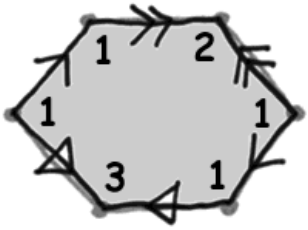
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

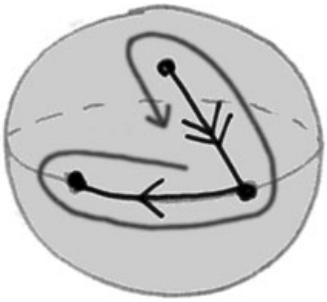
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

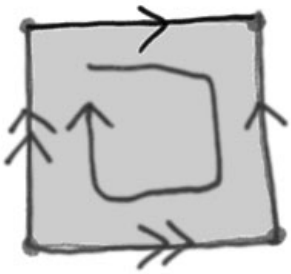
First Exam DG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

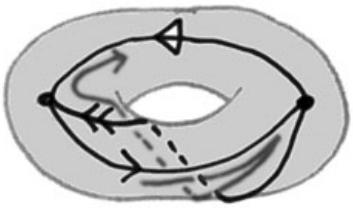
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

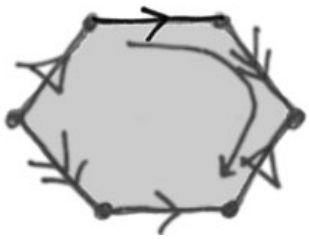




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

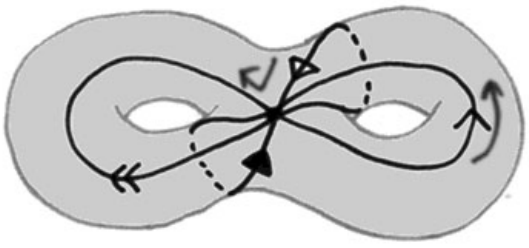
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

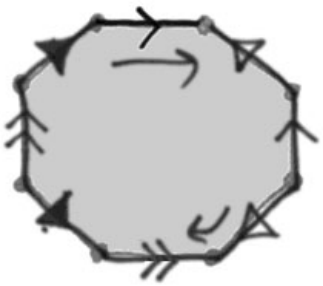




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

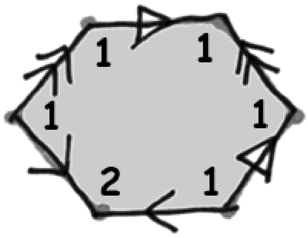
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





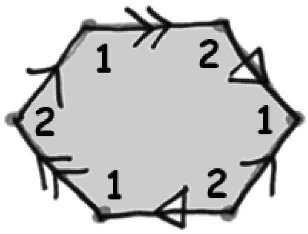
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[**4**] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



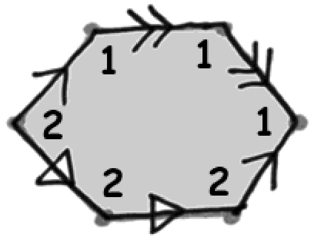
$$\begin{array}{rcl} +\,v & = & 2 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

orientable



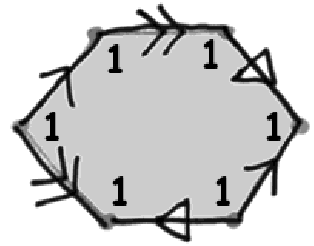
$$\begin{array}{rcl} +\,v & = & 2 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable



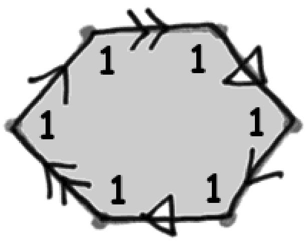
$$\begin{array}{rcl} +\,v & = & 2 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable



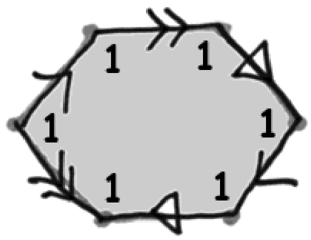
$$\begin{array}{rcl} +\,v & = & 1 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



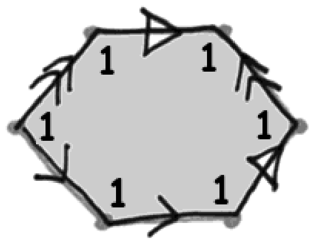
$$\begin{array}{rcl} +\,v & = & 1 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



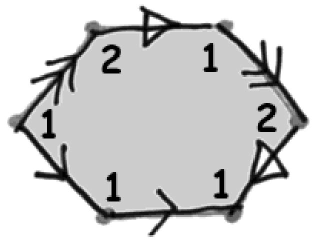
$$\begin{array}{rcl} +\,v & = & 1 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\,v & = & 1 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\,v & = & 2 \\ -\,e & = & 3 \\ +\,f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable

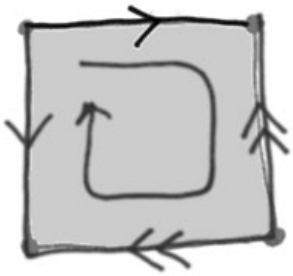
[**5**] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam DH

Surfaces and Knots, Dave Bayer, February 21, 2002

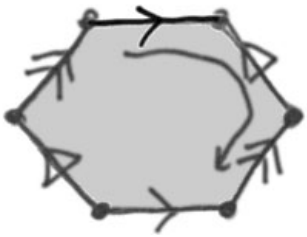
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



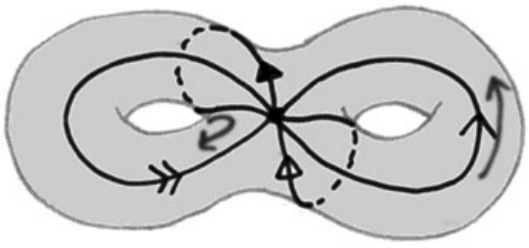
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

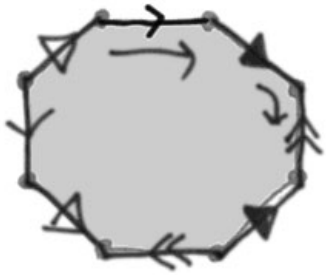
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

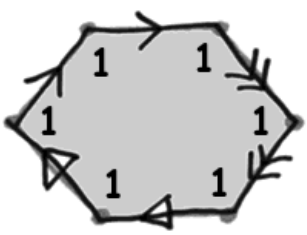
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



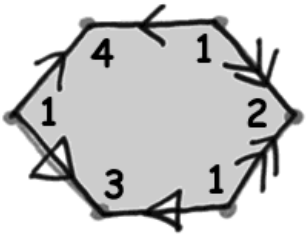


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

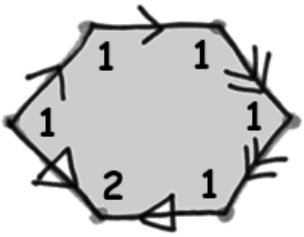
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



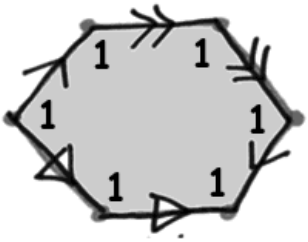
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



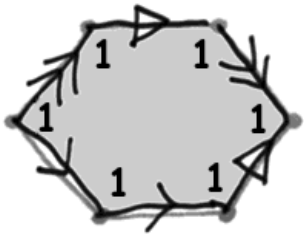
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



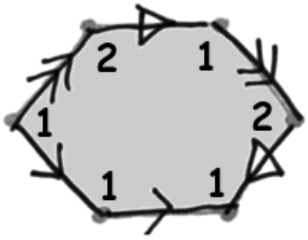
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



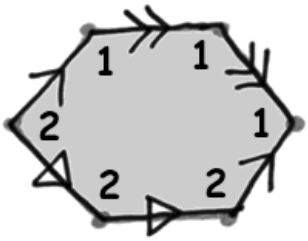
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



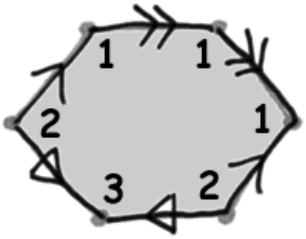
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

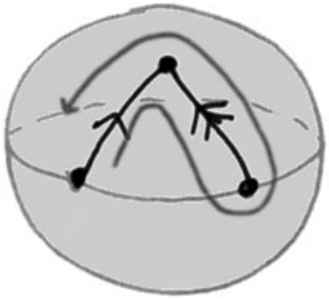
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

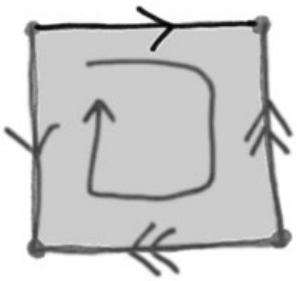
First Exam DI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

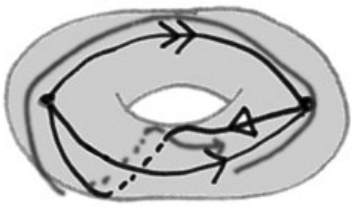
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

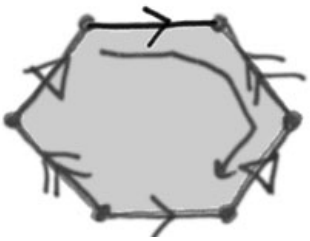




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

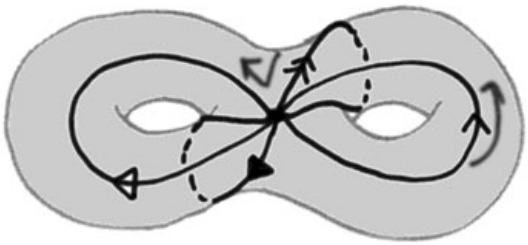
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

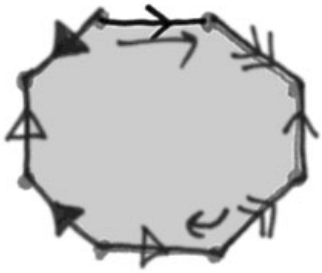




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

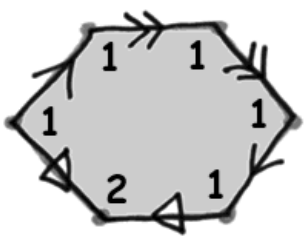
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



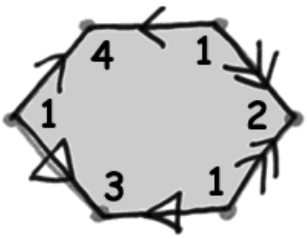


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

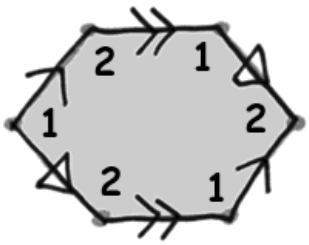
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



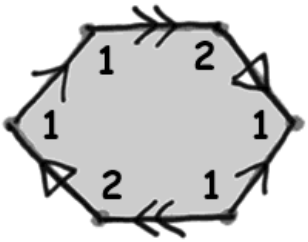
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



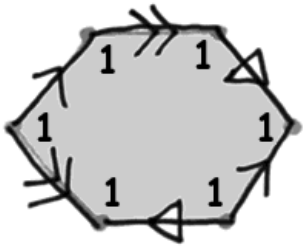
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



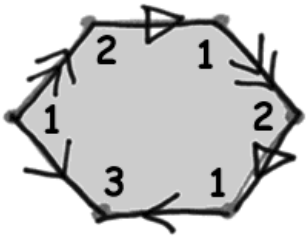
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



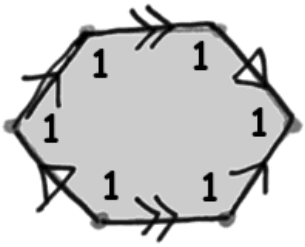
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



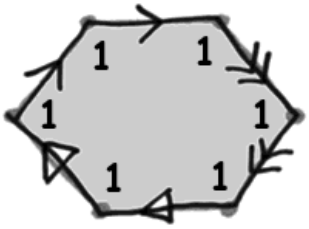
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

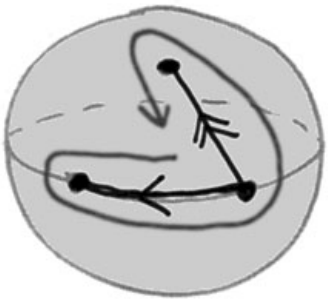
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

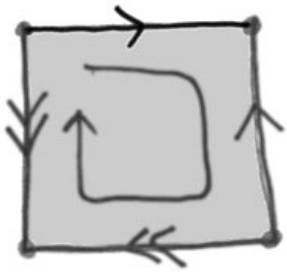
First Exam DJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

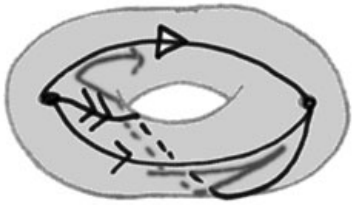
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

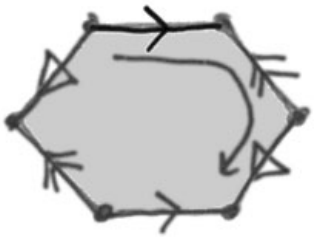




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

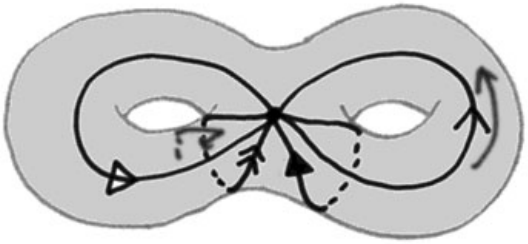
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

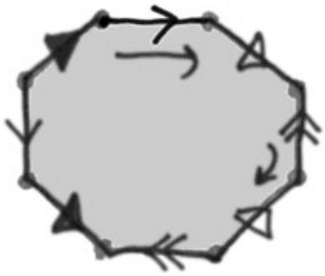




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

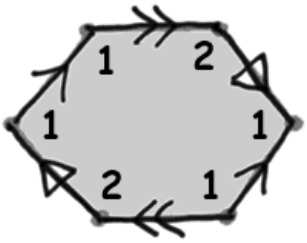
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



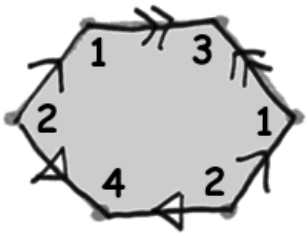


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

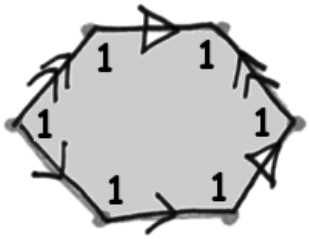
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



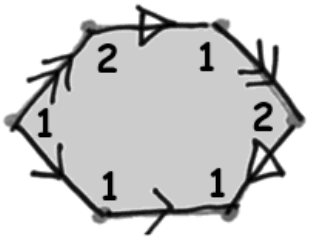
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



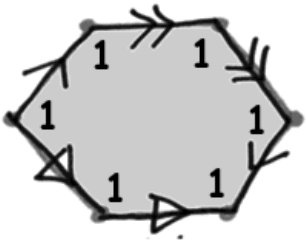
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



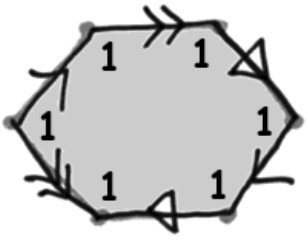
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



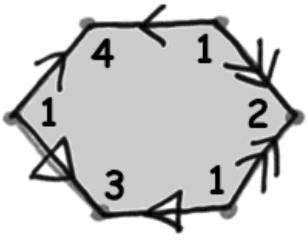
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



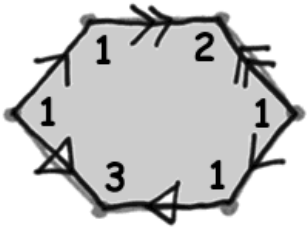
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

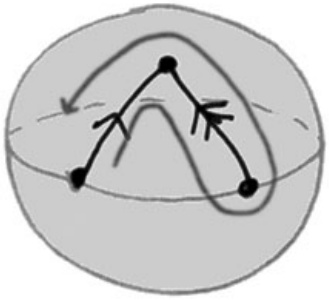
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

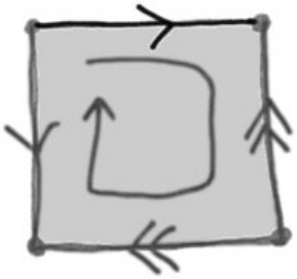
First Exam DK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

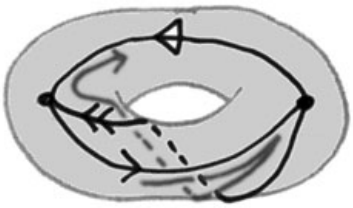
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

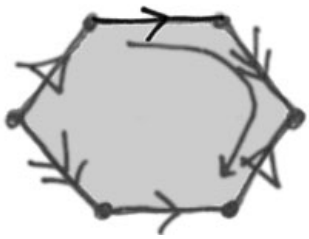




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

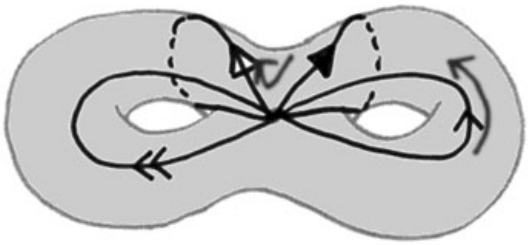
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

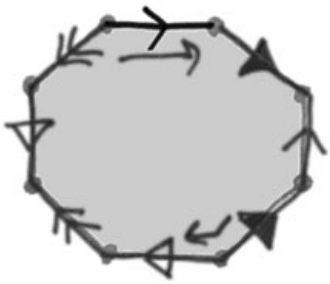




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

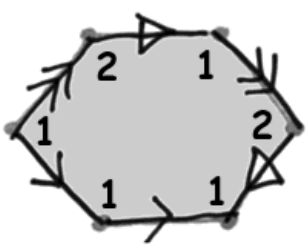
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



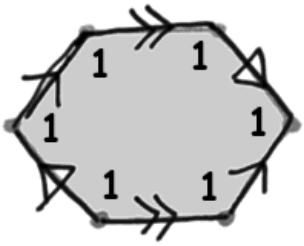


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

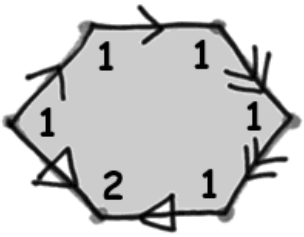
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



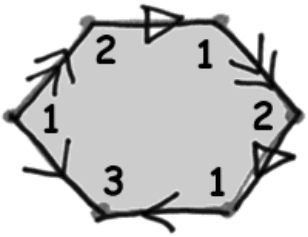
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



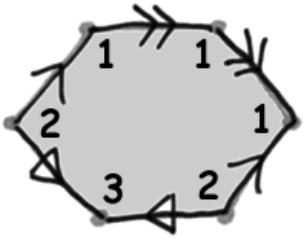
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



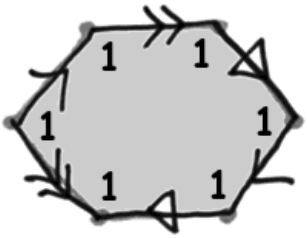
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



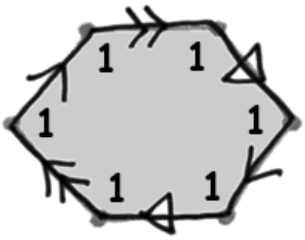
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



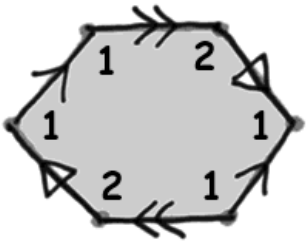
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

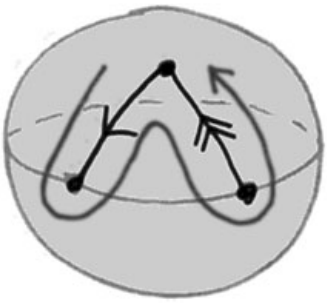
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

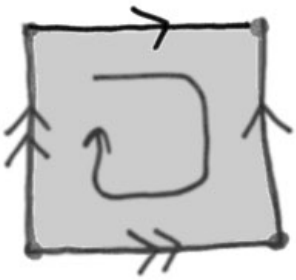
First Exam DL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

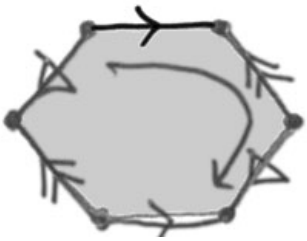
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





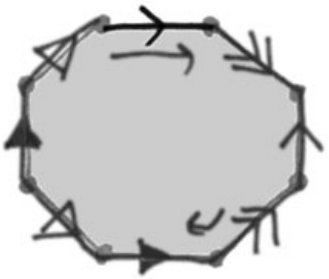
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



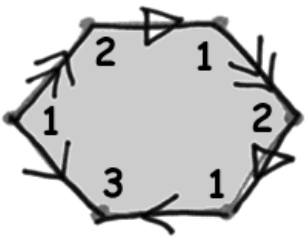
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

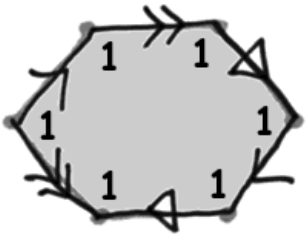


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

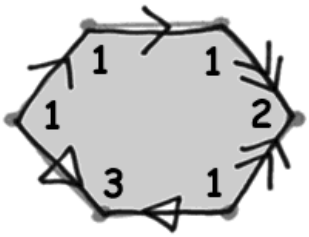
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



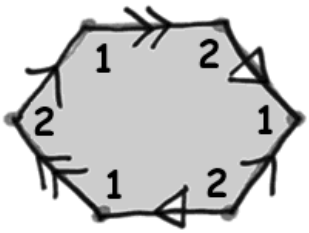
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



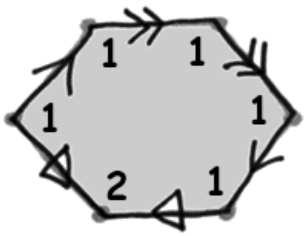
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



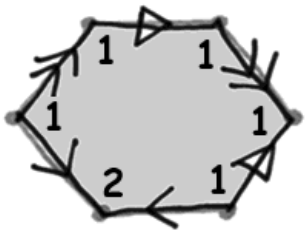
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



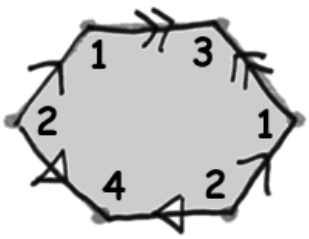
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



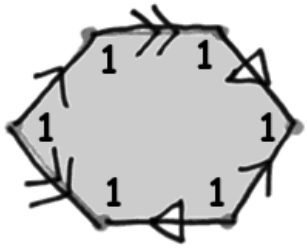
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

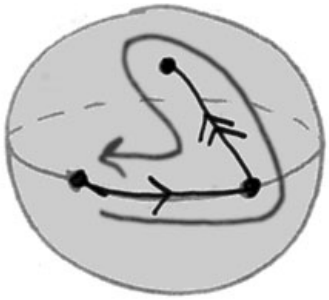
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

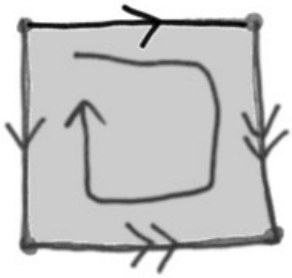
First Exam DM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

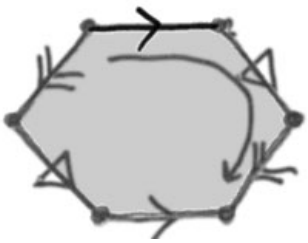
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





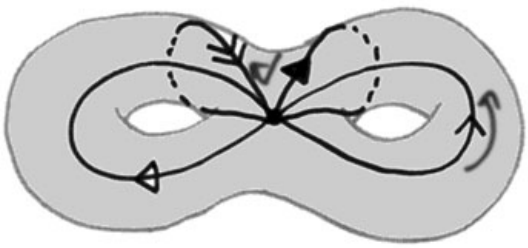
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

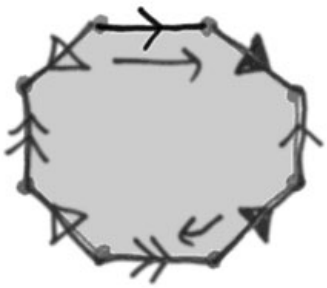
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

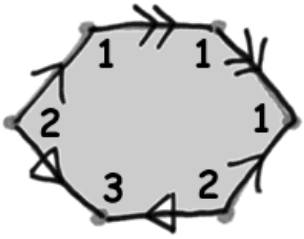
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



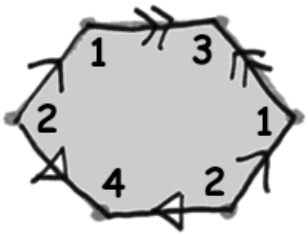


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

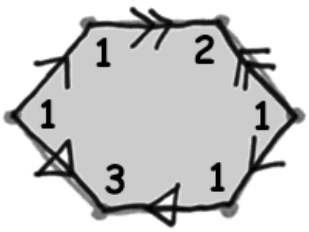
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



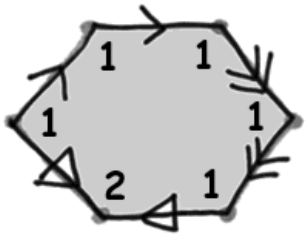
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



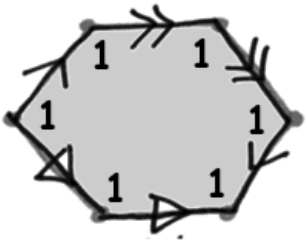
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



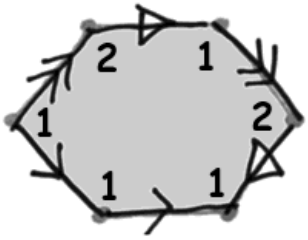
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



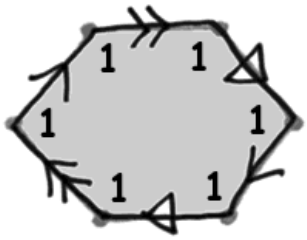
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



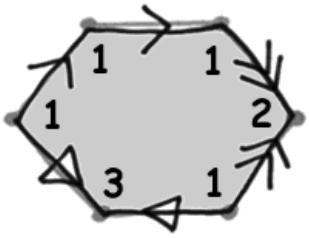
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

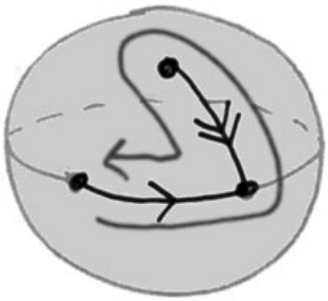
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

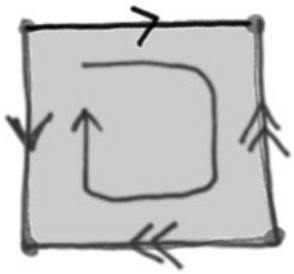
First Exam DN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



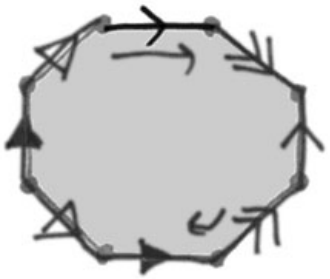


$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

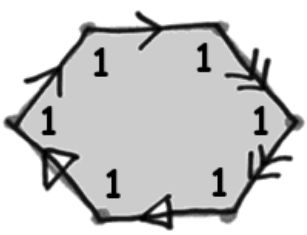
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

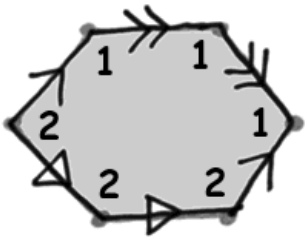


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

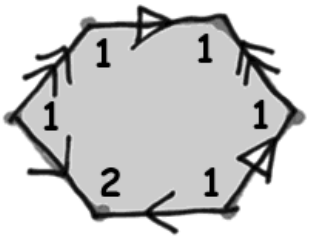
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



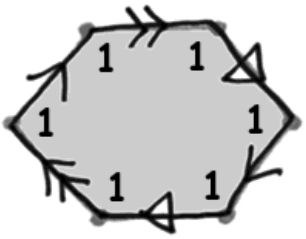
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



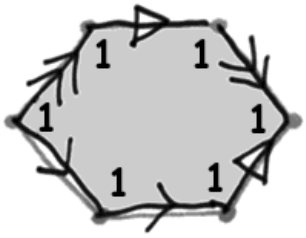
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



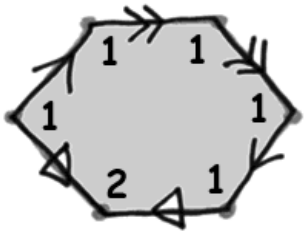
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



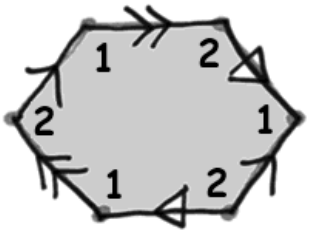
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



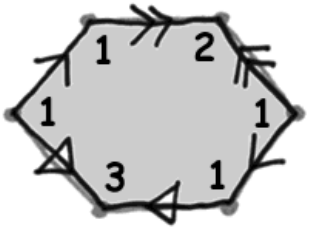
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

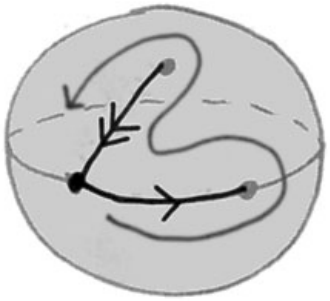
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

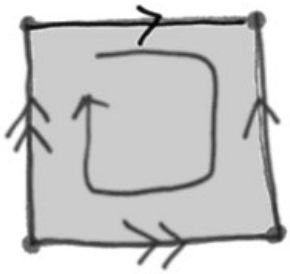
First Exam EA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

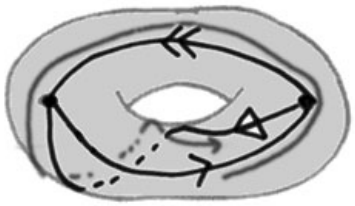
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

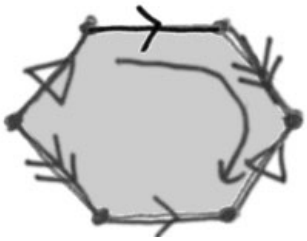




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

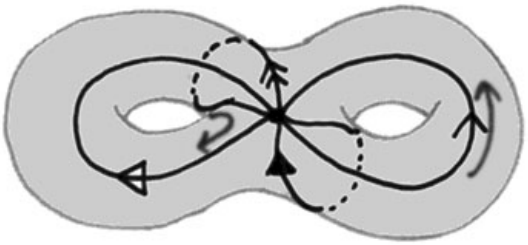
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

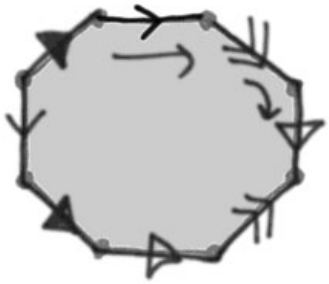




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

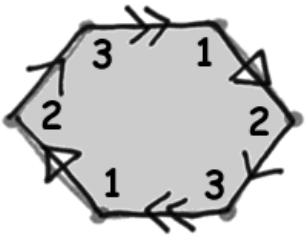
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



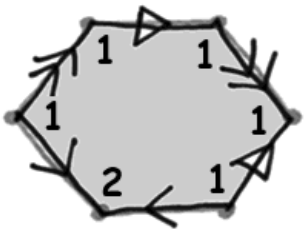


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

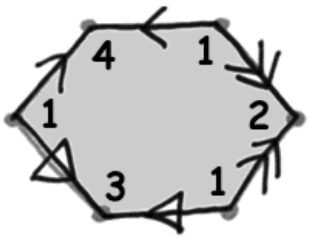
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



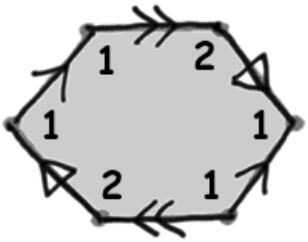
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



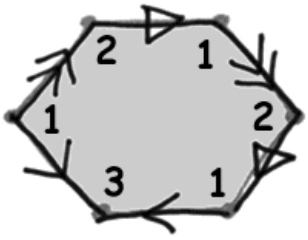
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



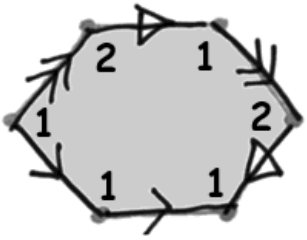
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



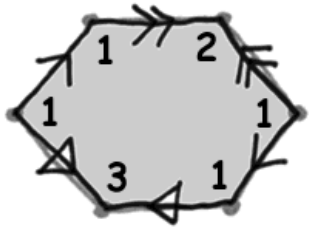
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



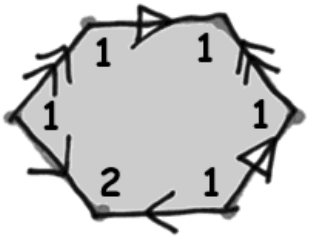
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

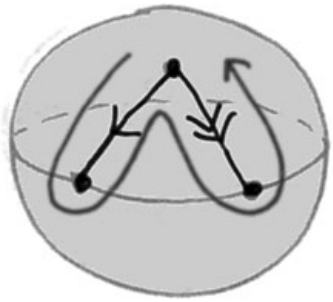
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

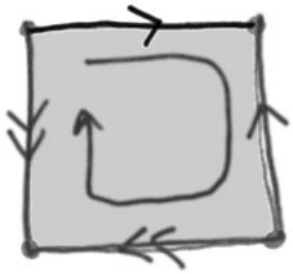
First Exam EB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

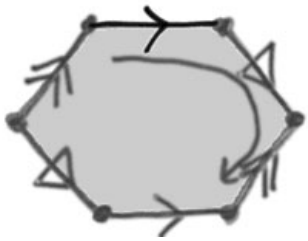
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





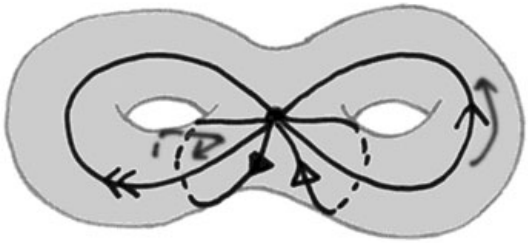
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

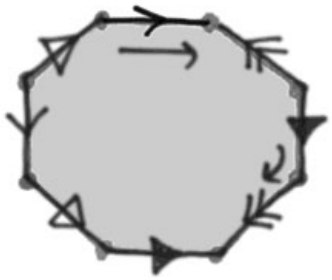
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

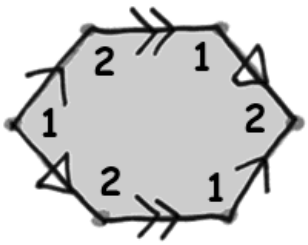
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



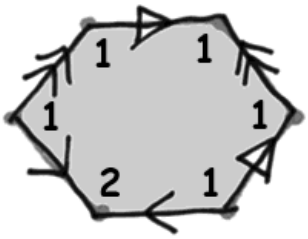


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

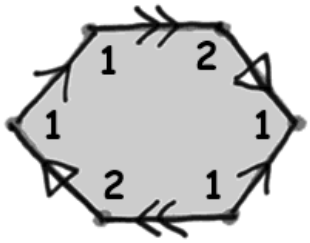
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



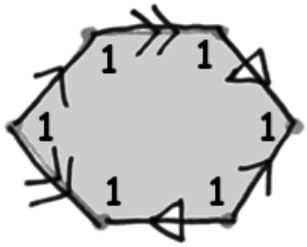
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



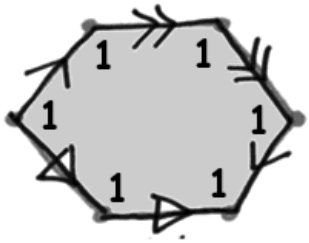
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



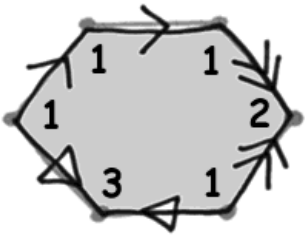
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



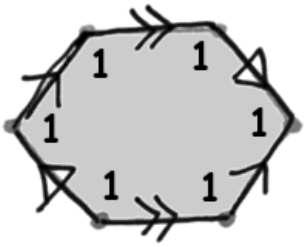
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



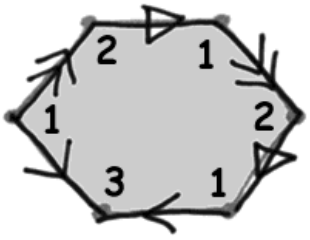
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

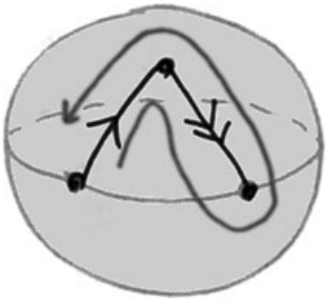
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

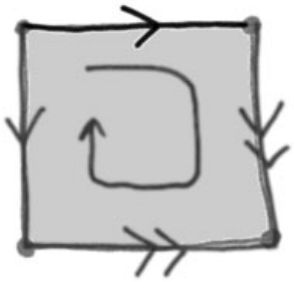
First Exam EC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

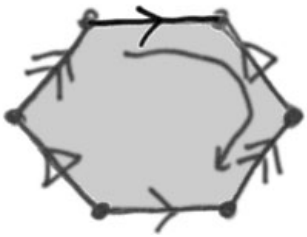
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





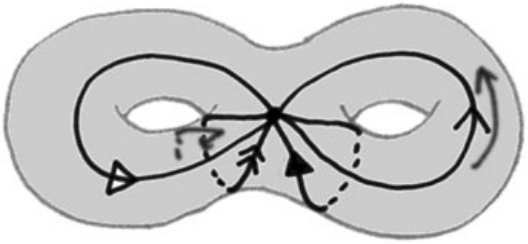
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

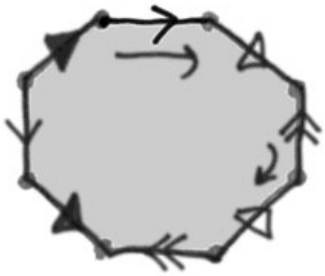
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

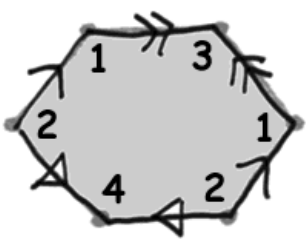
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



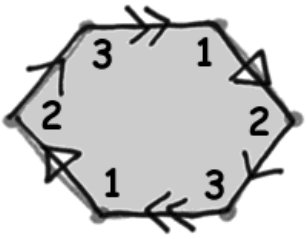


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

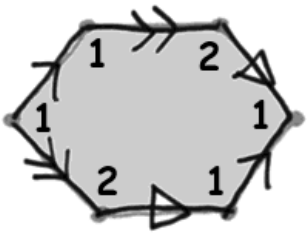
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



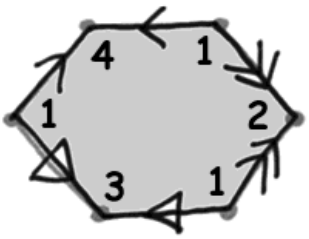
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



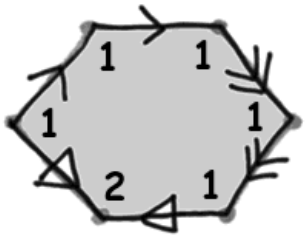
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



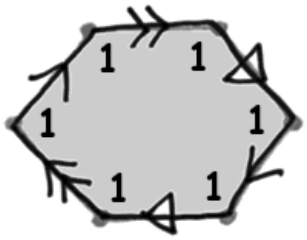
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



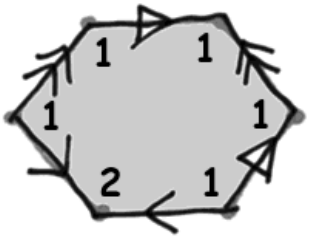
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



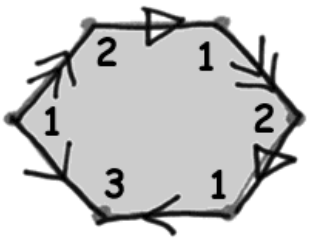
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

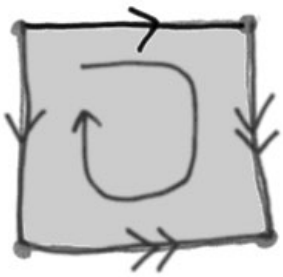
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam ED

Surfaces and Knots, Dave Bayer, February 21, 2002

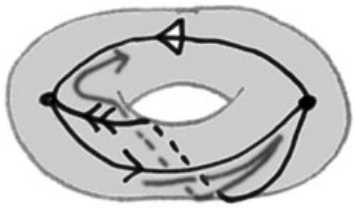
Answer Key

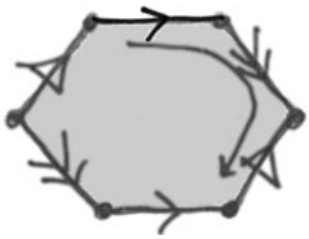
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

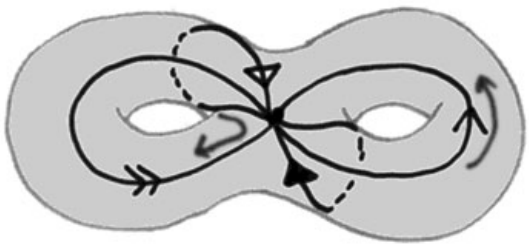
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

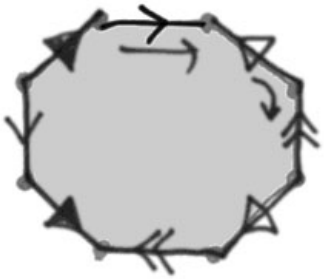




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

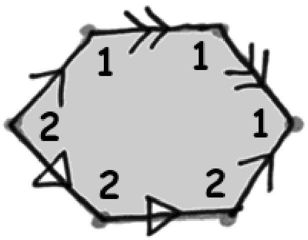
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





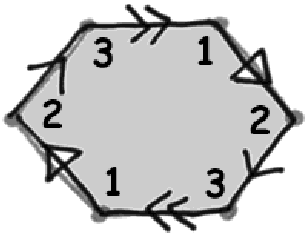
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[**4**] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



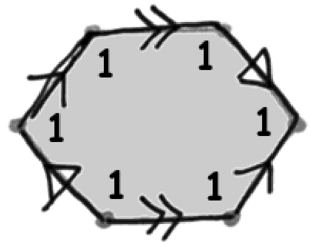
$$\begin{array}{rcr} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0 \end{array}$$

nonorientable



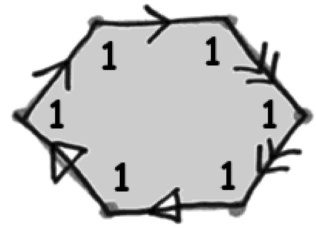
$$\begin{array}{rcr} +\,v &=& 3\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 1 \end{array}$$

nonorientable



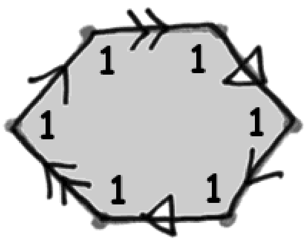
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



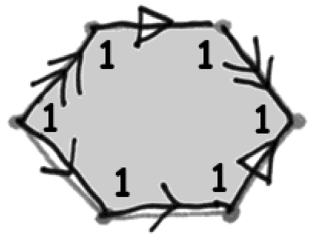
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



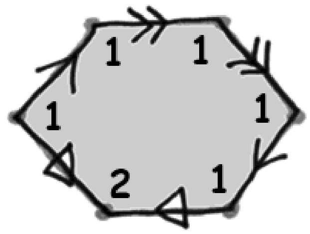
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



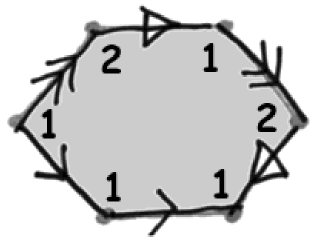
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



$$\begin{array}{rcr} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0 \end{array}$$

nonorientable



$$\begin{array}{rcr} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0 \end{array}$$

nonorientable

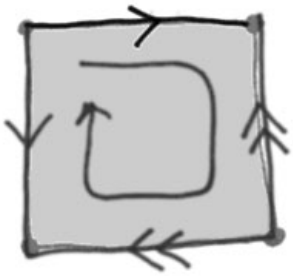
[**5**] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam EE

Surfaces and Knots, Dave Bayer, February 21, 2002

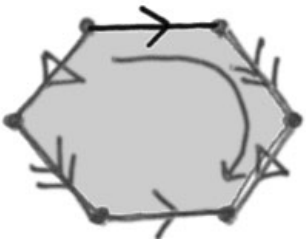
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



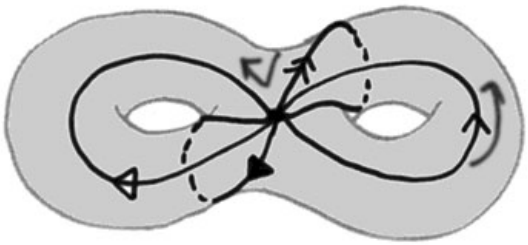
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

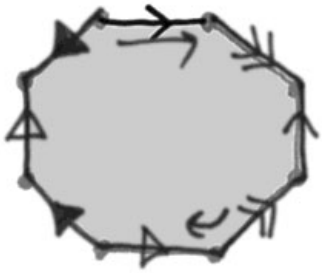
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

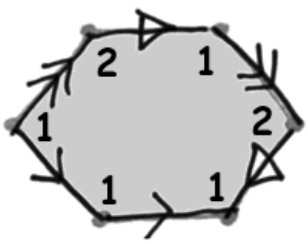
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



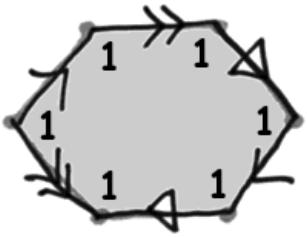


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

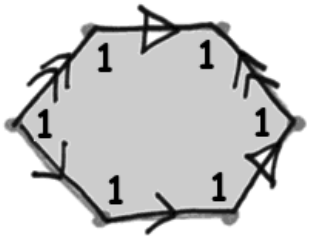
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



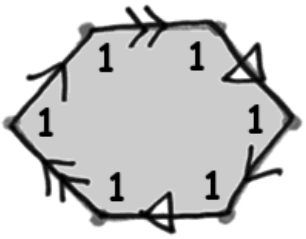
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



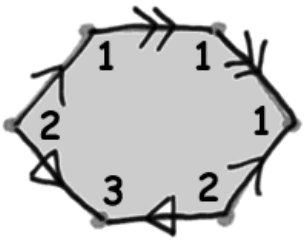
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



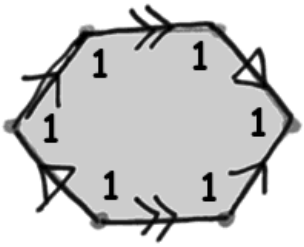
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



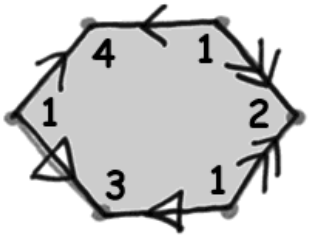
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



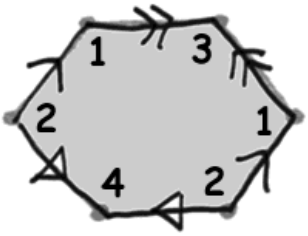
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

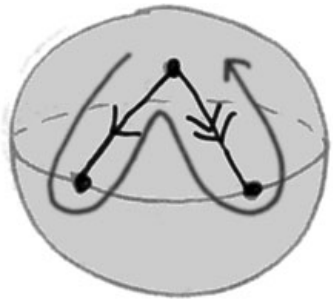
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

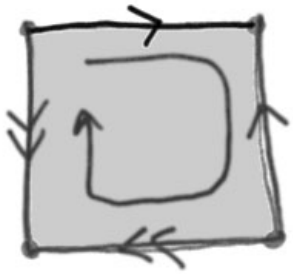
First Exam EF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

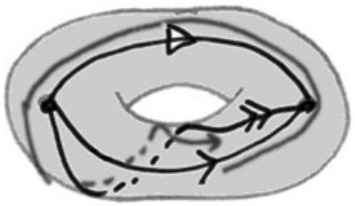
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

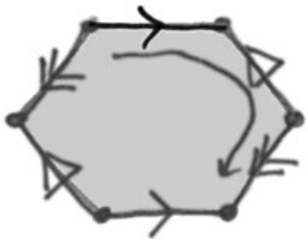




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

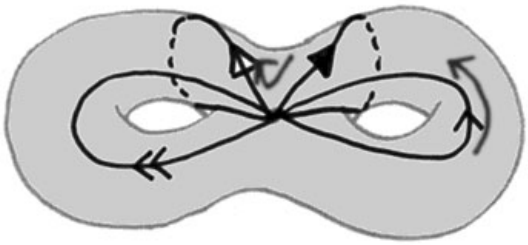
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

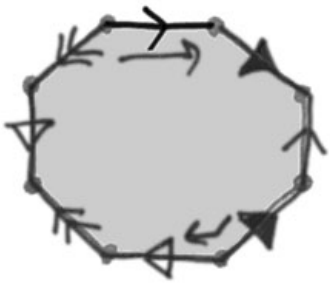




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

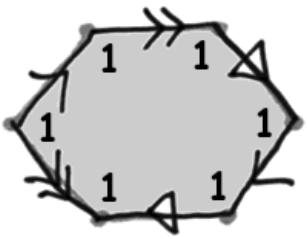
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



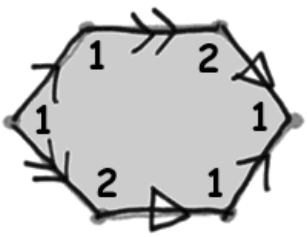


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

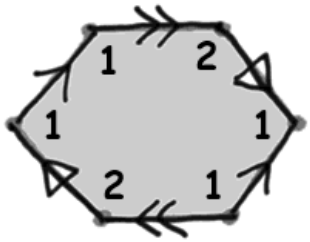
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



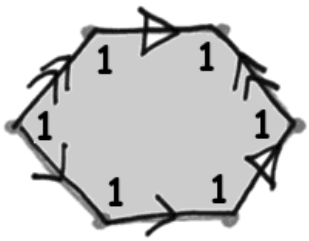
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



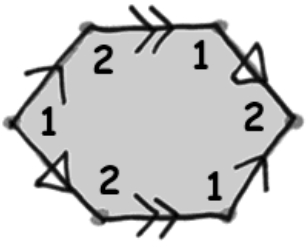
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



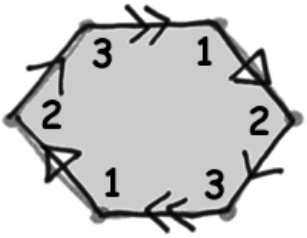
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



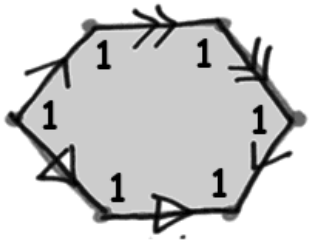
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



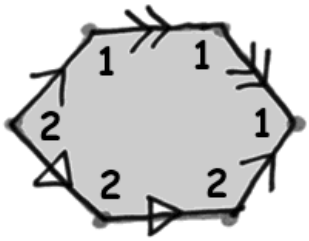
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

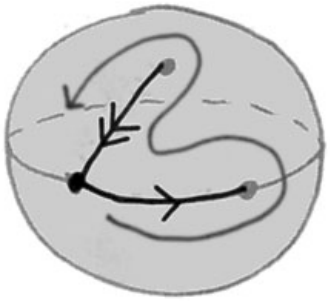
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

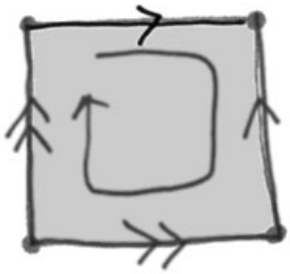
First Exam EG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

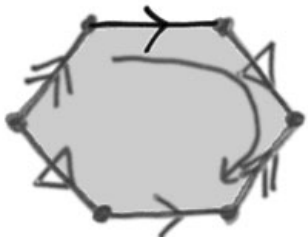
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





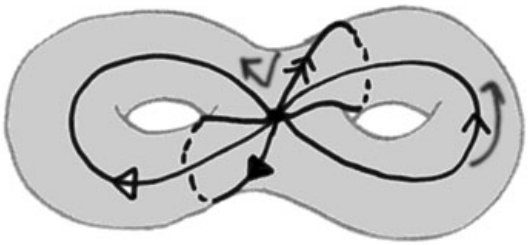
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

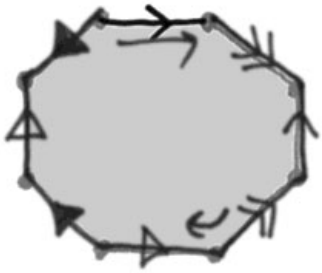
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

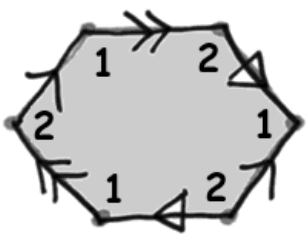
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



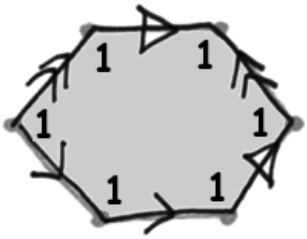


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

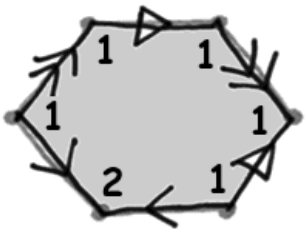
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



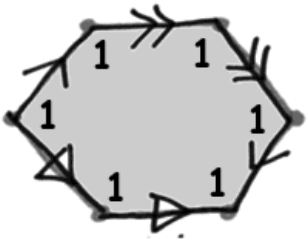
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



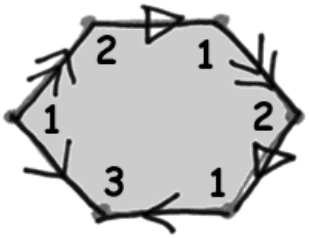
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



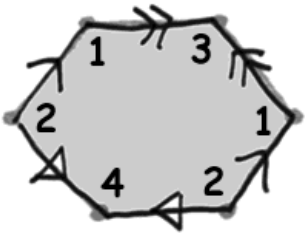
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



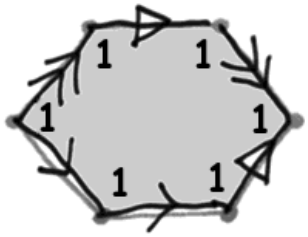
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



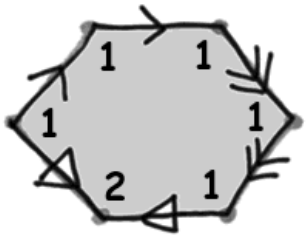
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

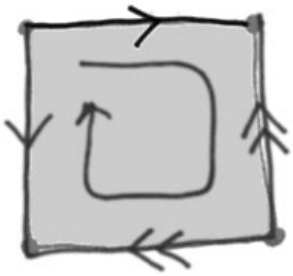
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam EH

Surfaces and Knots, Dave Bayer, February 21, 2002

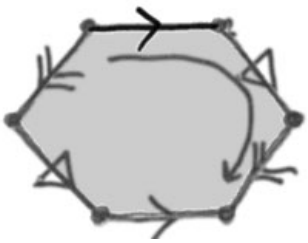
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



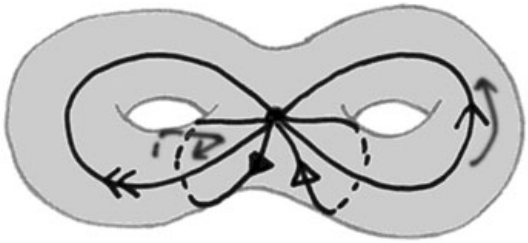
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

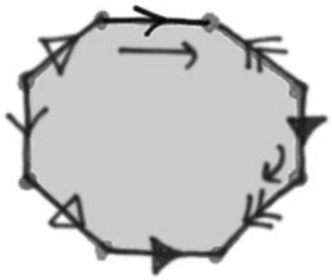
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

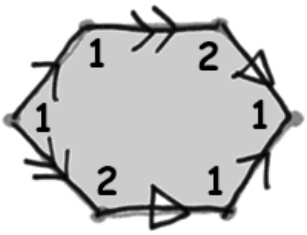
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



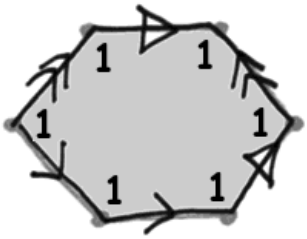


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

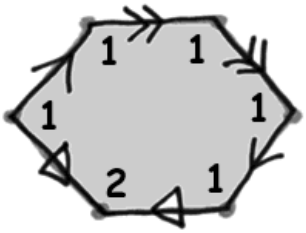
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



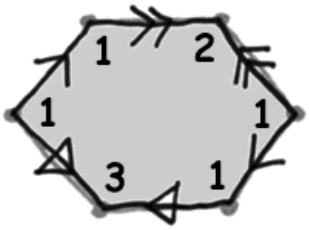
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



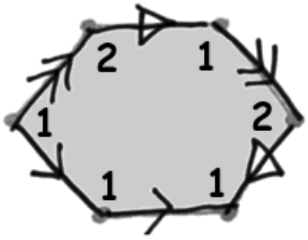
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



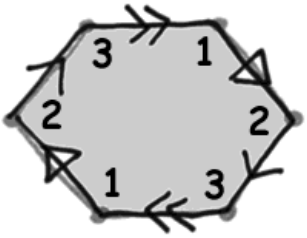
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



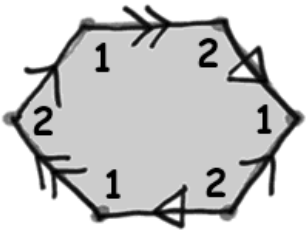
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



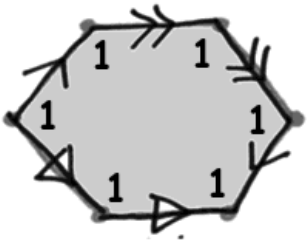
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

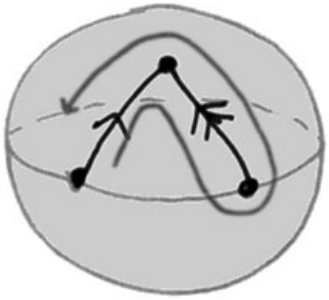
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

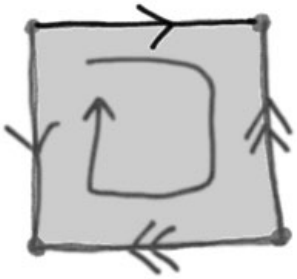
First Exam EI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

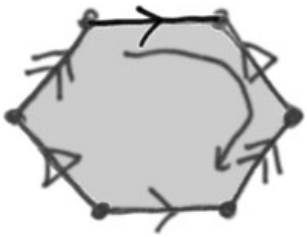
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





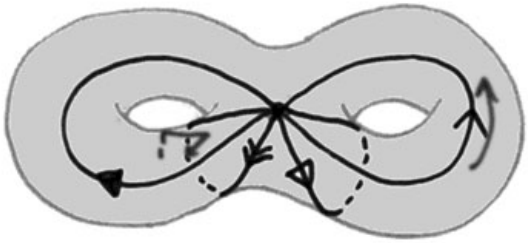
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

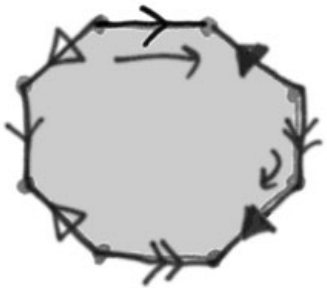
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

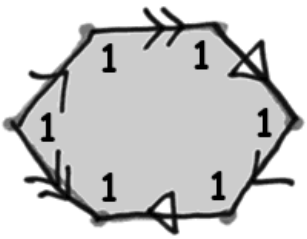
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



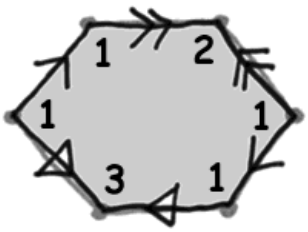


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

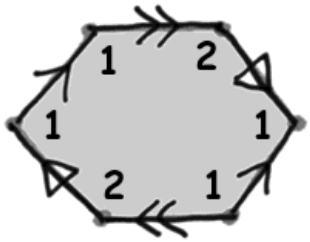
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



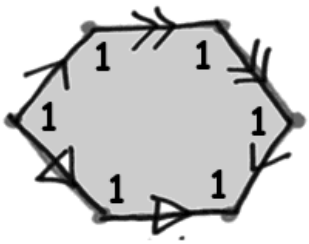
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



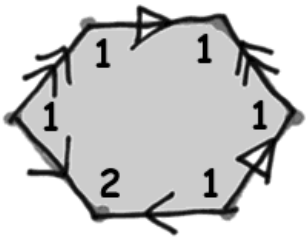
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



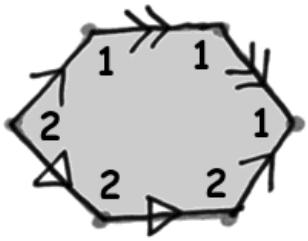
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



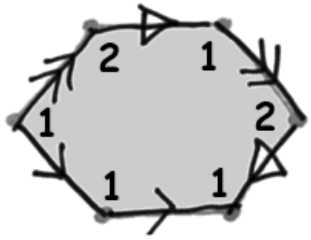
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



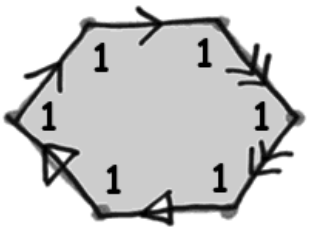
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

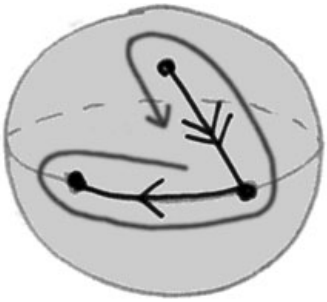
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

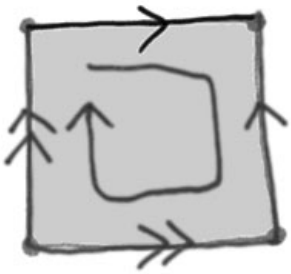
First Exam EJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

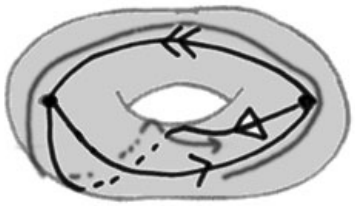
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

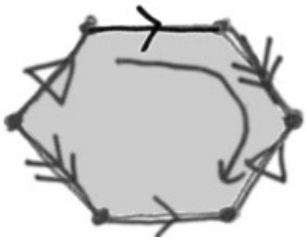




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

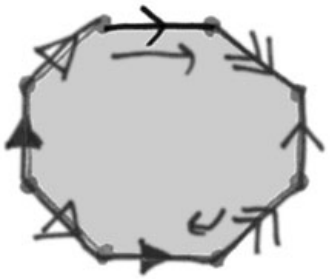
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





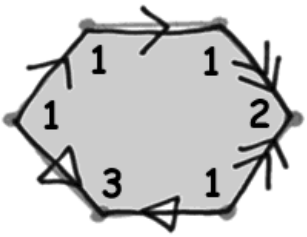
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



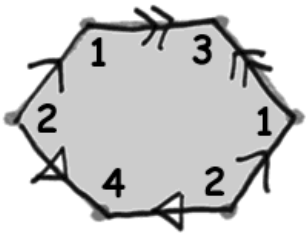
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



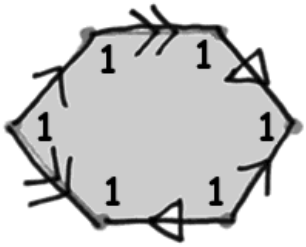
$$\begin{array}{r} +\ v = 3 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 1 \end{array}$$

nonorientable



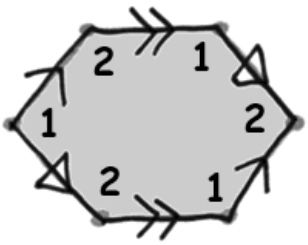
$$\begin{array}{r} +\ v = 4 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 2 \end{array}$$

orientable



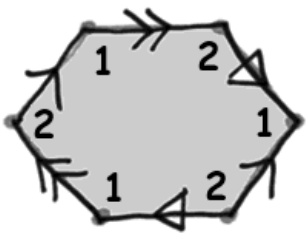
$$\begin{array}{r} +\ v = 1 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = -1 \end{array}$$

nonorientable



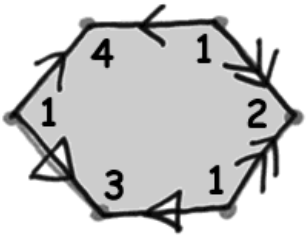
$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

orientable



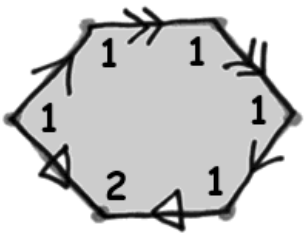
$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

nonorientable



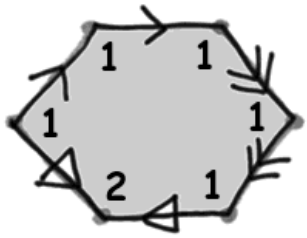
$$\begin{array}{r} +\ v = 4 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 2 \end{array}$$

orientable



$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

nonorientable



$$\begin{array}{r} +\ v = 2 \\ -\ e = 3 \\ \hline +\ f = 1 \\ \hline \chi = 0 \end{array}$$

nonorientable

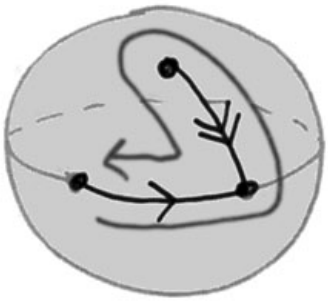
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

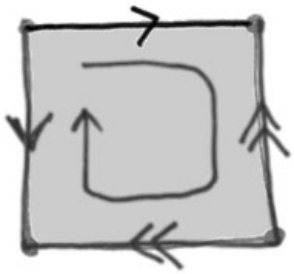
First Exam EK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

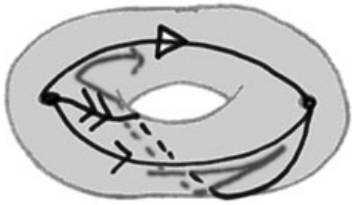
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

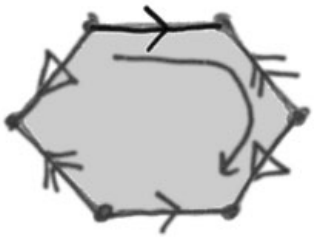




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

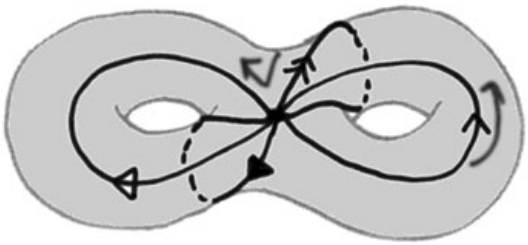
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

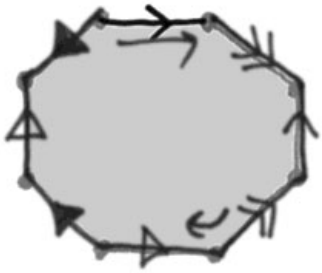




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

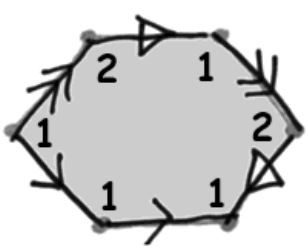
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



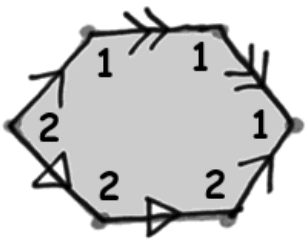


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

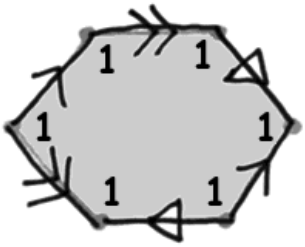
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



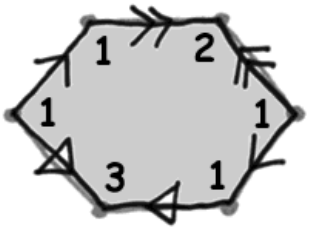
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



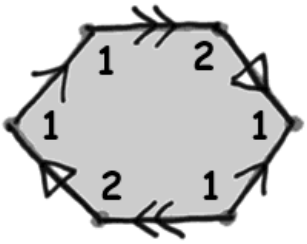
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



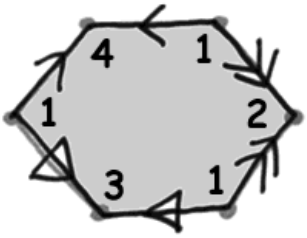
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



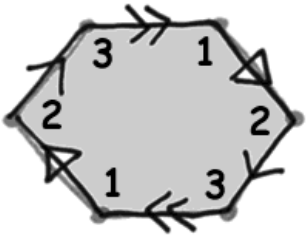
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



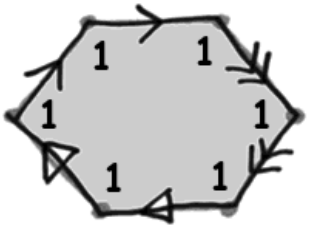
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

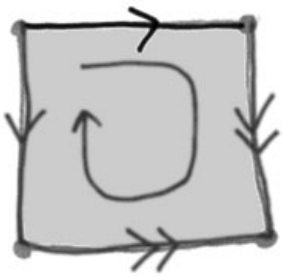
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam EL

Surfaces and Knots, Dave Bayer, February 21, 2002

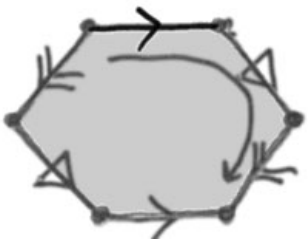
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



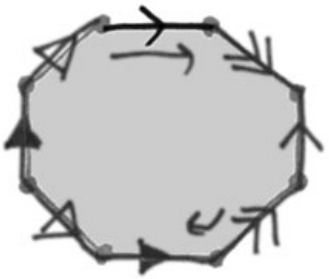
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



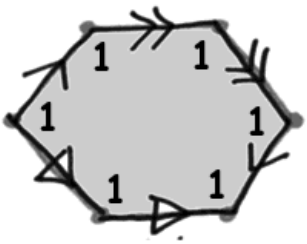
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

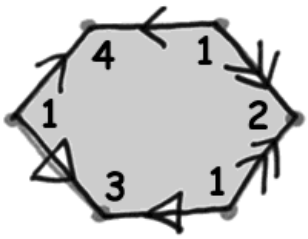


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

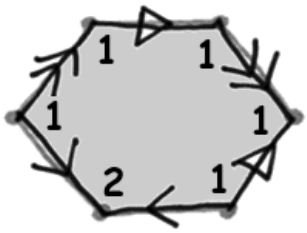
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



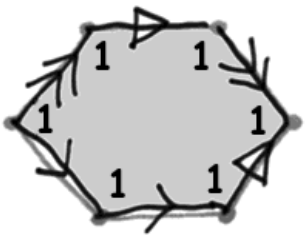
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



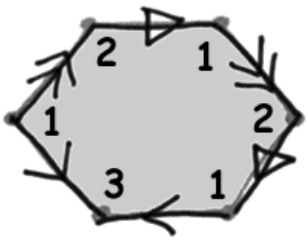
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



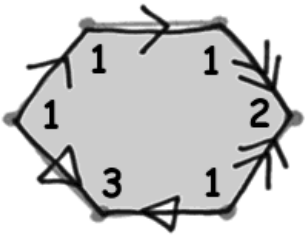
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



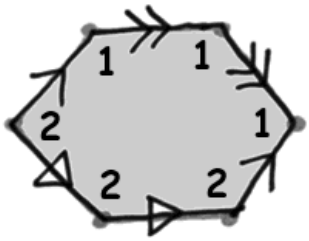
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



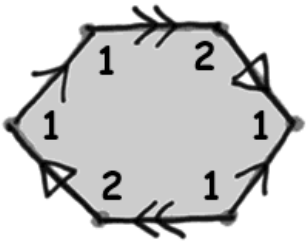
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

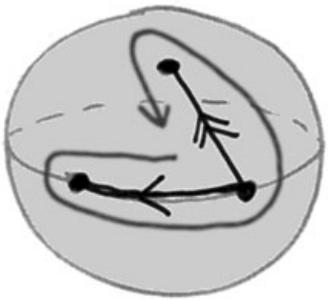
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

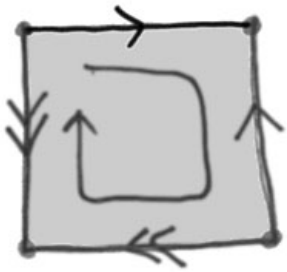
First Exam EM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

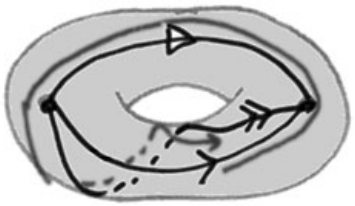
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

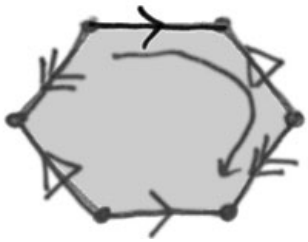




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

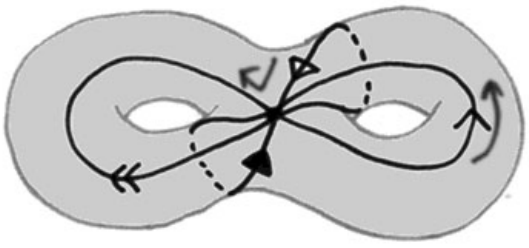
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

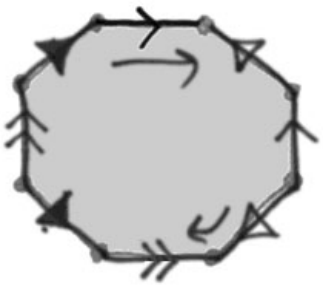




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

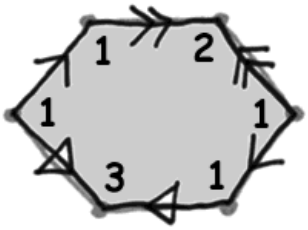
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



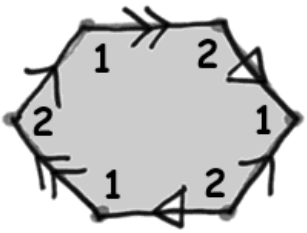


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

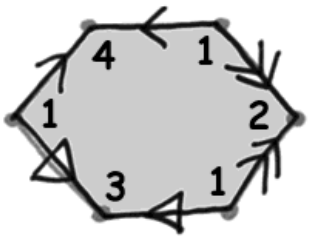
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



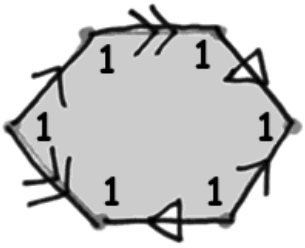
$+\ v\ =\ 3$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 1$
nonorientable



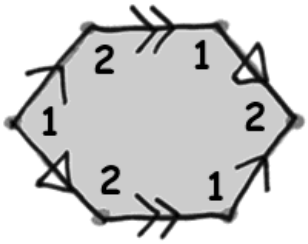
$+\ v\ =\ 2$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 0$
nonorientable



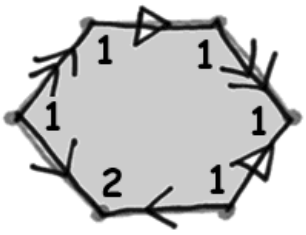
$+\ v\ =\ 4$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 2$
orientable



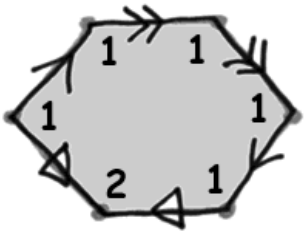
$+\ v\ =\ 1$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ -1$
nonorientable



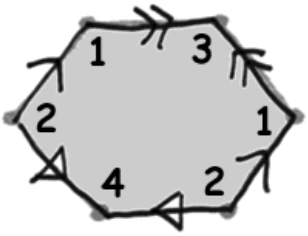
$+\ v\ =\ 2$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 0$
orientable



$+\ v\ =\ 2$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 0$
nonorientable



$+\ v\ =\ 2$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 0$
nonorientable



$+\ v\ =\ 4$
$-\ e\ =\ 3$
$+\ f\ =\ 1$
$\chi\ =\ 2$
orientable

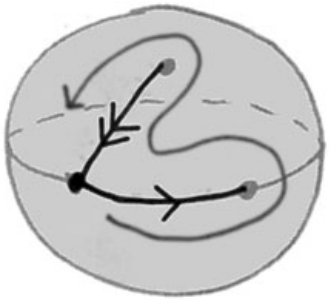
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

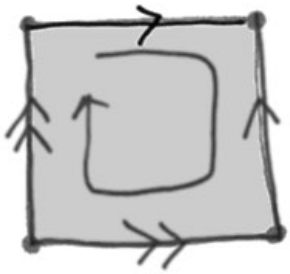
First Exam EN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

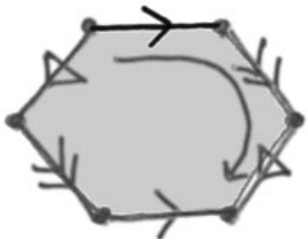
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





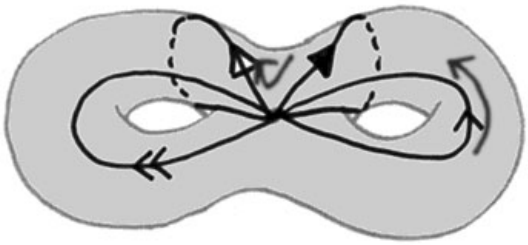
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

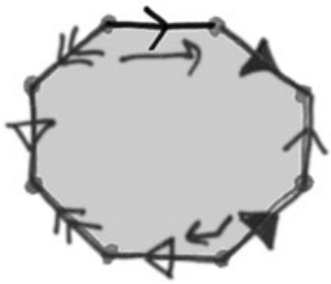
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

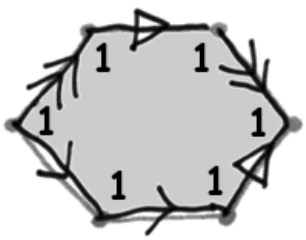
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



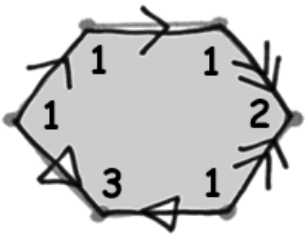


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

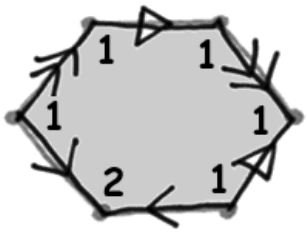
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



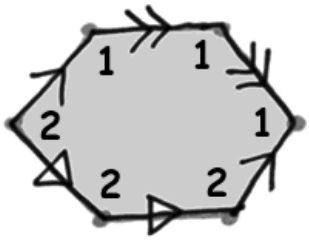
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



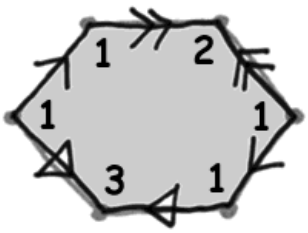
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



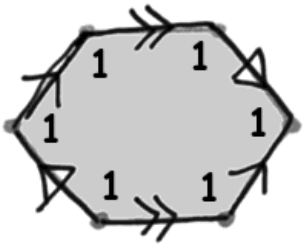
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



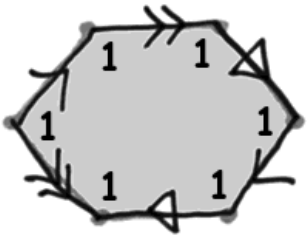
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



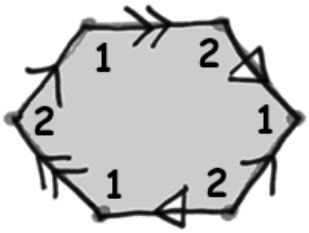
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

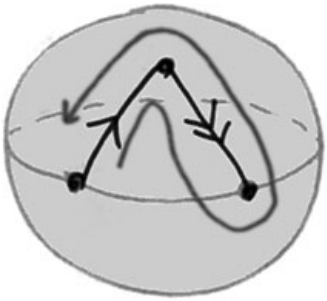
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

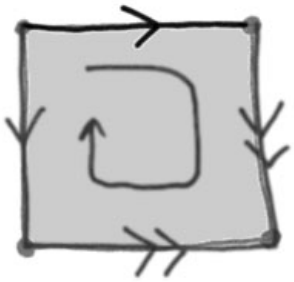
First Exam FA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



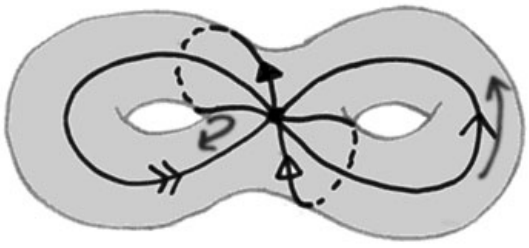


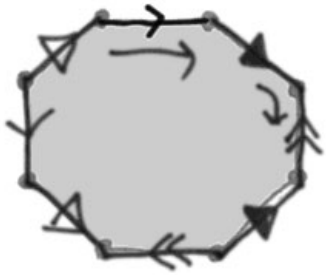
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

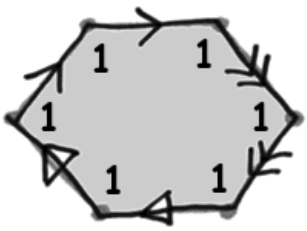
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



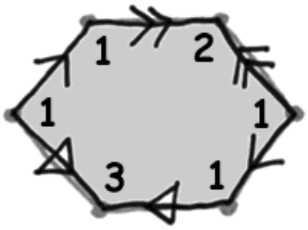


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

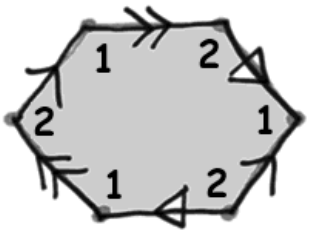
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



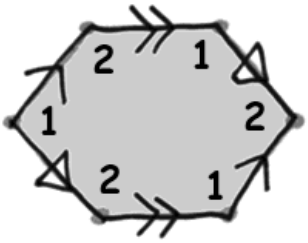
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



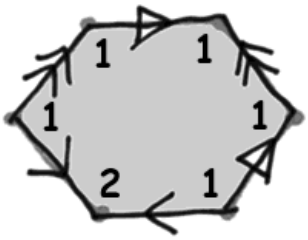
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



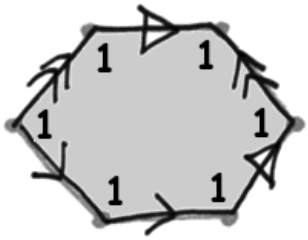
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



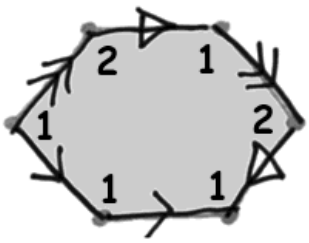
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



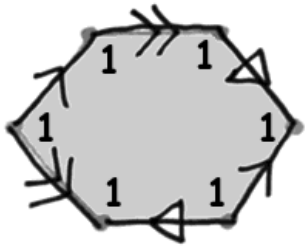
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

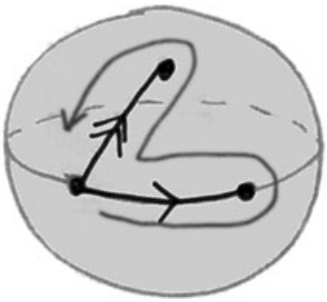
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

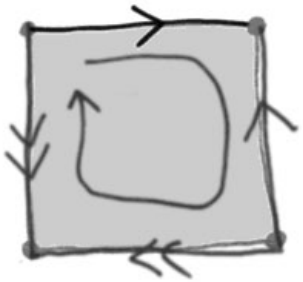
First Exam FB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

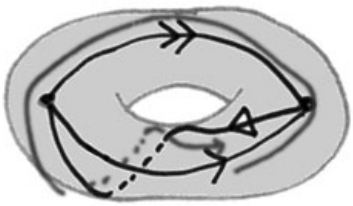
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

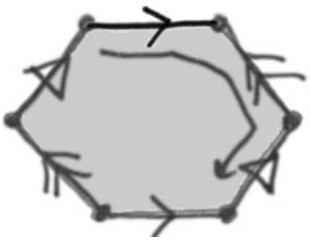




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

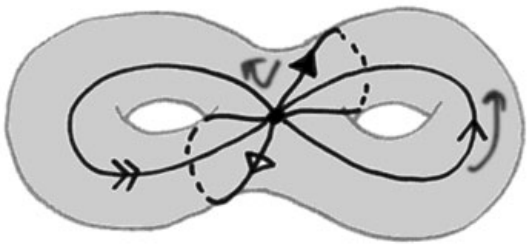
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

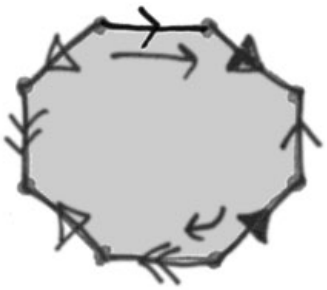




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

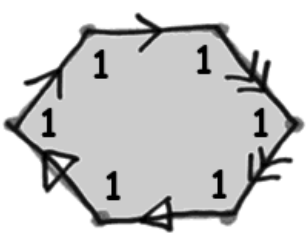
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



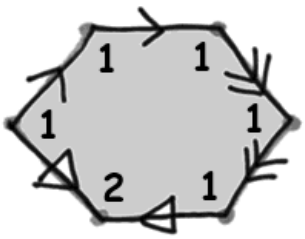


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

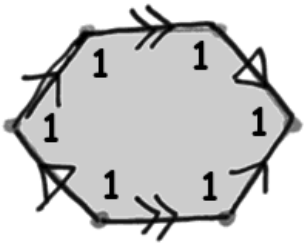
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



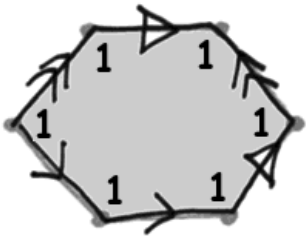
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



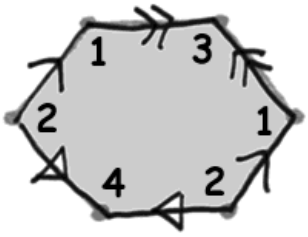
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



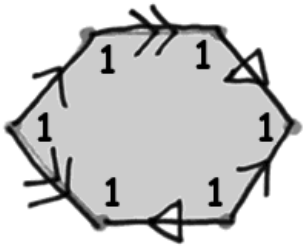
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



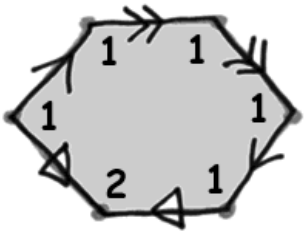
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



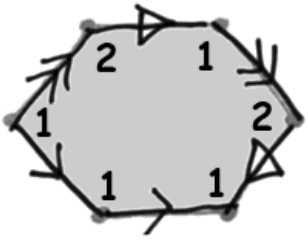
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

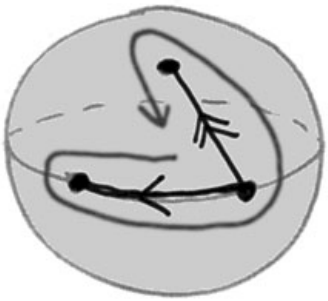
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

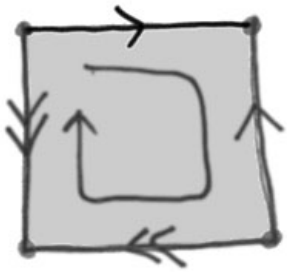
First Exam FC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

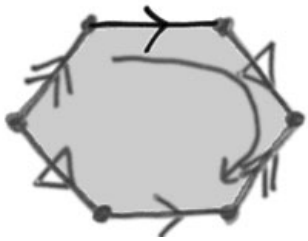
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





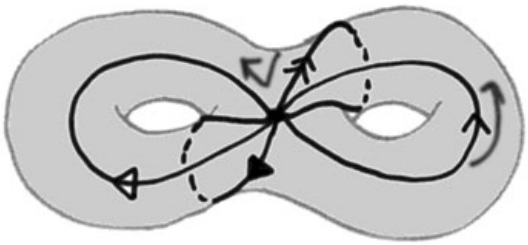
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

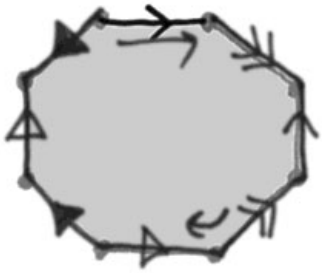
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

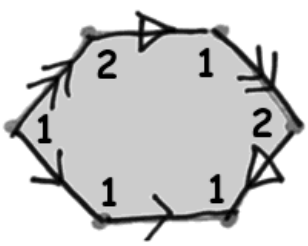
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



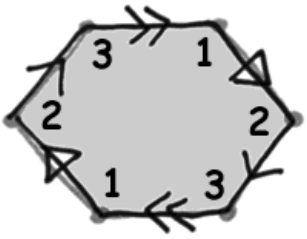


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

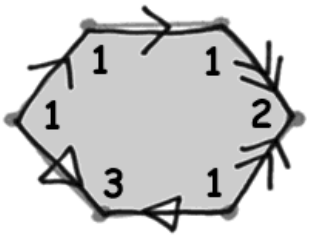
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



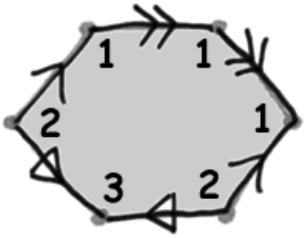
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



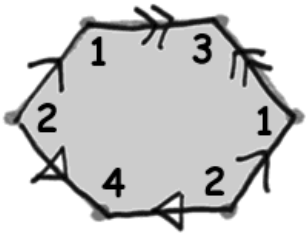
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



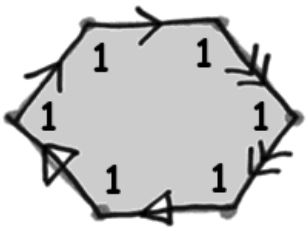
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



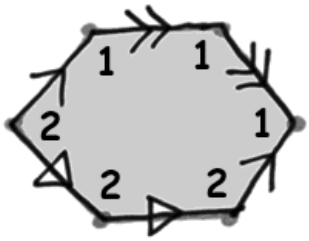
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



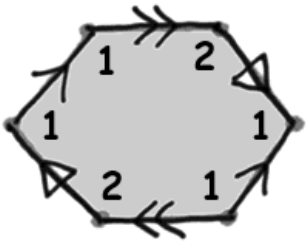
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

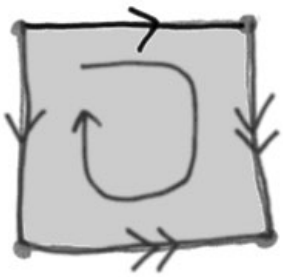
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam FD

Surfaces and Knots, Dave Bayer, February 21, 2002

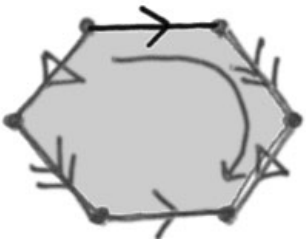
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



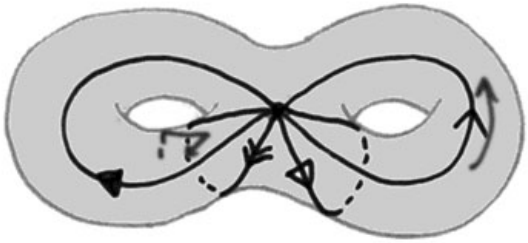
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

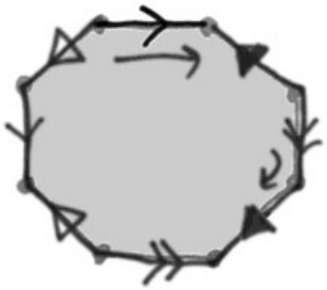
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

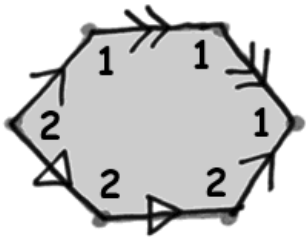
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



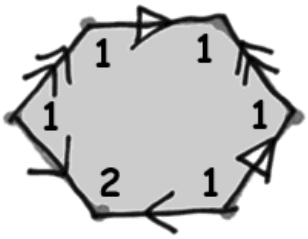


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

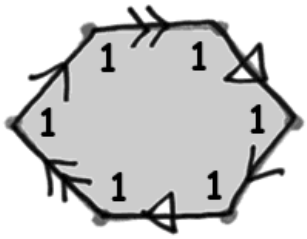
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



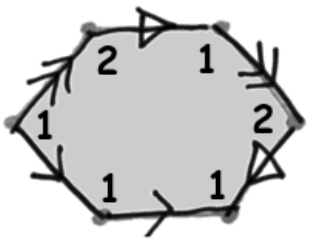
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



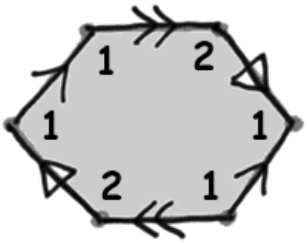
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



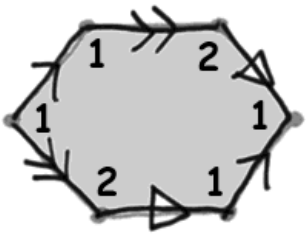
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



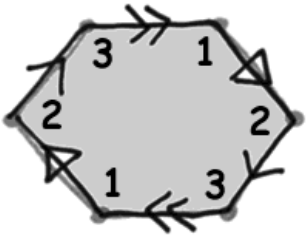
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



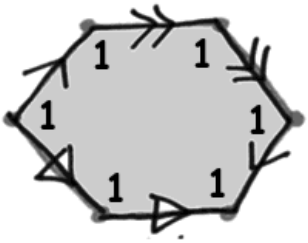
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

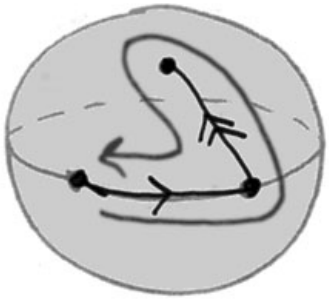
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

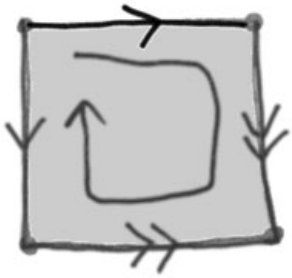
First Exam FE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

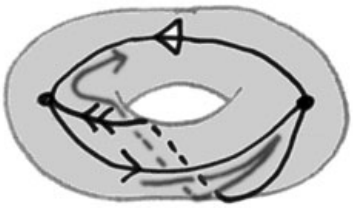
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

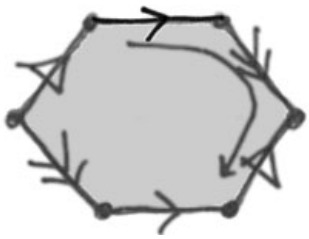




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

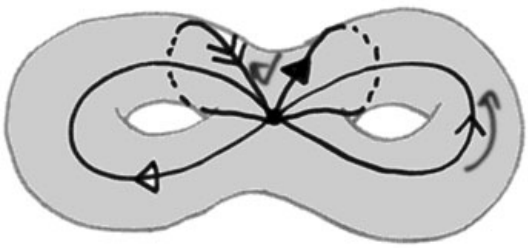
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

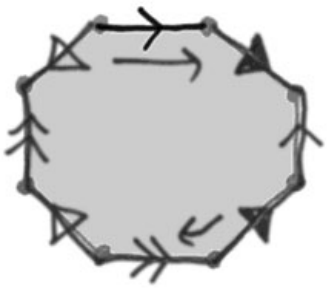




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

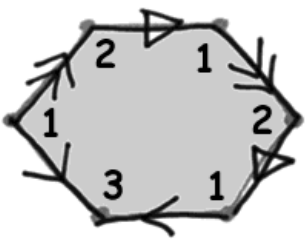
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



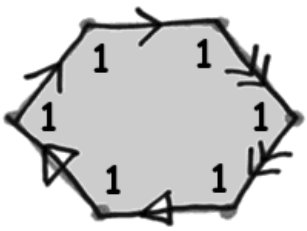


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

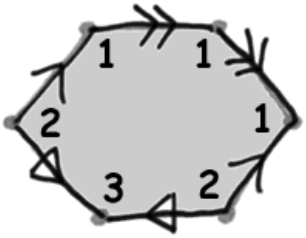
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



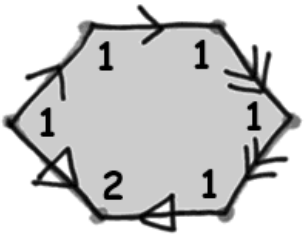
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



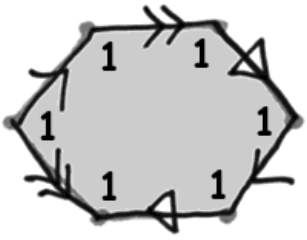
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



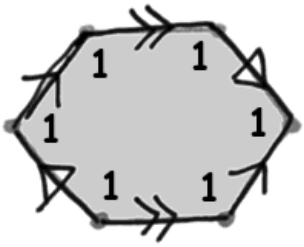
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



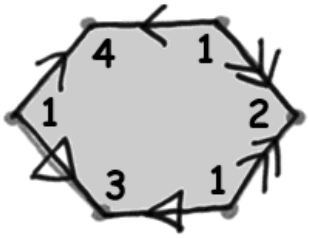
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



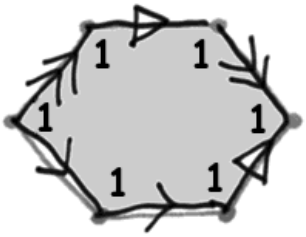
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

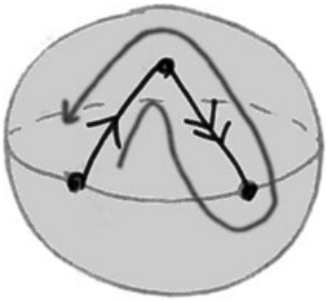
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

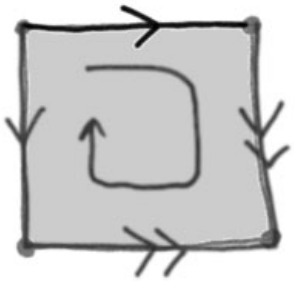
First Exam FF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



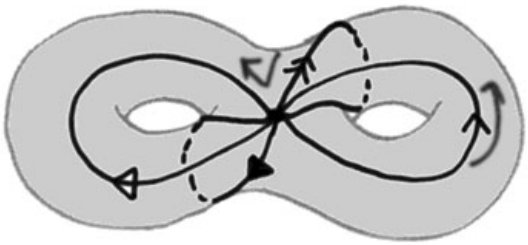


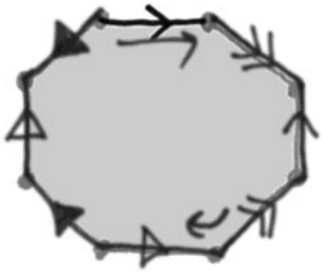
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

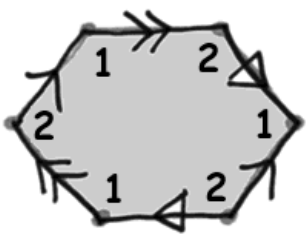
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



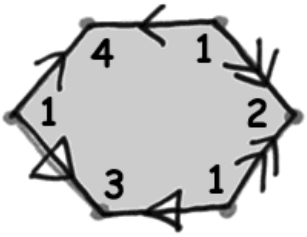


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

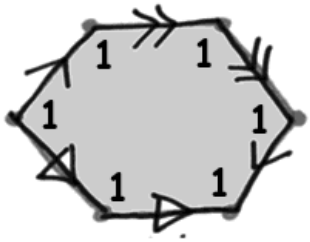
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



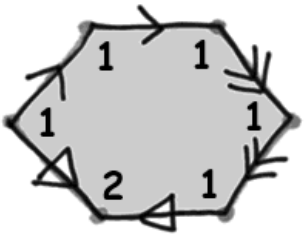
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



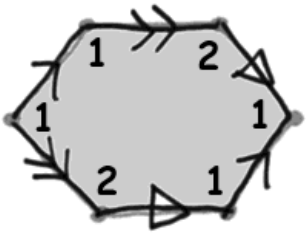
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



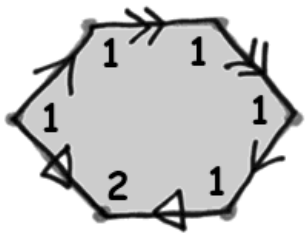
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



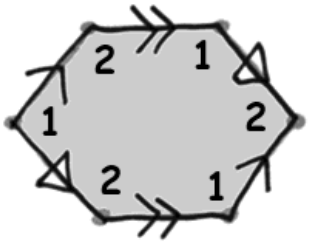
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



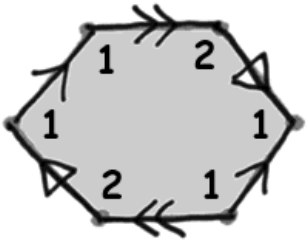
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

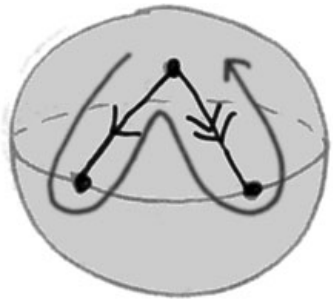
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

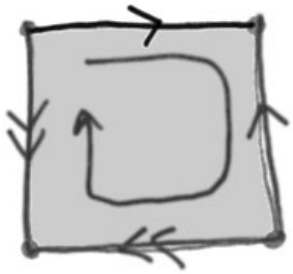
First Exam FG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

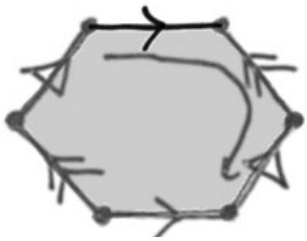
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





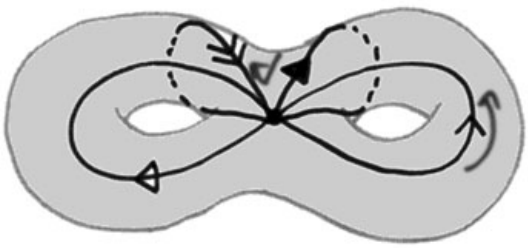
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

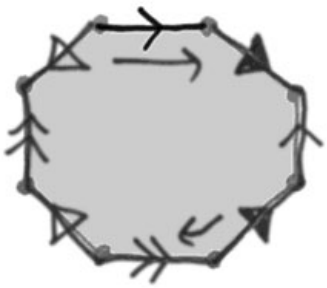
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

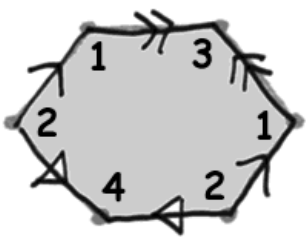
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



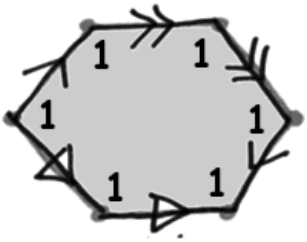


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

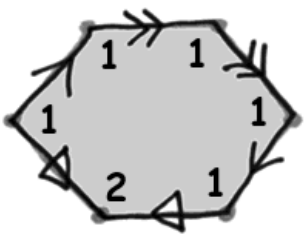
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



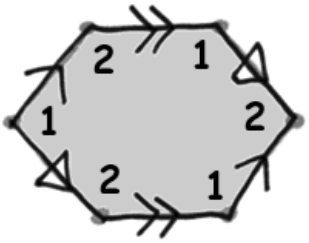
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



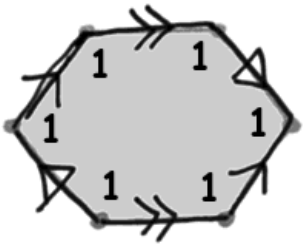
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



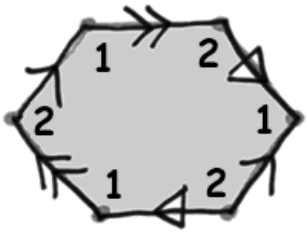
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



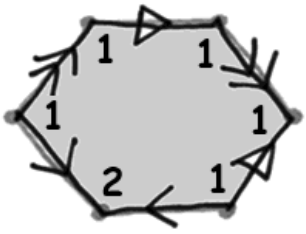
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



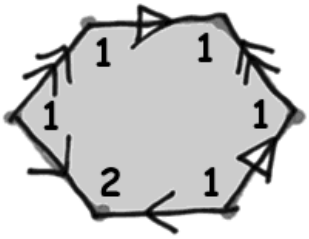
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

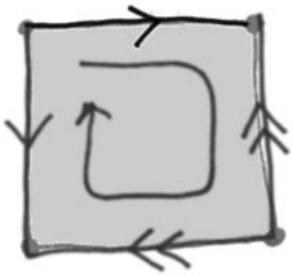
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam FH

Surfaces and Knots, Dave Bayer, February 21, 2002

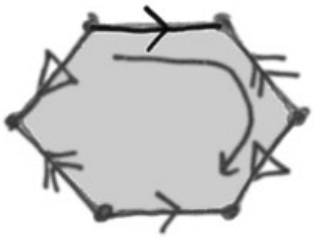
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



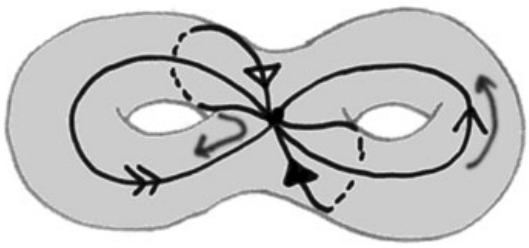
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

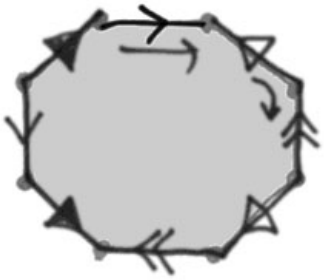
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

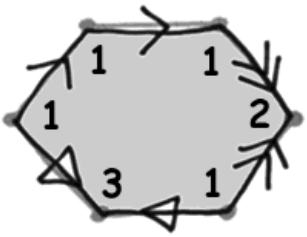
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





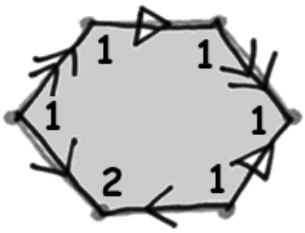
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



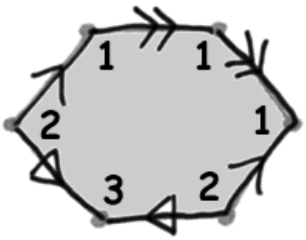
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 1 \end{aligned}$$

nonorientable



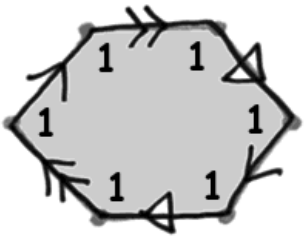
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

nonorientable



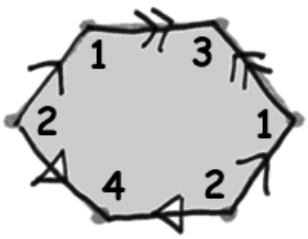
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 1 \end{aligned}$$

nonorientable



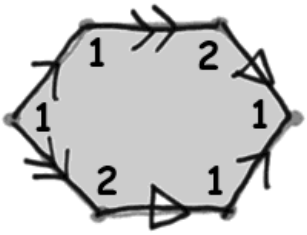
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= -1 \end{aligned}$$

nonorientable



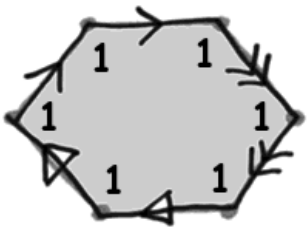
$$\begin{aligned} +\ v &= 4 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

orientable



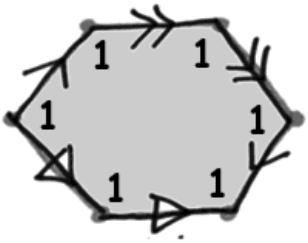
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

orientable



$$\begin{aligned} +\ v &= 1 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= -1 \end{aligned}$$

nonorientable



$$\begin{aligned} +\ v &= 1 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= -1 \end{aligned}$$

nonorientable

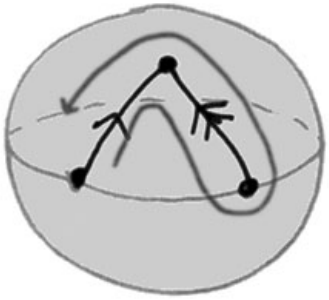
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

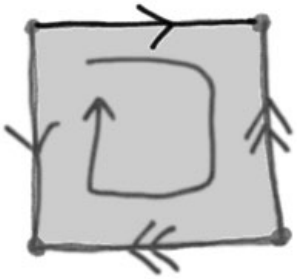
First Exam FI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

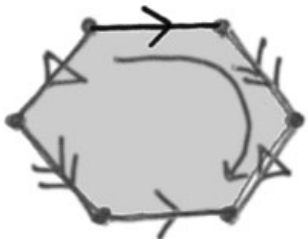
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





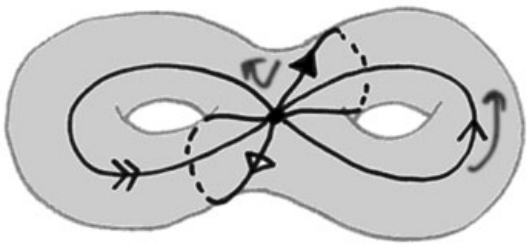
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

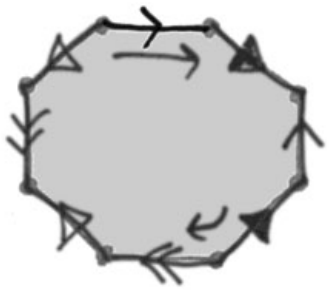
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

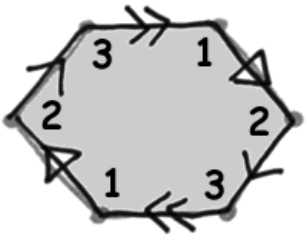
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



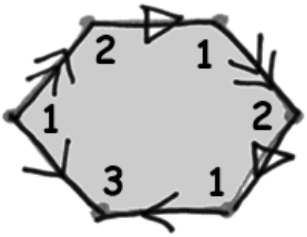


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

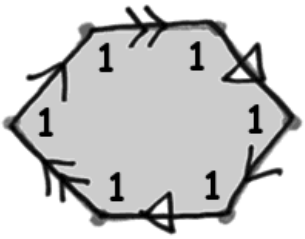
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



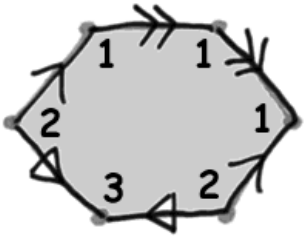
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



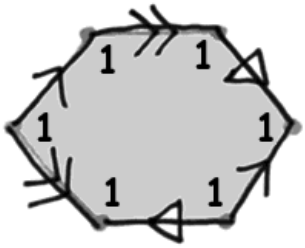
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



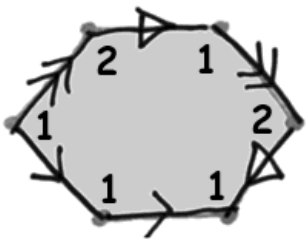
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



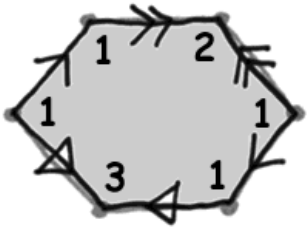
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



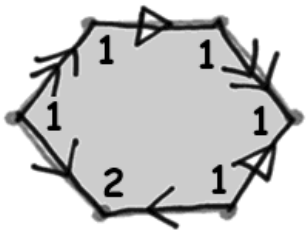
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

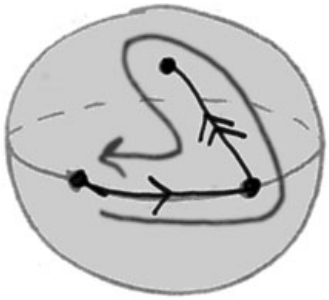
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

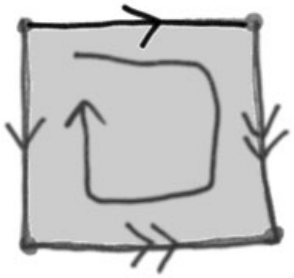
First Exam FJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

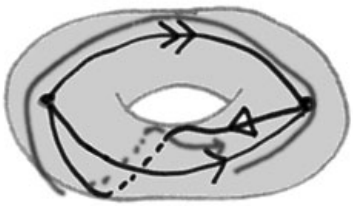
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

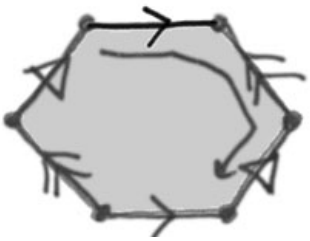




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

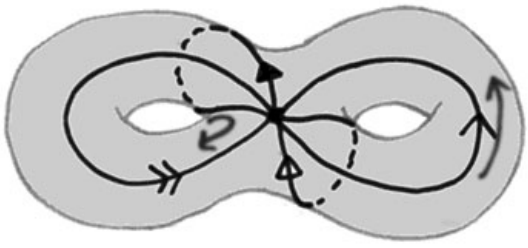
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

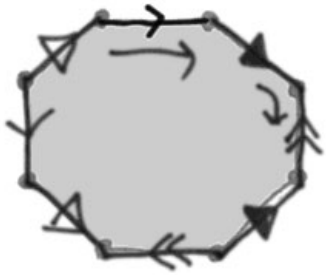




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

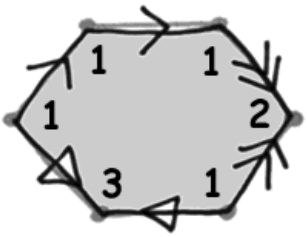
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



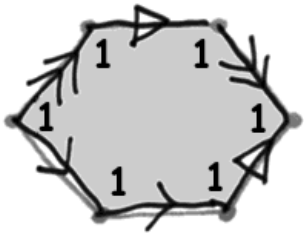


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

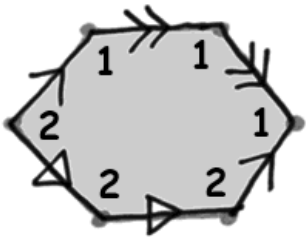
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



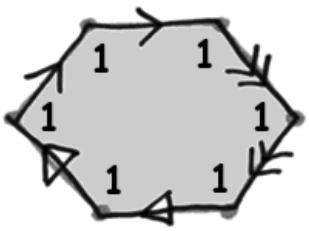
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



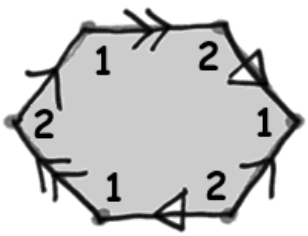
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



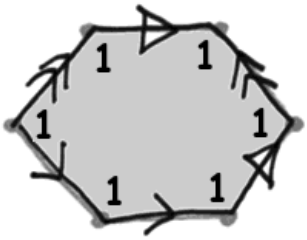
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



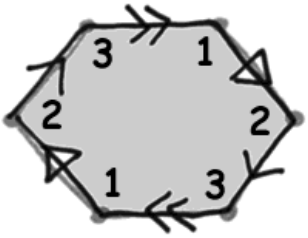
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



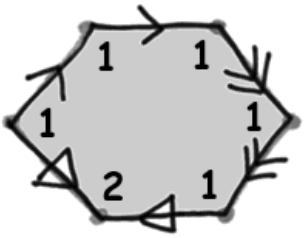
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

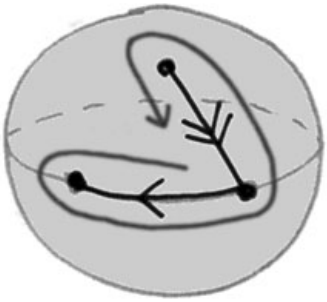
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

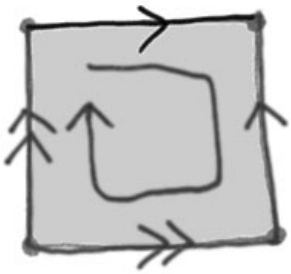
First Exam FK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



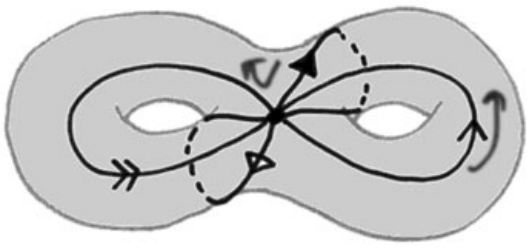


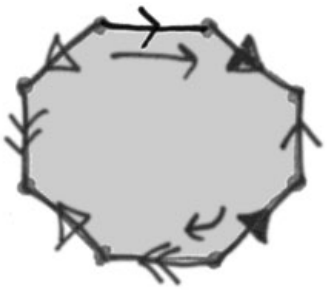
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

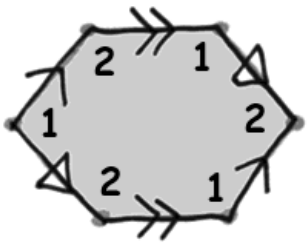
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



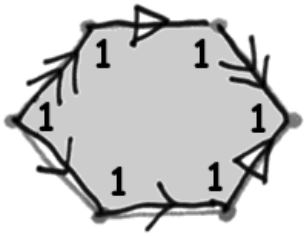


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

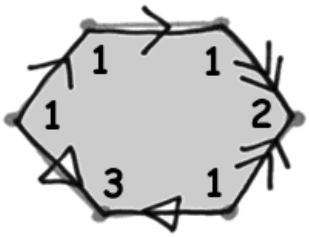
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



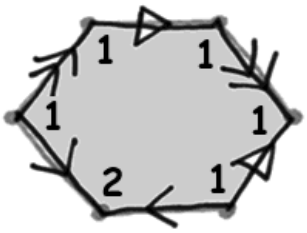
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



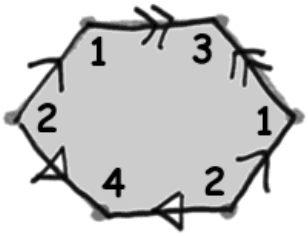
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



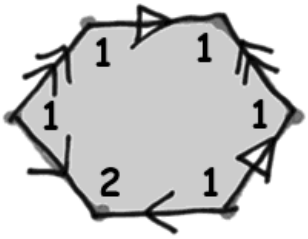
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



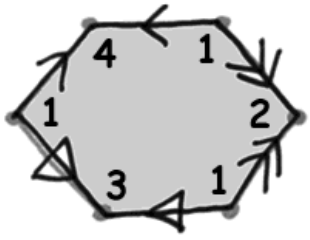
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



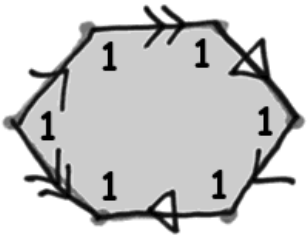
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

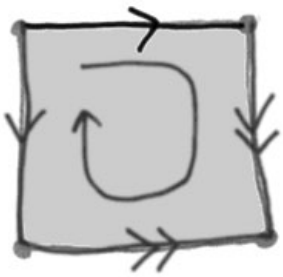
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam FL

Surfaces and Knots, Dave Bayer, February 21, 2002

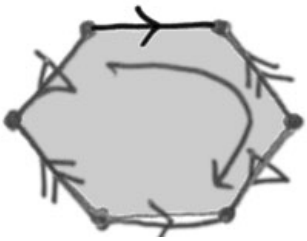
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



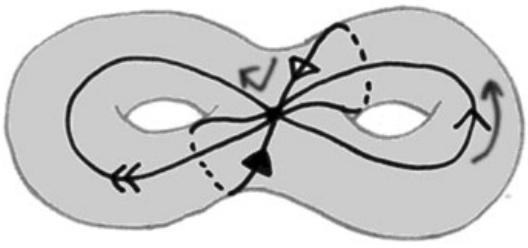
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

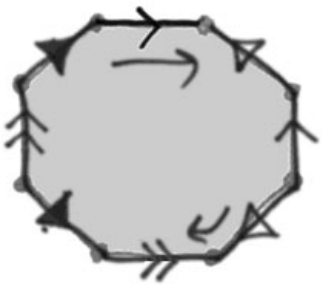
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

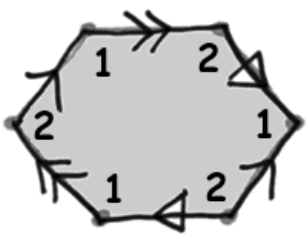
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



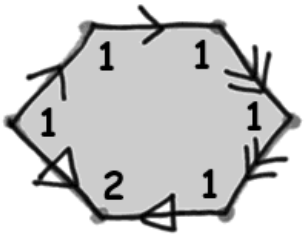


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

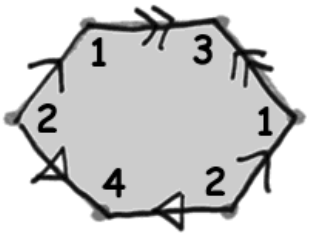
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



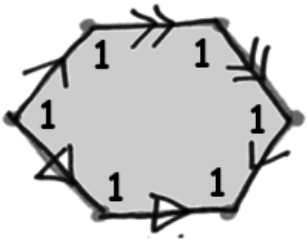
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



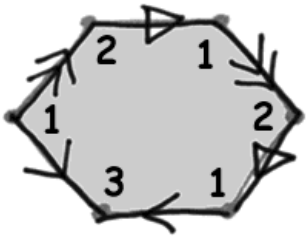
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



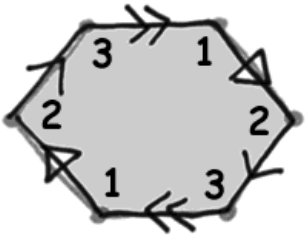
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



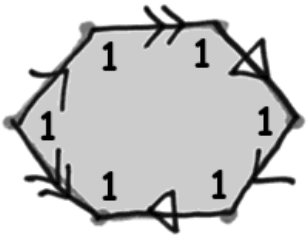
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



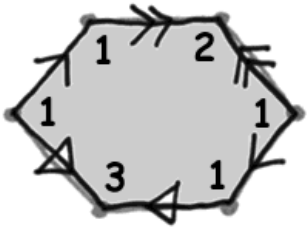
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

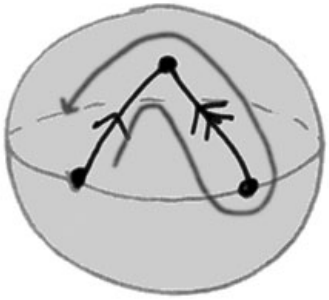
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

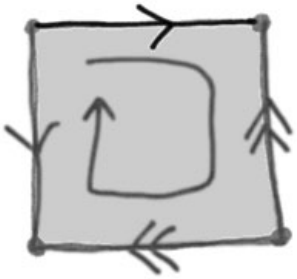
First Exam FM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

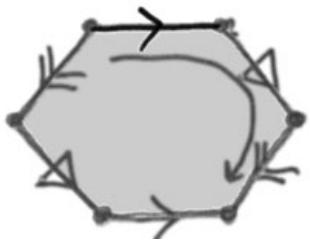
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





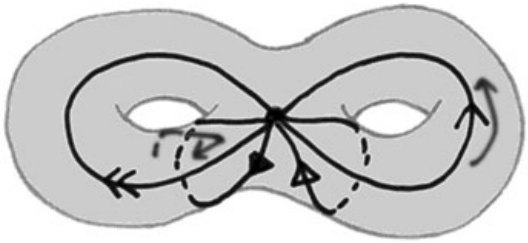
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

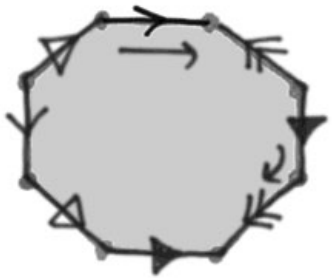
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

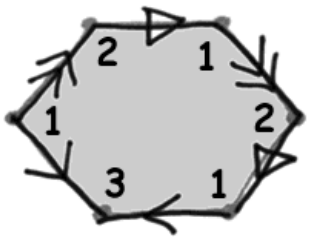
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



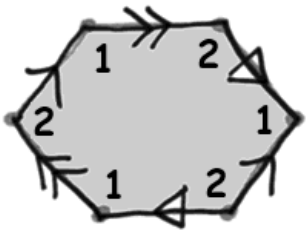


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

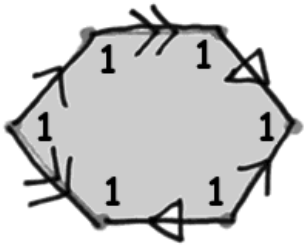
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



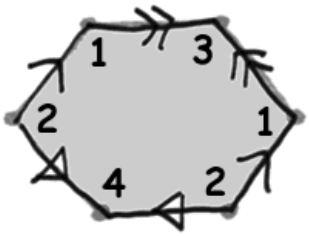
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



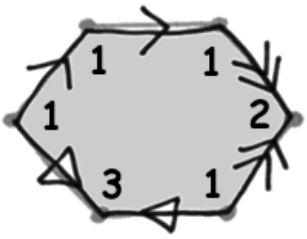
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



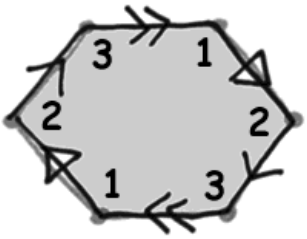
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



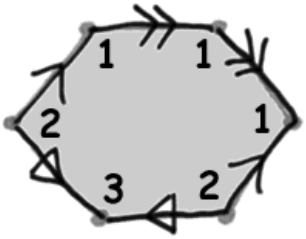
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



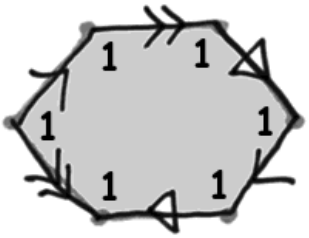
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

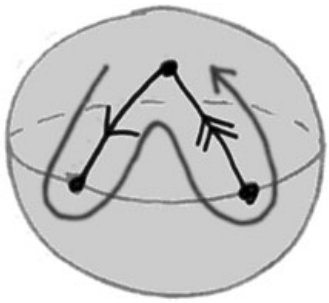
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

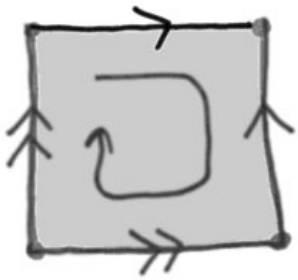
First Exam FN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

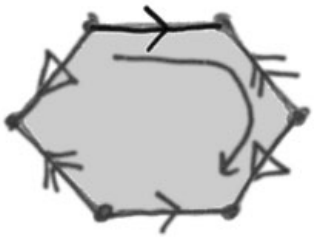
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





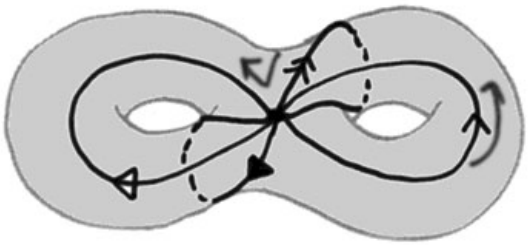
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

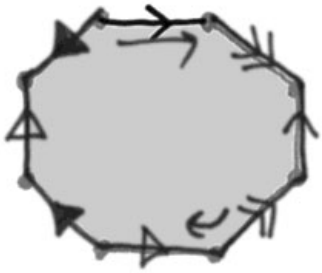
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

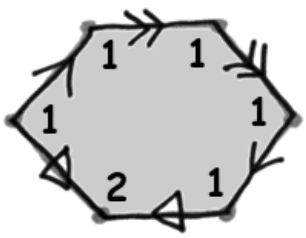
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



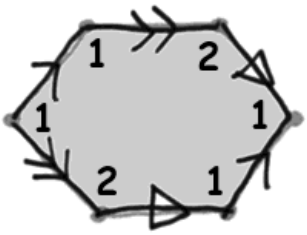


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

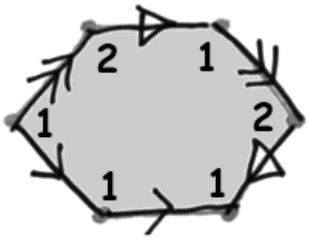
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



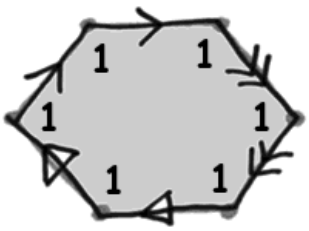
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



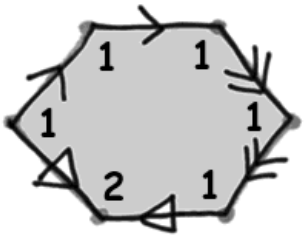
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



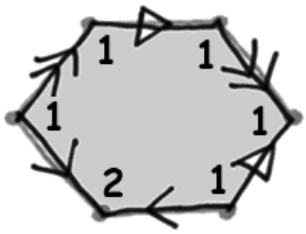
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



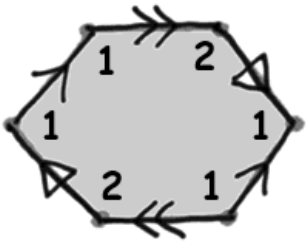
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



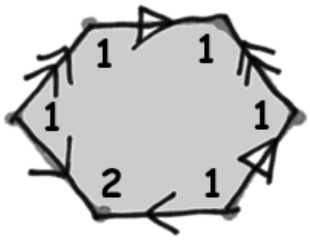
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

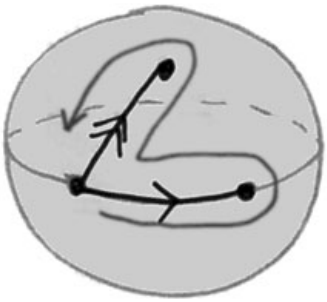
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

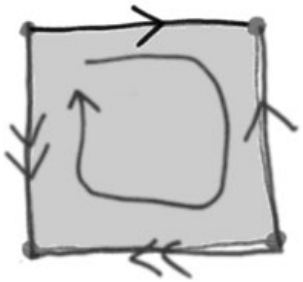
First Exam GA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

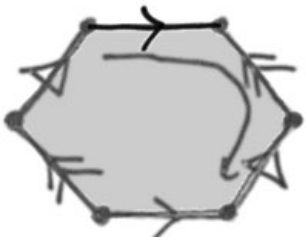
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





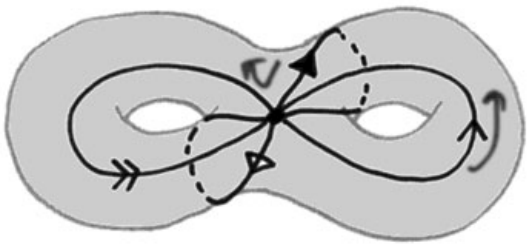
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

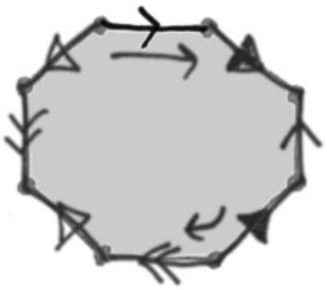
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

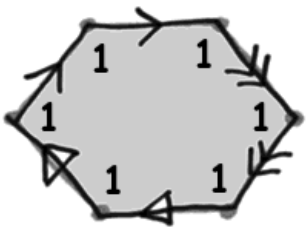
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



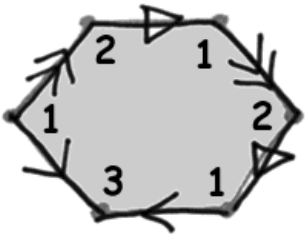


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

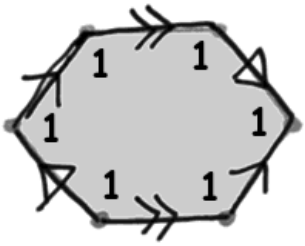
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



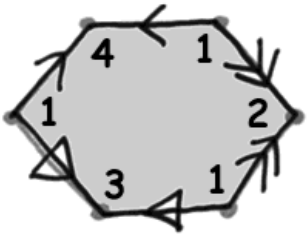
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



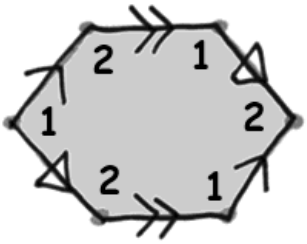
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



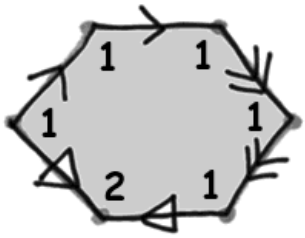
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



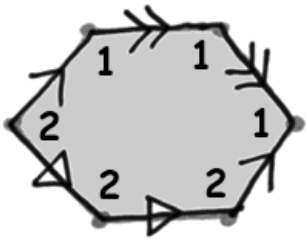
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



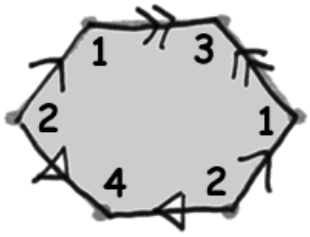
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam GB

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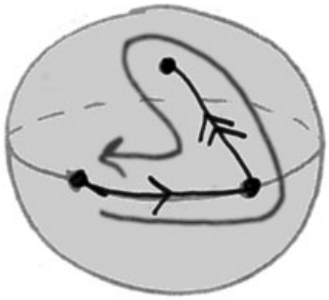
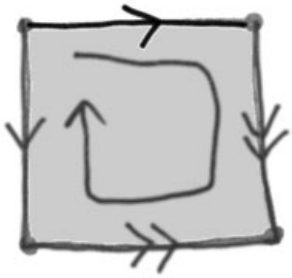
Answer Key

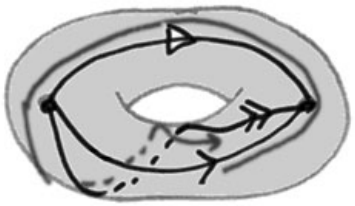
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

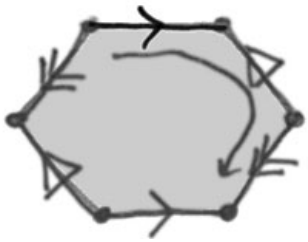




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

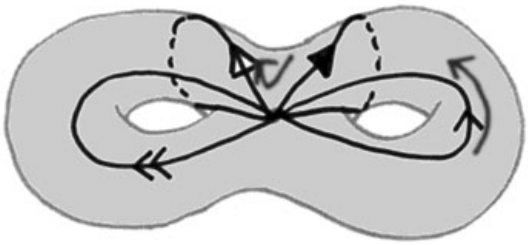
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

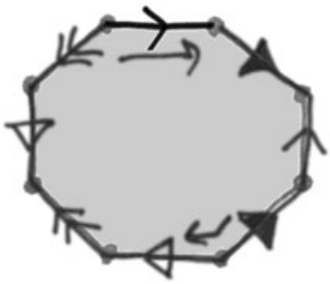




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

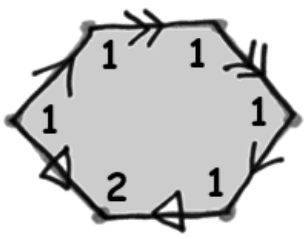
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



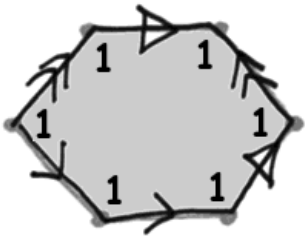


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

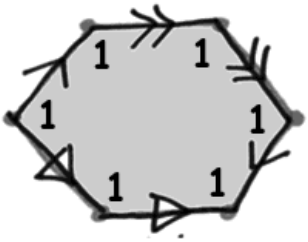
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



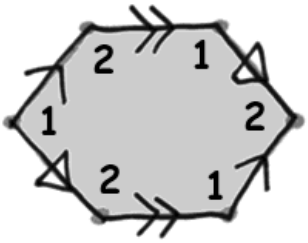
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



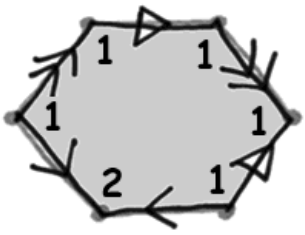
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



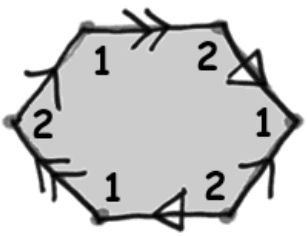
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



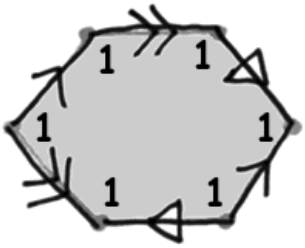
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



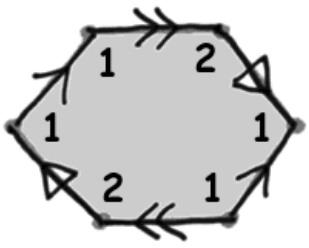
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

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Answer Key

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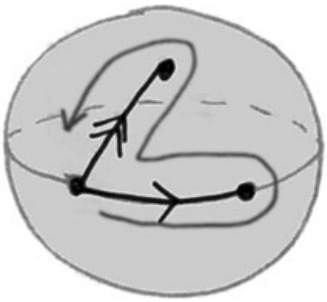
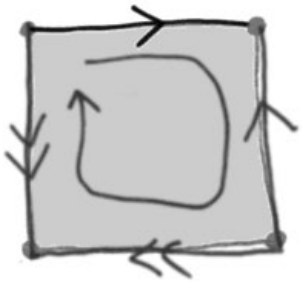
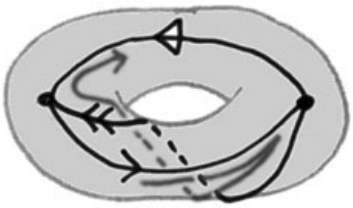
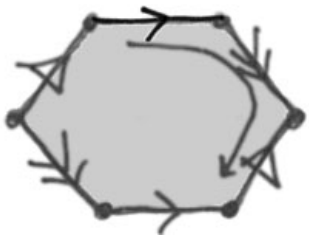




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

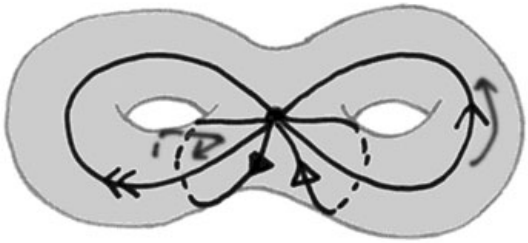
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

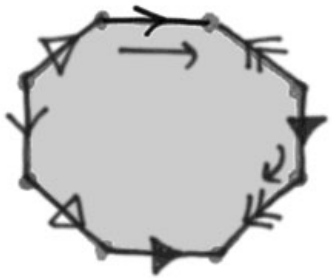




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

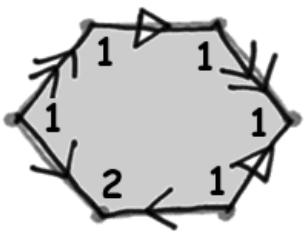
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





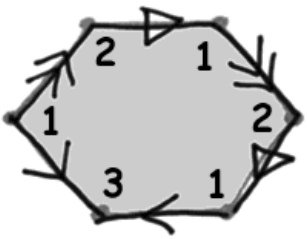
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



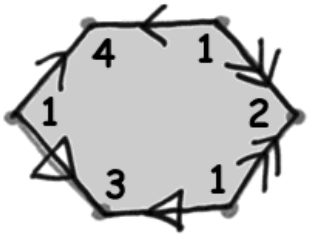
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$

nonorientable



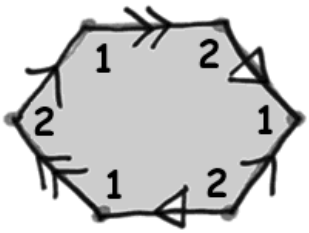
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$

nonorientable



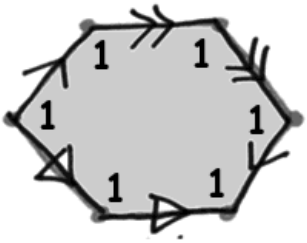
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$

orientable



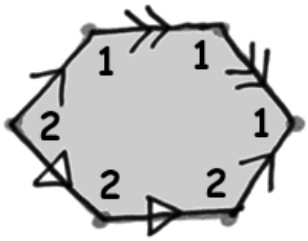
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$

nonorientable



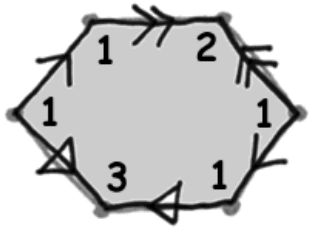
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$

nonorientable



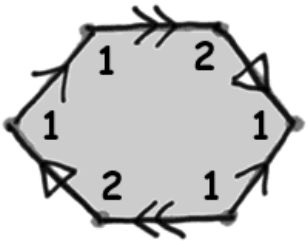
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$

nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$

nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$

nonorientable

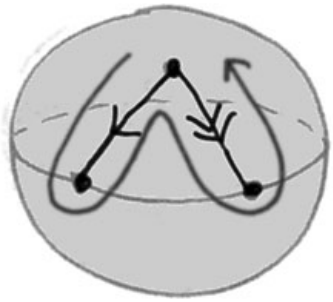
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

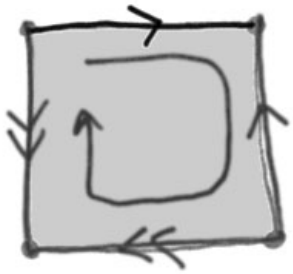
First Exam GD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

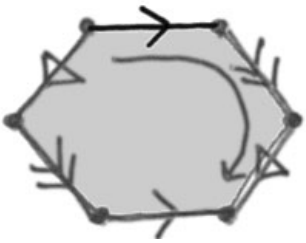
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





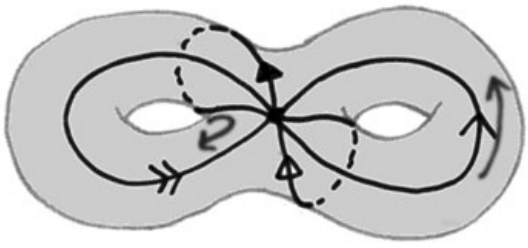
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

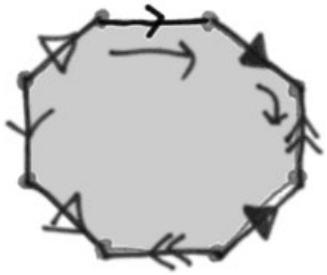
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

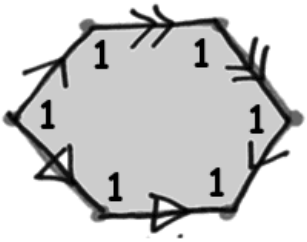
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



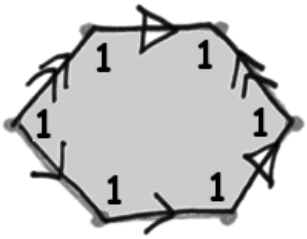


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

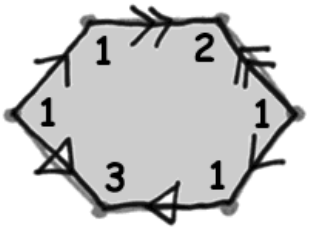
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



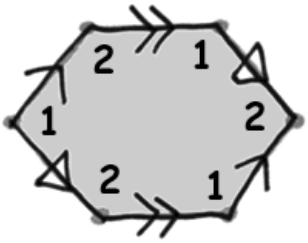
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



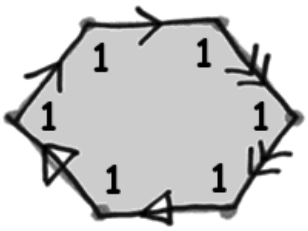
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



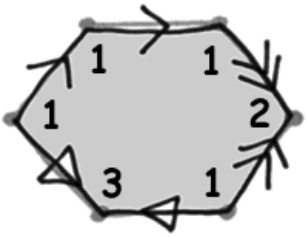
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



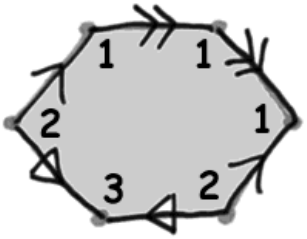
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



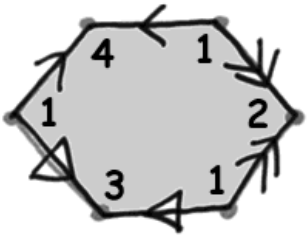
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

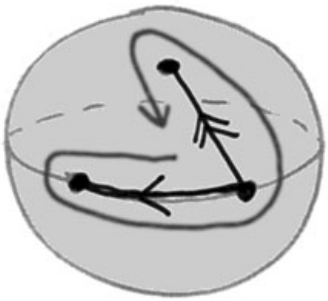
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

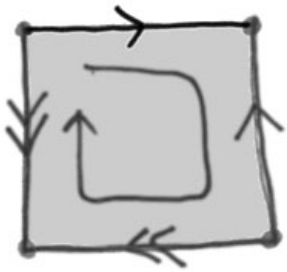
First Exam GE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

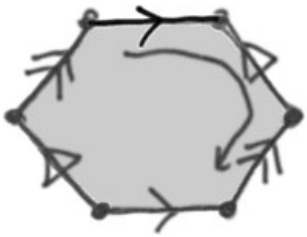
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





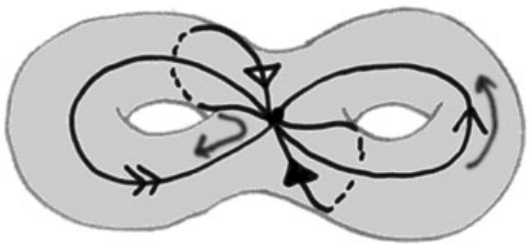
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

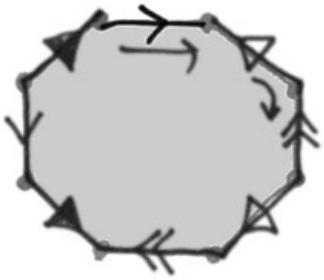
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

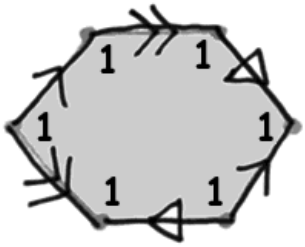
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



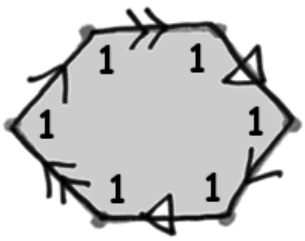


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

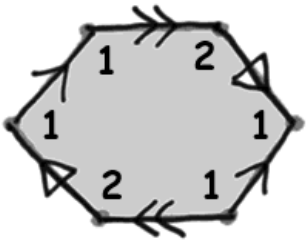
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



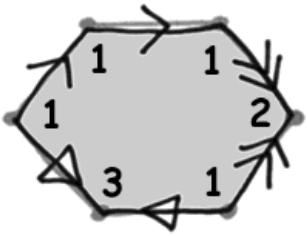
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



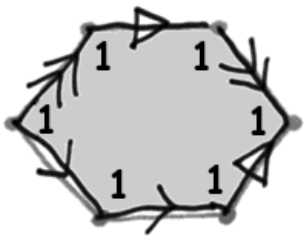
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



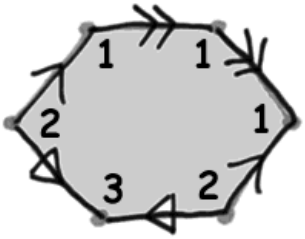
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



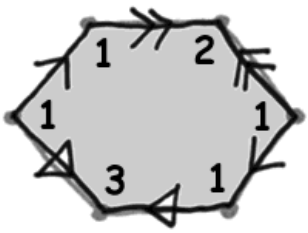
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



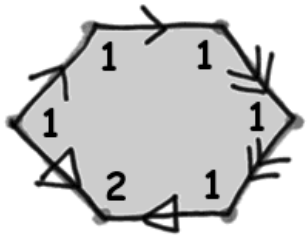
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

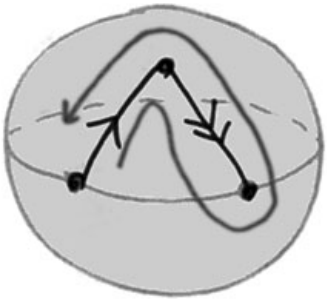
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

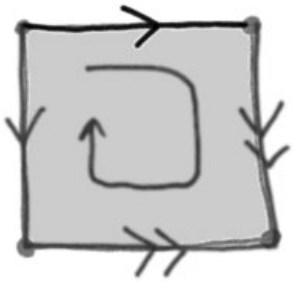
First Exam GF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

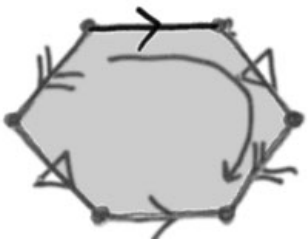
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





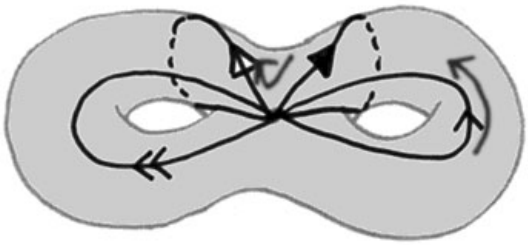
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

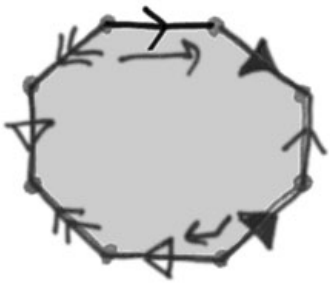
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

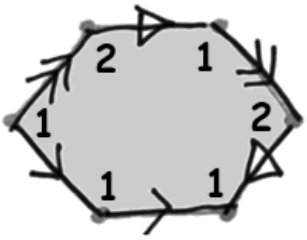
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



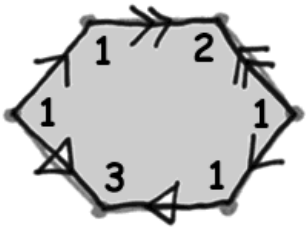


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

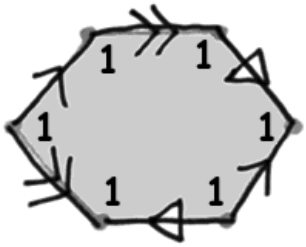
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



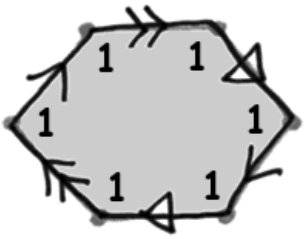
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



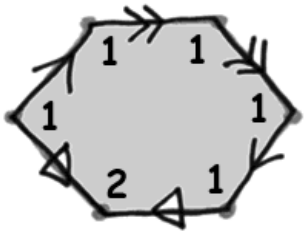
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



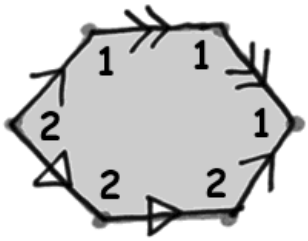
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



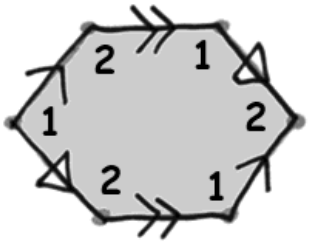
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



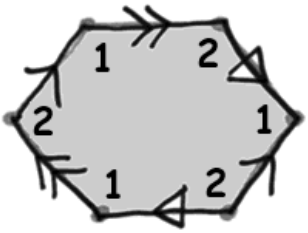
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

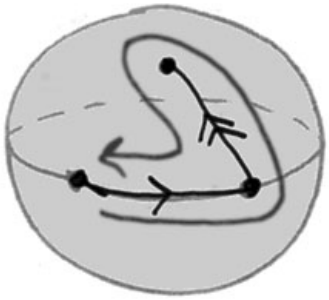
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

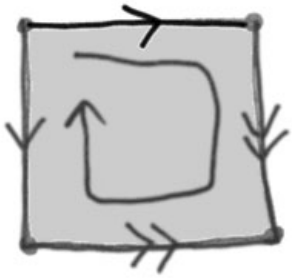
First Exam GG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

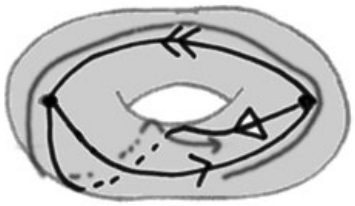
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

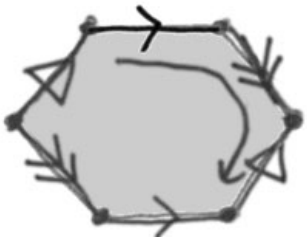




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

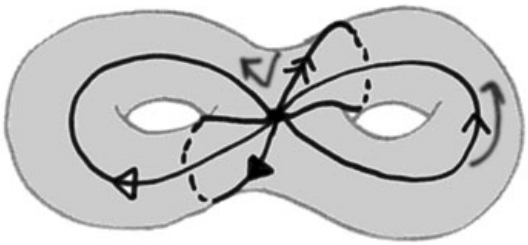
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

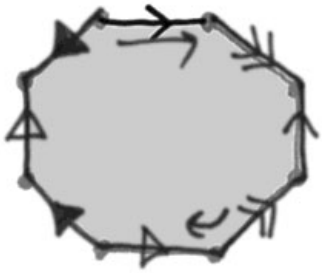




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

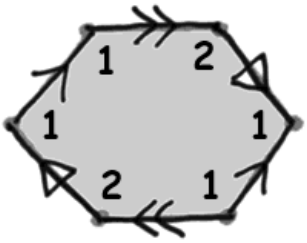
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



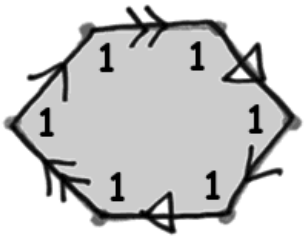


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

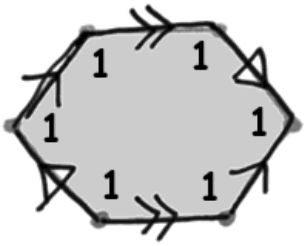
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



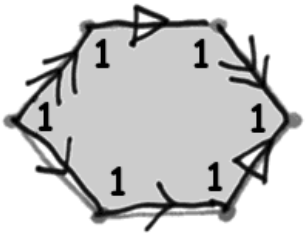
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



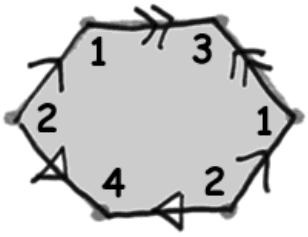
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



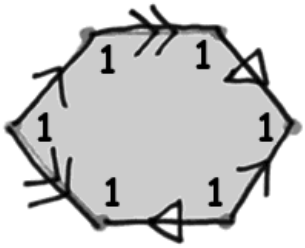
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



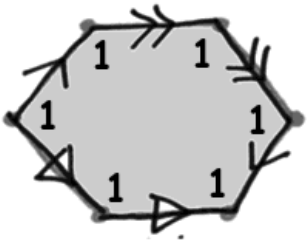
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



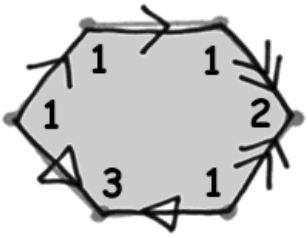
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

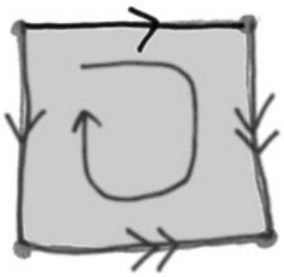
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam GH

Surfaces and Knots, Dave Bayer, February 21, 2002

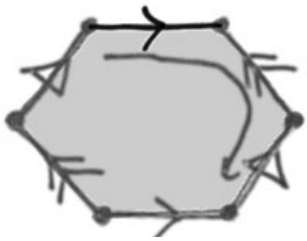
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



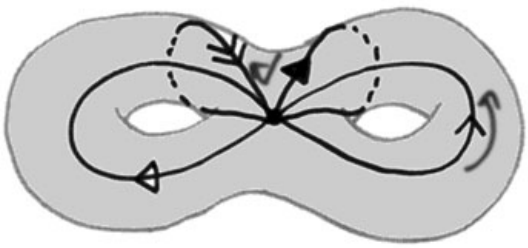
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

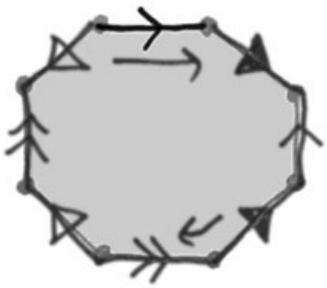
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

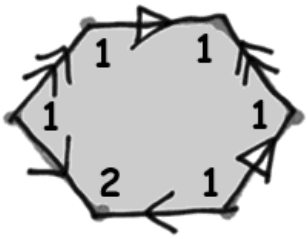
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



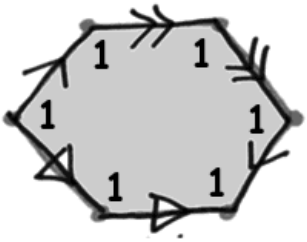


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

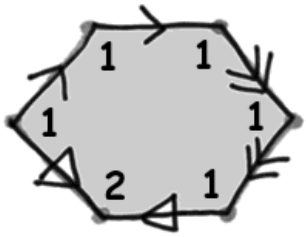
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



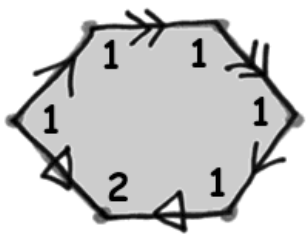
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



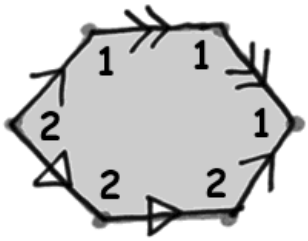
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



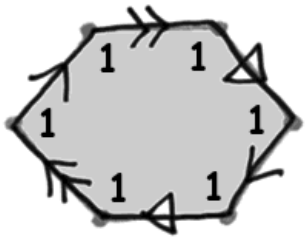
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



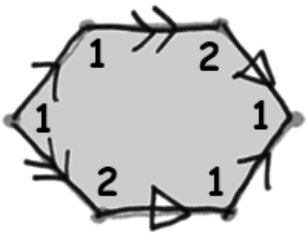
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



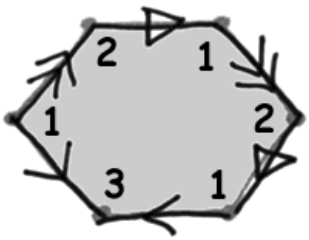
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

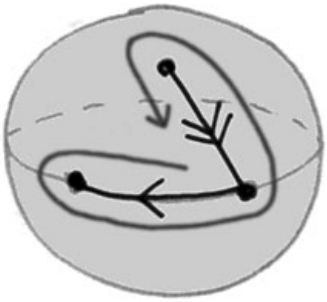
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

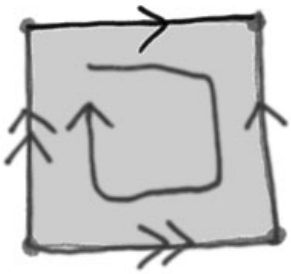
First Exam GI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

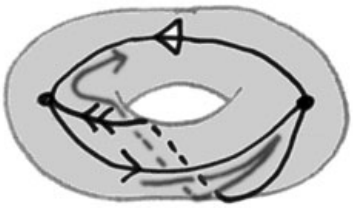
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

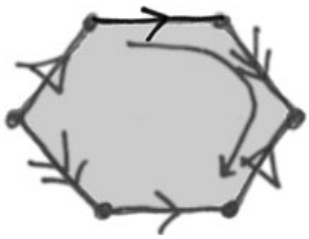




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

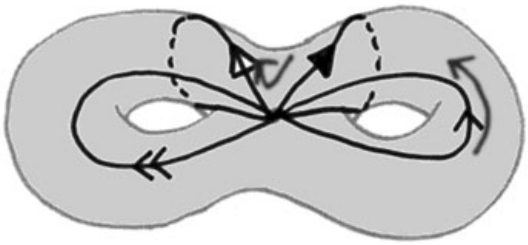
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

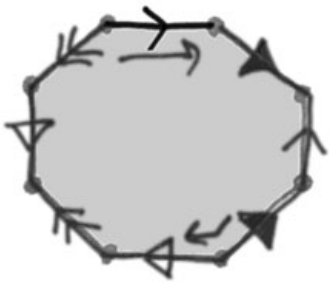




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

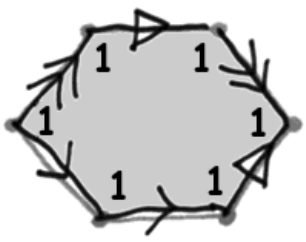
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



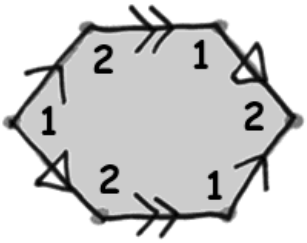


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

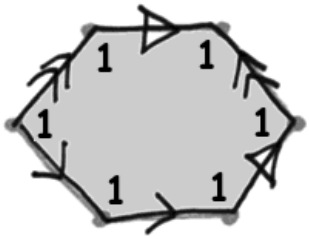
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



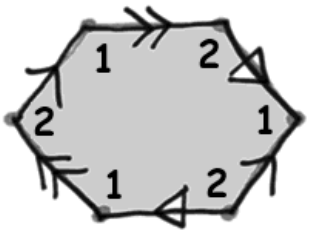
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



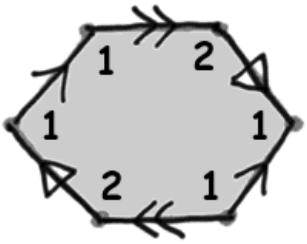
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



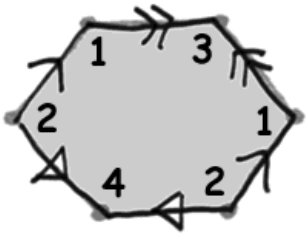
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



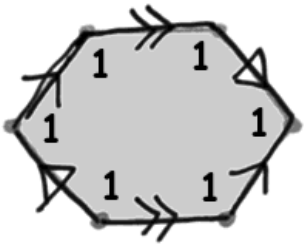
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



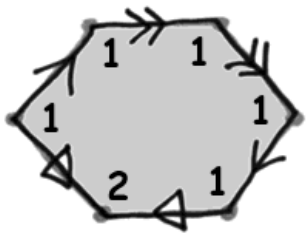
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

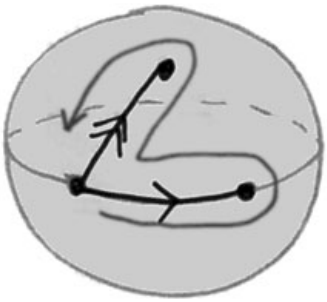
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

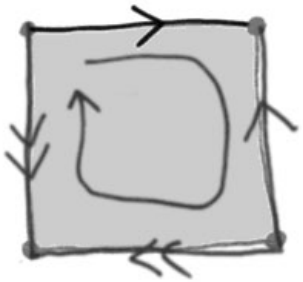
First Exam GJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

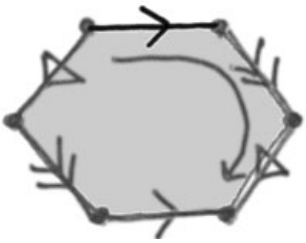
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





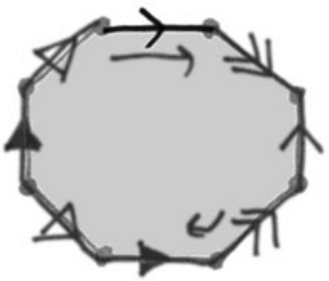
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



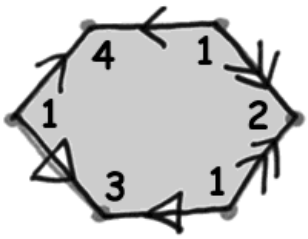
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

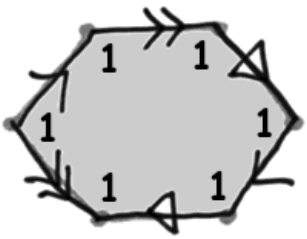


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

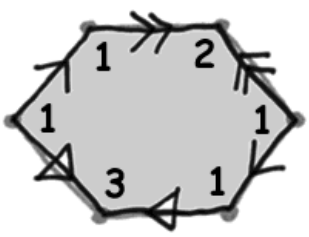
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



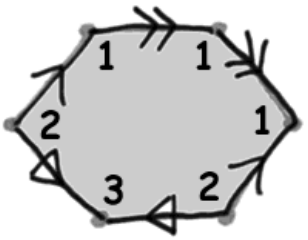
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



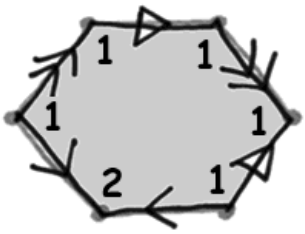
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



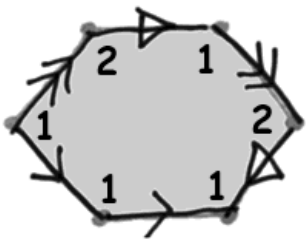
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



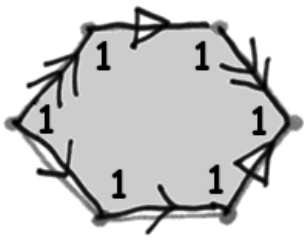
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



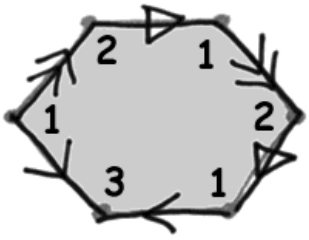
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

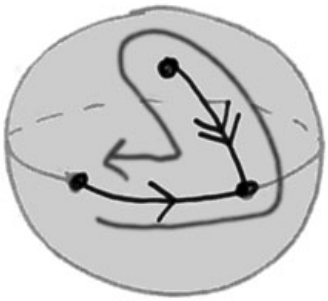
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

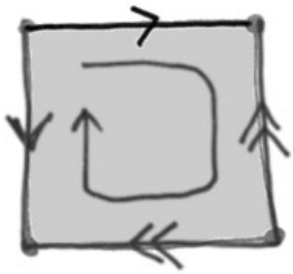
First Exam GK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

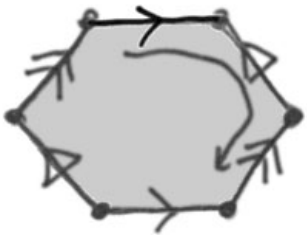
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





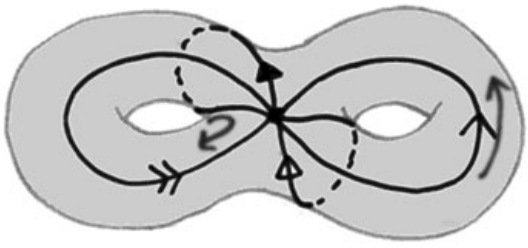
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

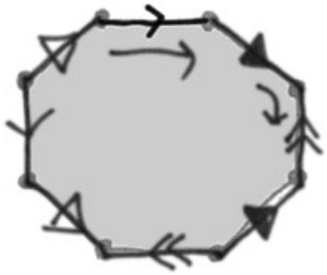
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

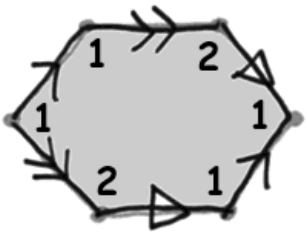
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



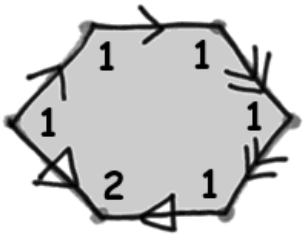


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

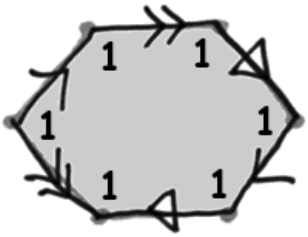
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



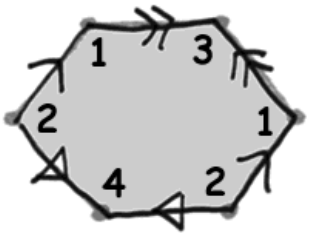
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



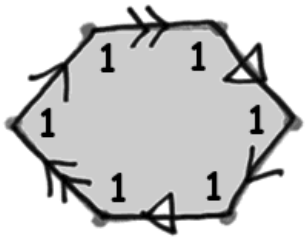
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



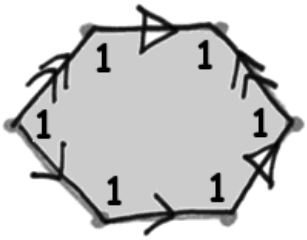
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



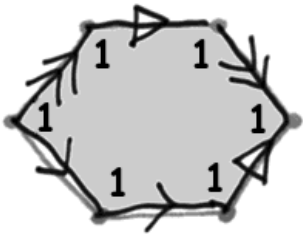
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



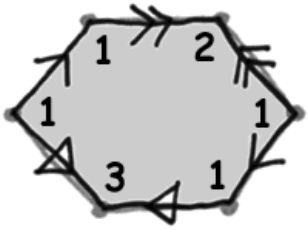
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

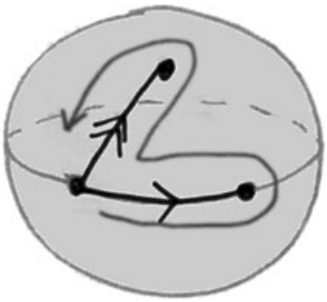
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

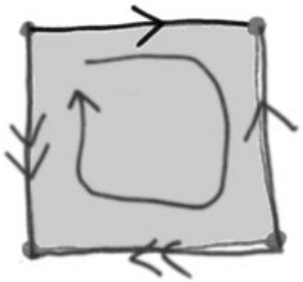
First Exam GL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

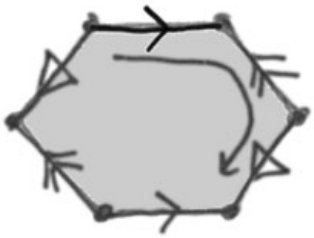
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





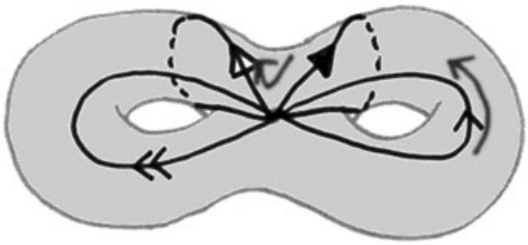
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

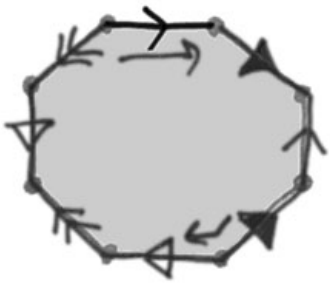
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

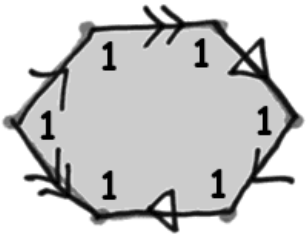
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



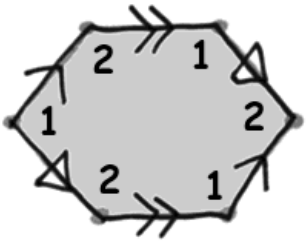


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

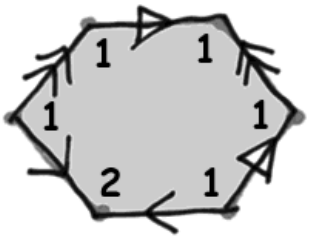
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



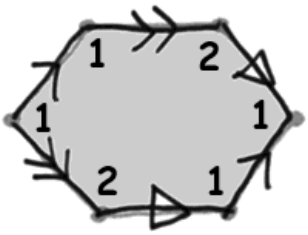
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



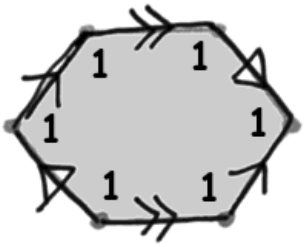
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



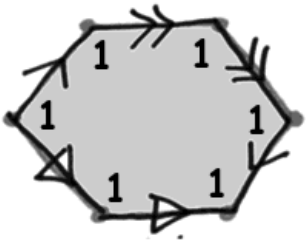
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



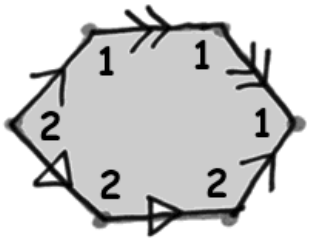
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



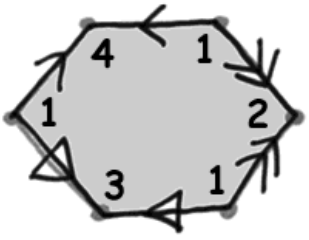
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

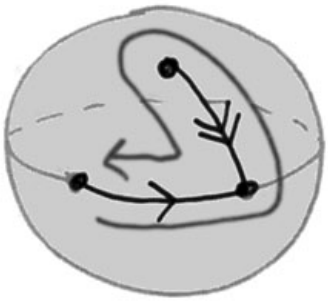
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

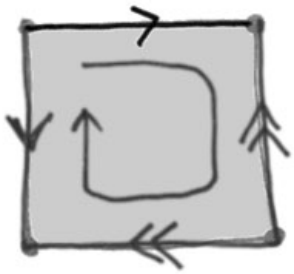
First Exam GM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

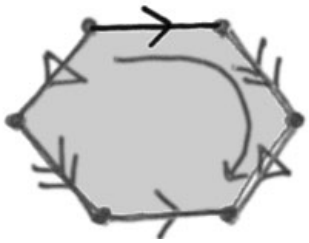
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





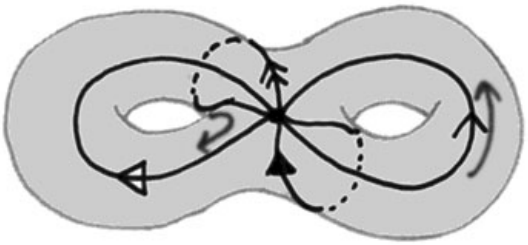
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

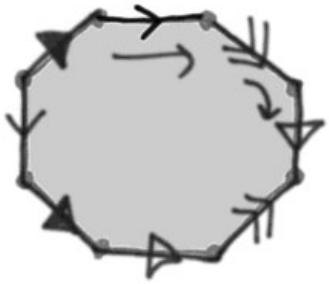
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

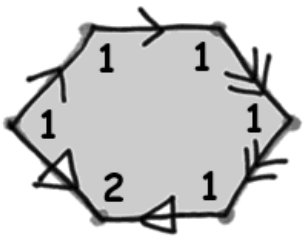
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



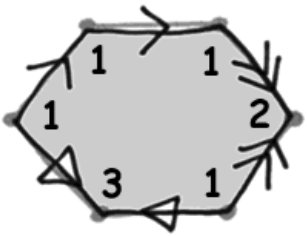


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

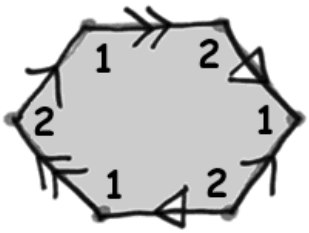
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



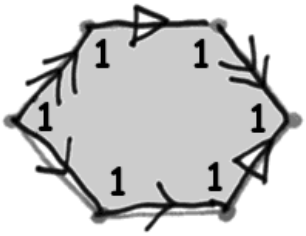
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



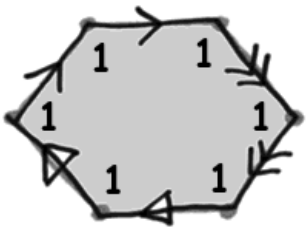
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



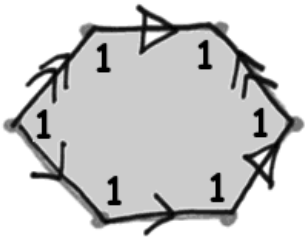
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



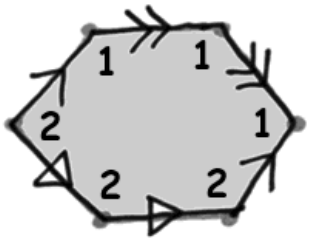
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



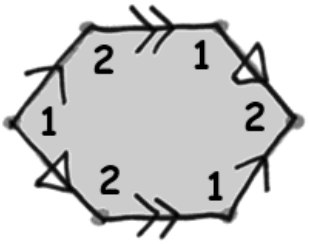
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

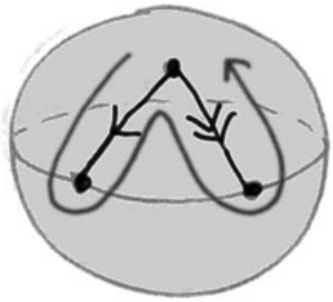
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

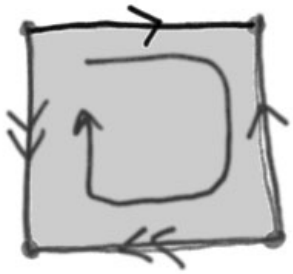
First Exam GN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

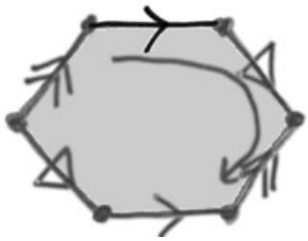
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





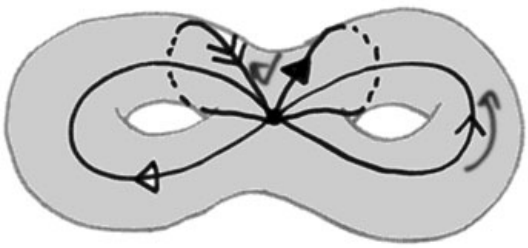
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

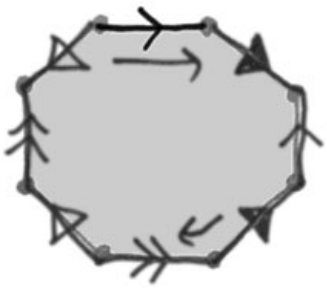
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

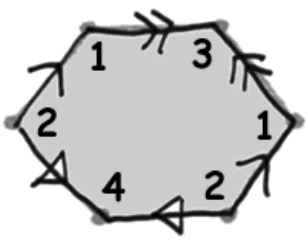
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



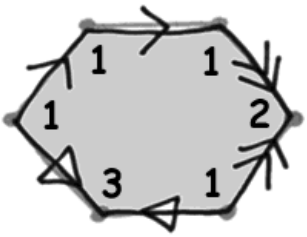


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

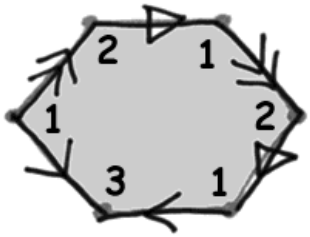
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



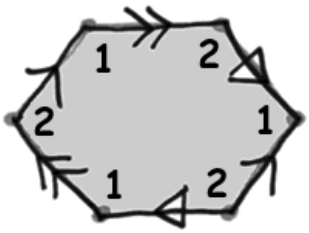
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



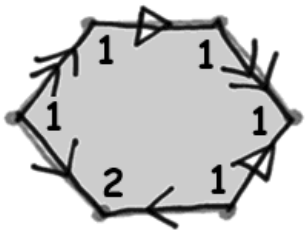
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



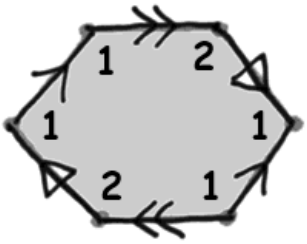
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



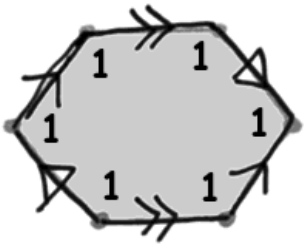
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



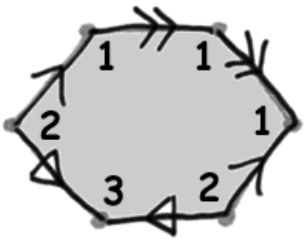
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

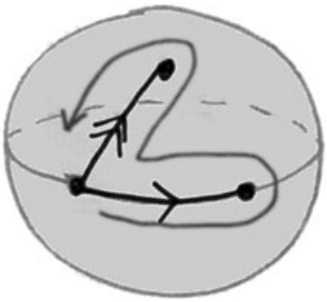
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

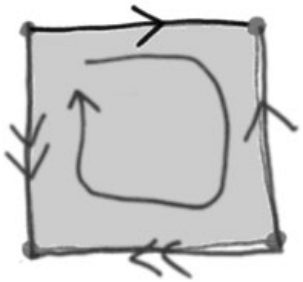
First Exam HA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

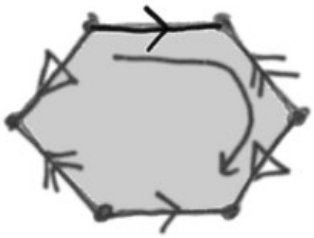
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





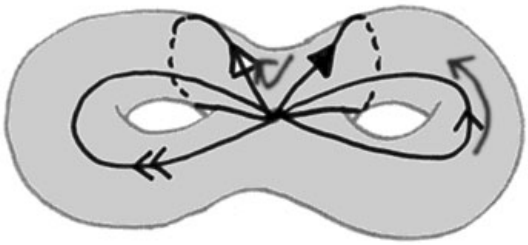
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

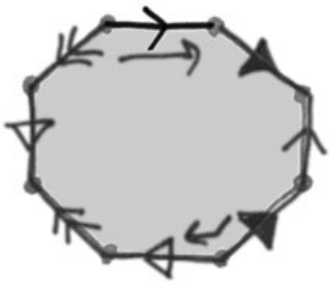
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

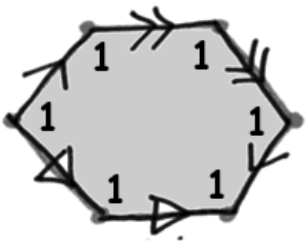
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



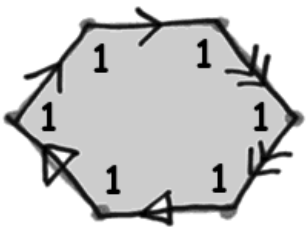


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

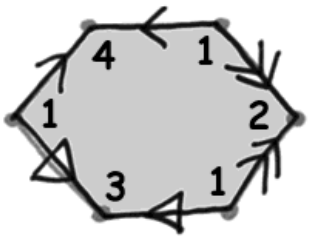
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



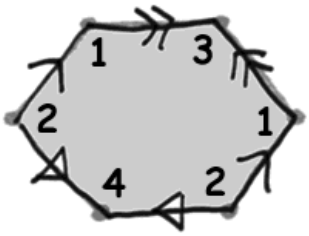
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



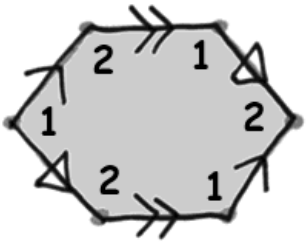
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



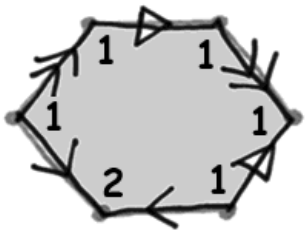
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



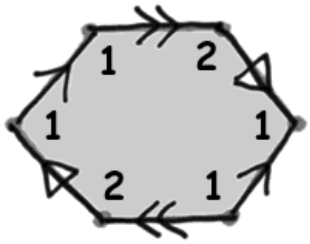
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



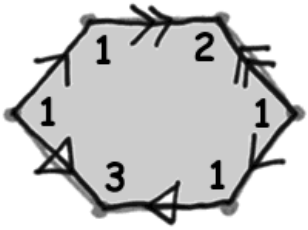
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

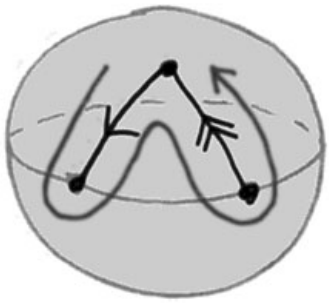
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

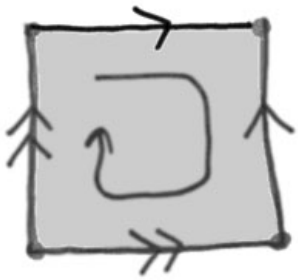
First Exam HB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

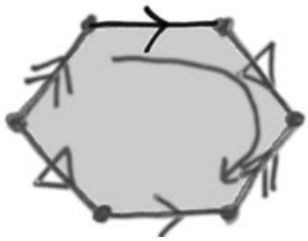
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





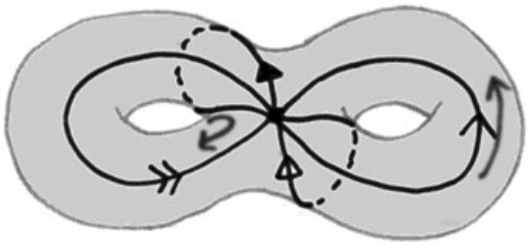
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

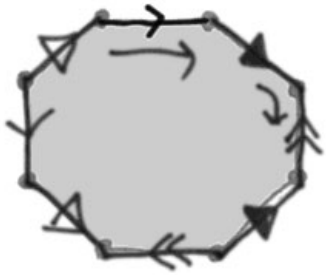
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

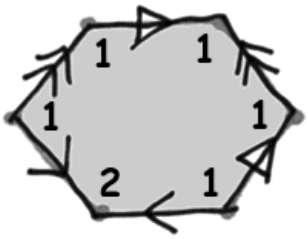
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



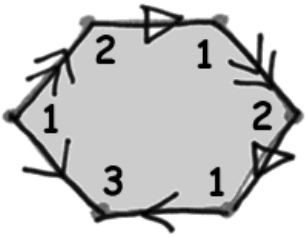


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

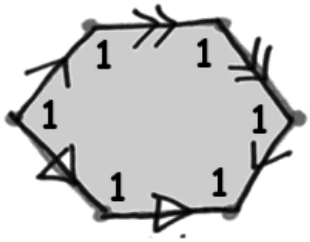
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



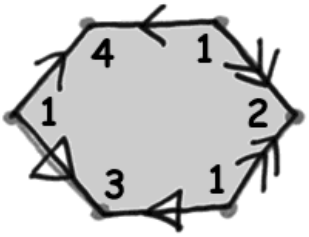
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



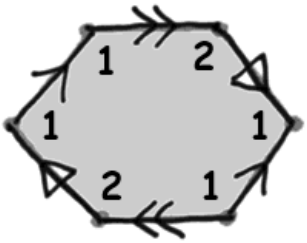
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



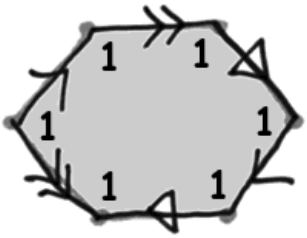
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



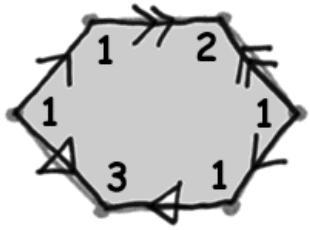
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



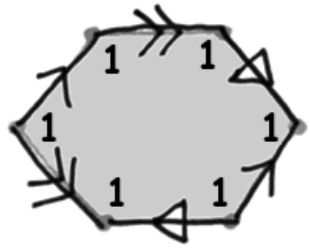
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

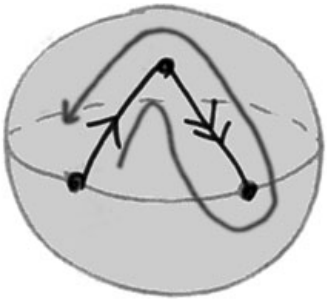
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

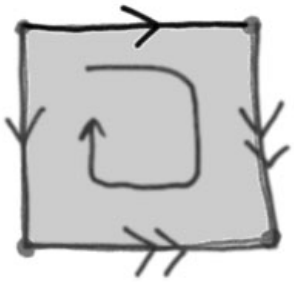
First Exam HC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

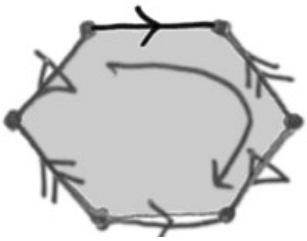
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





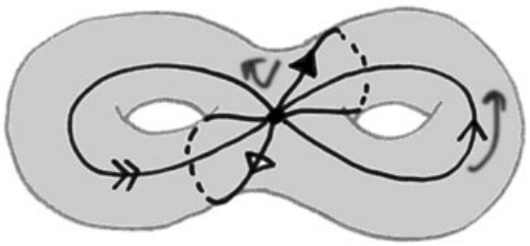
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

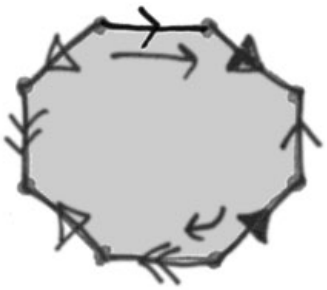
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

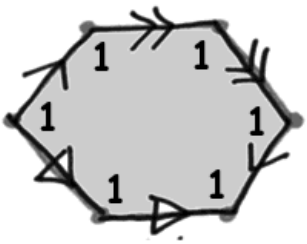
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



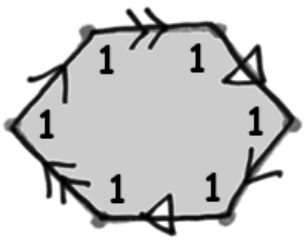


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

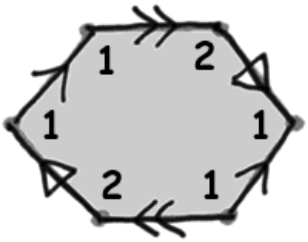
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



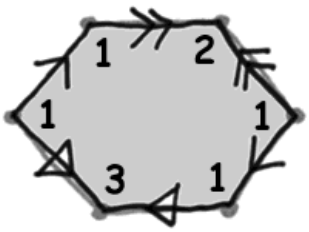
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



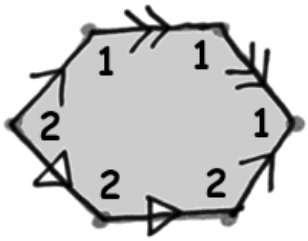
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



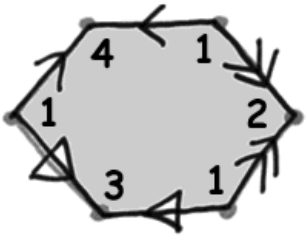
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



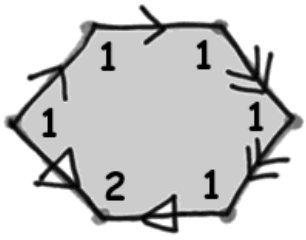
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



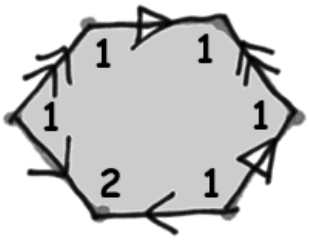
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

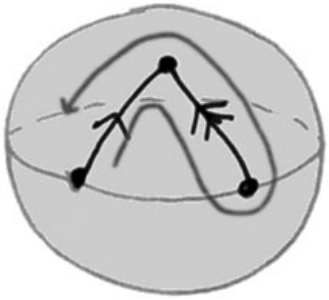
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

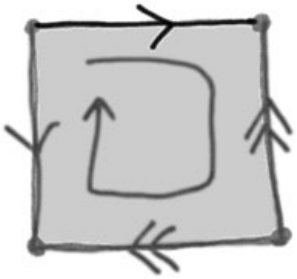
First Exam HD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

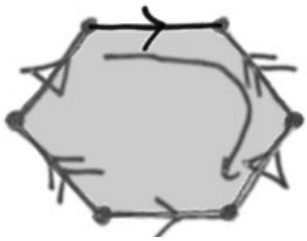
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





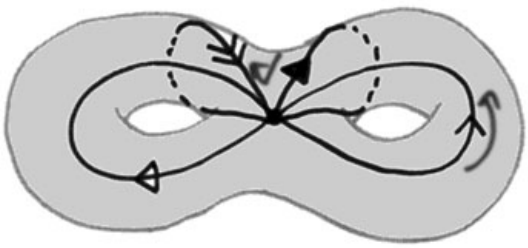
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

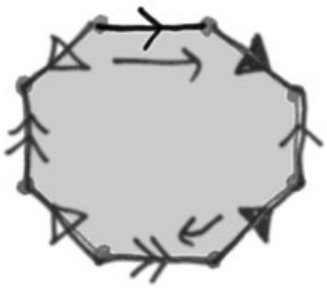
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

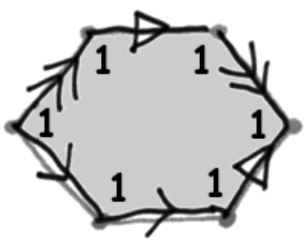
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



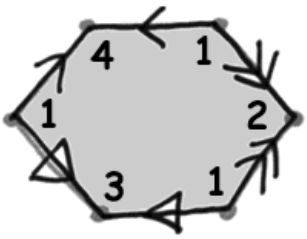


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

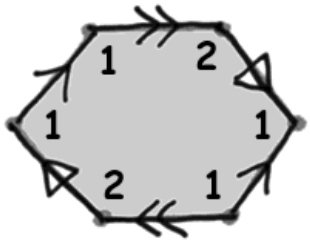
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



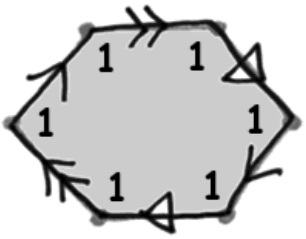
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



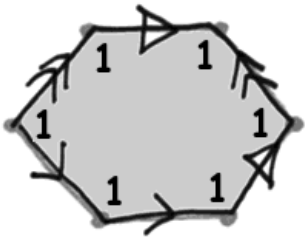
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



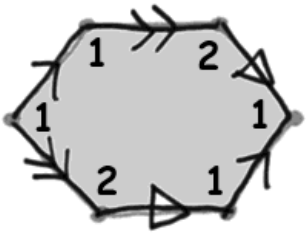
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



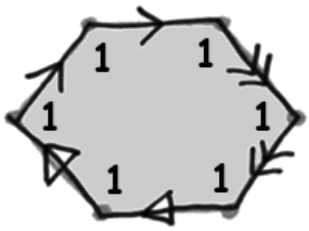
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



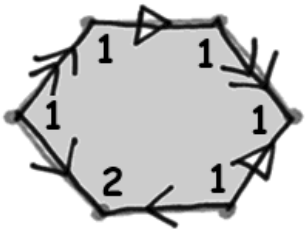
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

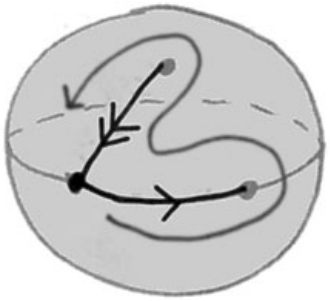
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

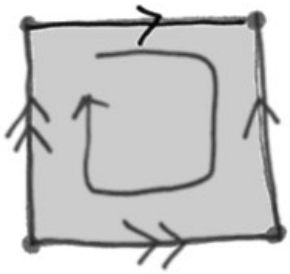
First Exam HE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

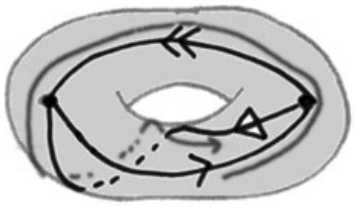
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

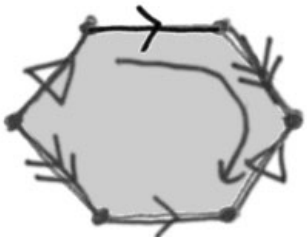




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

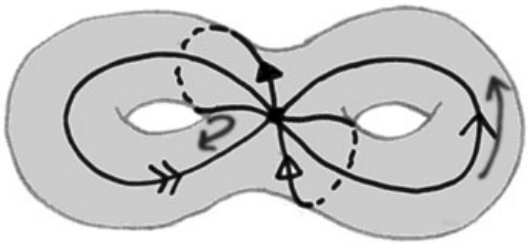
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

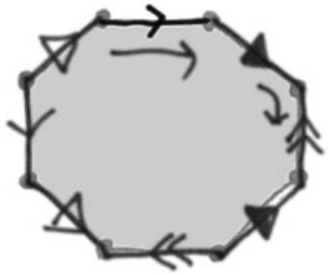




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

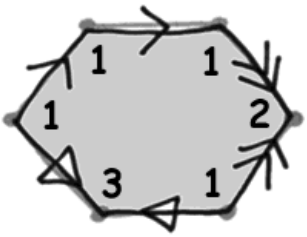
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



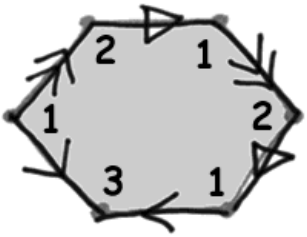


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

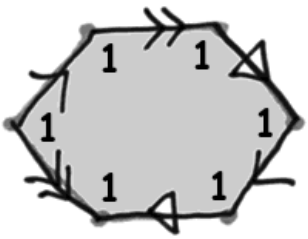
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



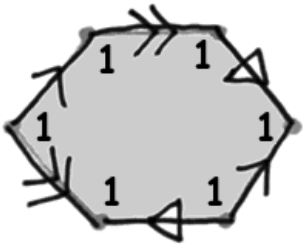
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



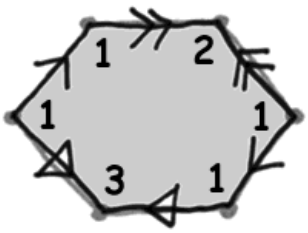
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



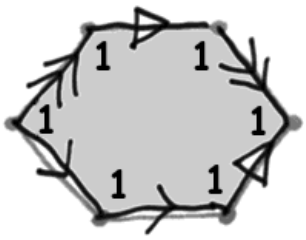
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



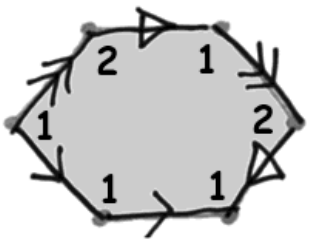
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



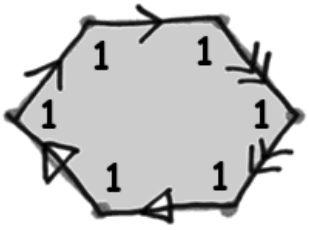
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

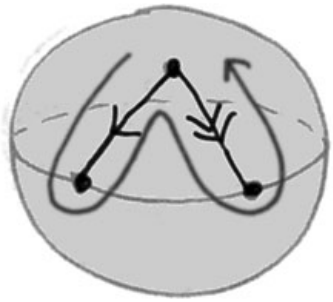
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

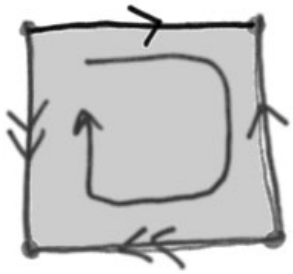
First Exam HF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

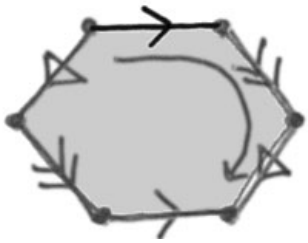
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





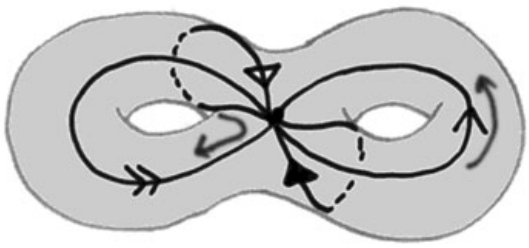
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

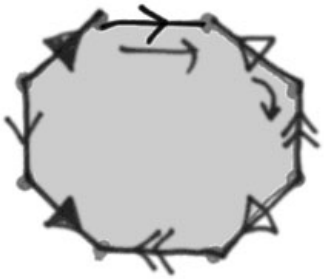
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

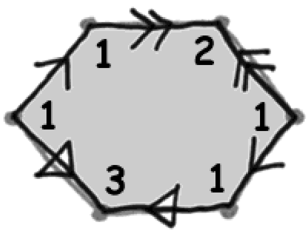
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





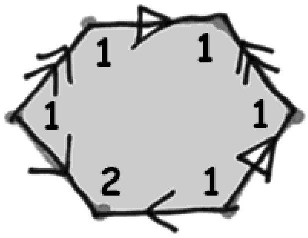
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



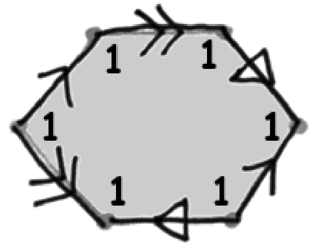
$$\begin{array}{rcl} +\,v &=& 3\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 1\end{array}$$

nonorientable



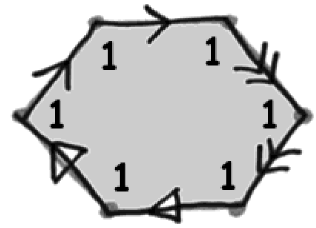
$$\begin{array}{rcl} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0\end{array}$$

orientable



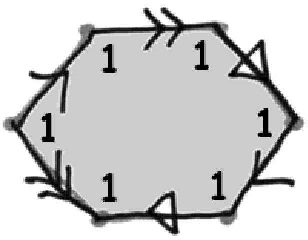
$$\begin{array}{rcl} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



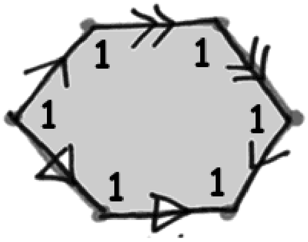
$$\begin{array}{rcl} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



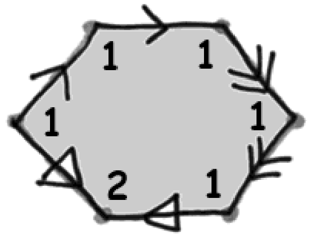
$$\begin{array}{rcl} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



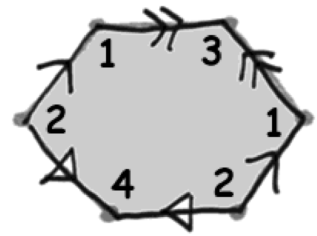
$$\begin{array}{rcl} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



$$\begin{array}{rcl} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0\end{array}$$

nonorientable



$$\begin{array}{rcl} +\,v &=& 4\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 2\end{array}$$

orientable

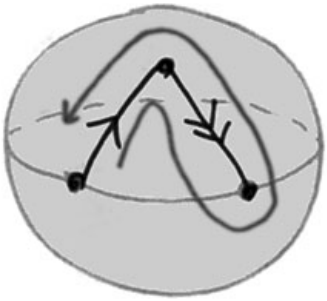
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

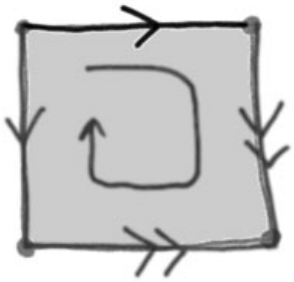
First Exam HG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

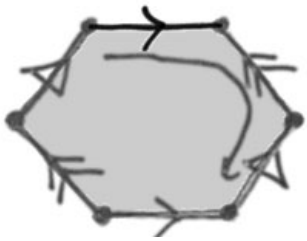
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





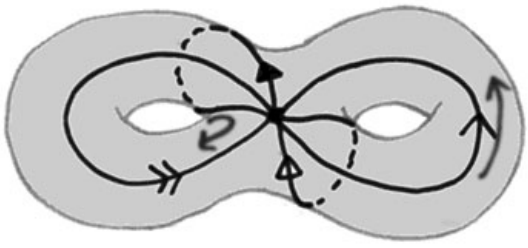
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

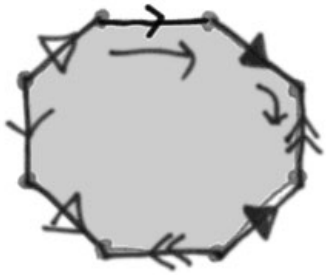
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

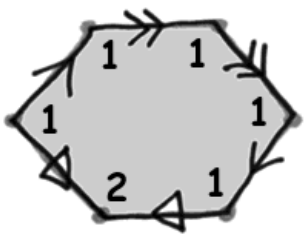
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



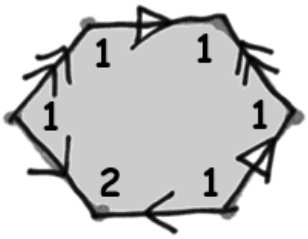


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

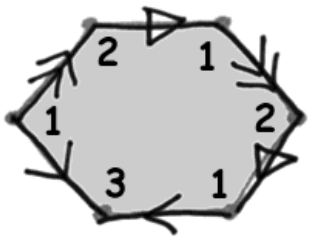
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



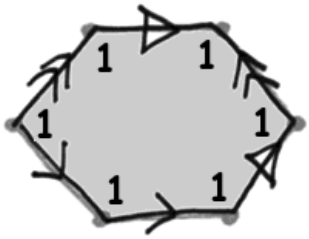
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



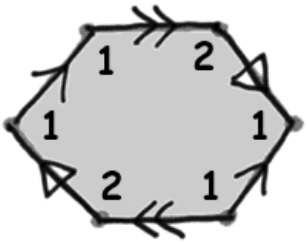
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



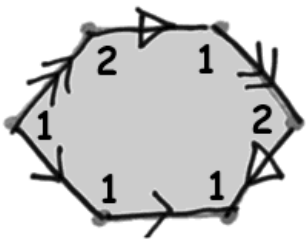
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



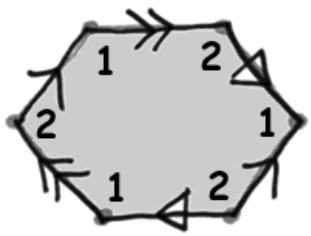
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



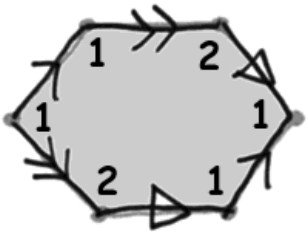
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

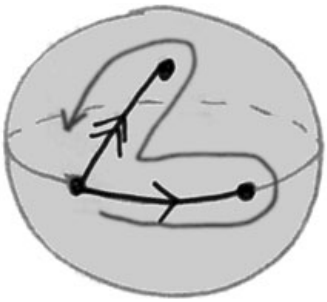
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

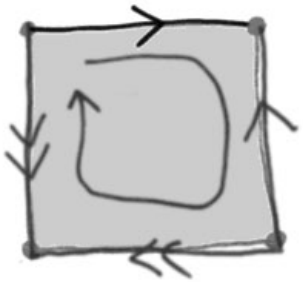
First Exam HH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

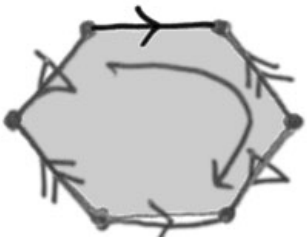
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





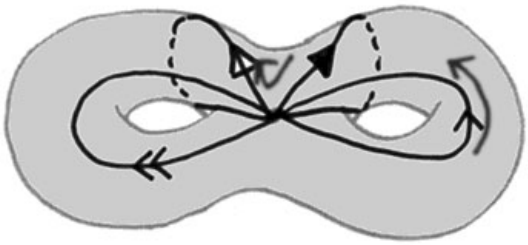
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

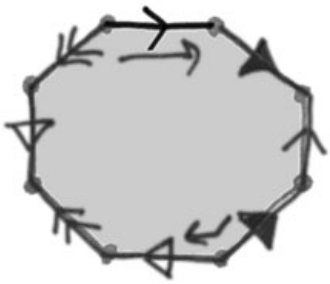
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

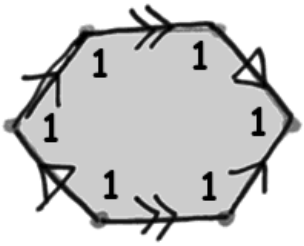
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



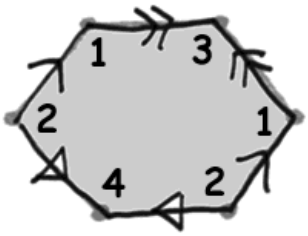


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

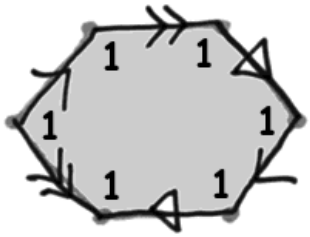
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



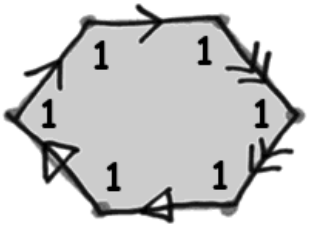
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



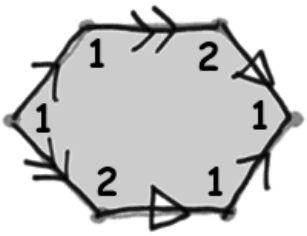
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



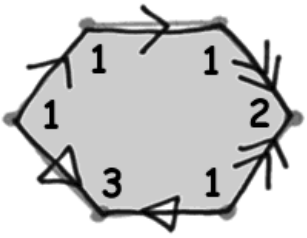
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



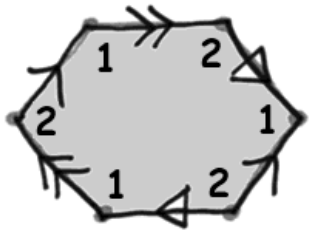
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



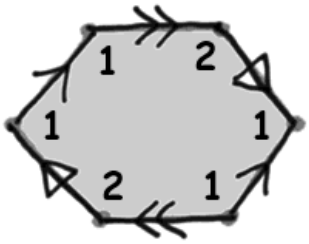
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

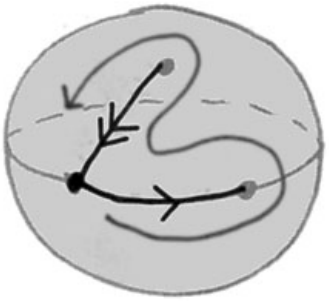
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

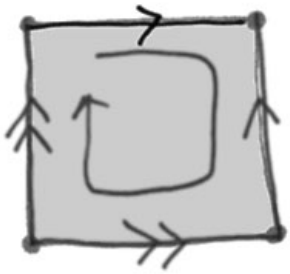
First Exam HI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

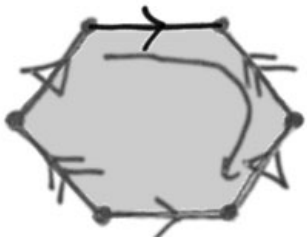
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





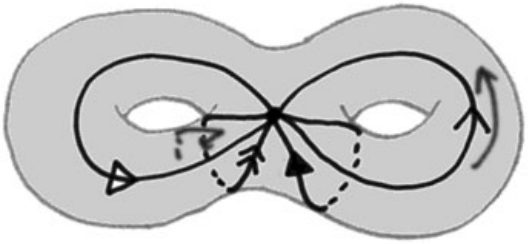
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

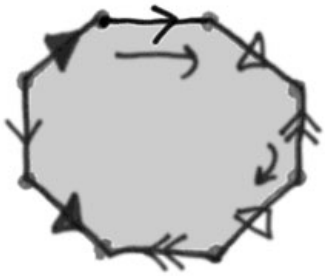
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

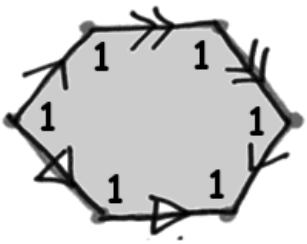
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



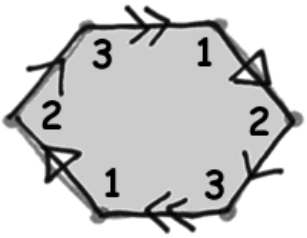


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

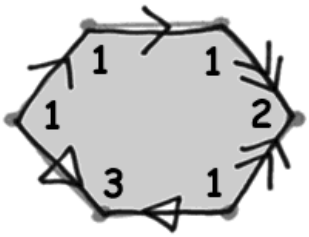
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



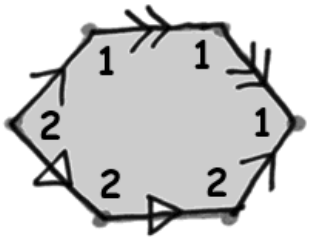
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



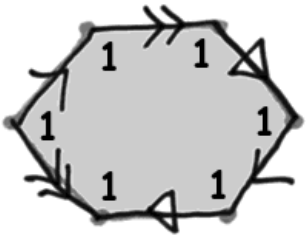
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



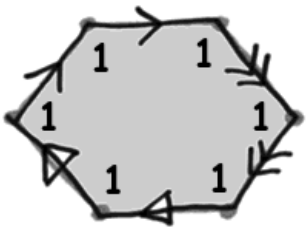
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



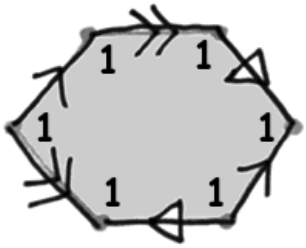
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



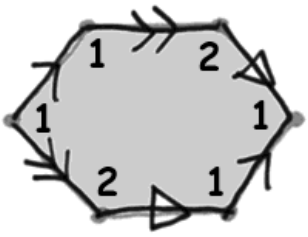
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

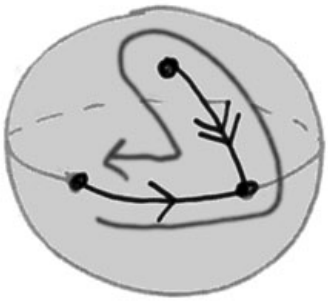
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

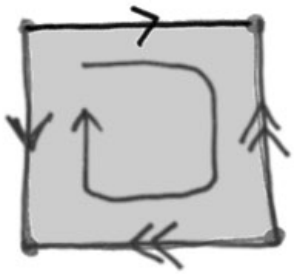
First Exam HJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

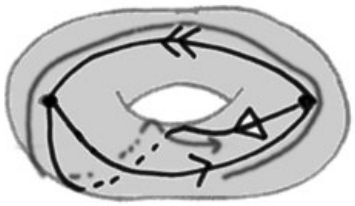
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

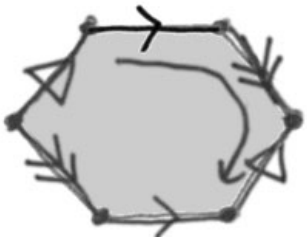




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

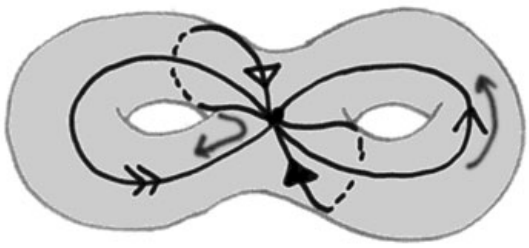
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

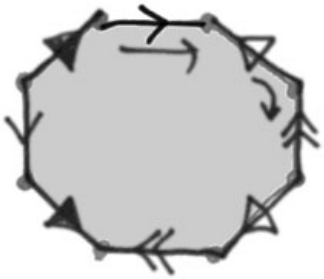




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

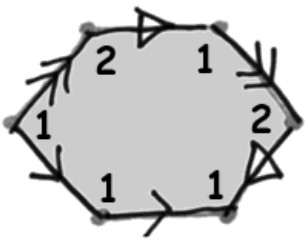
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



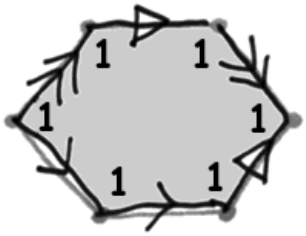


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

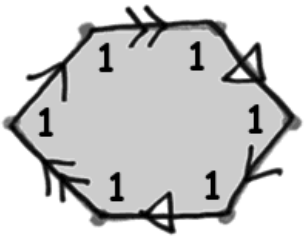
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



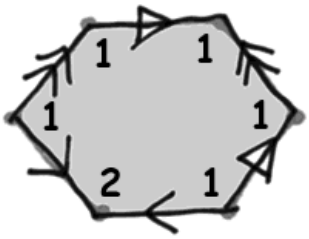
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



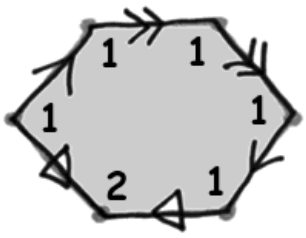
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



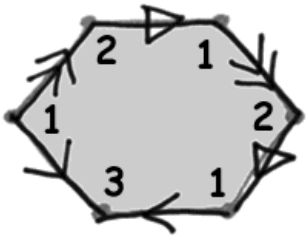
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



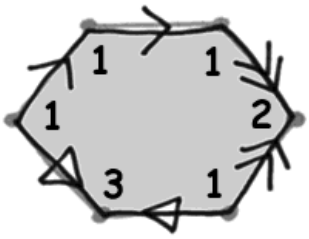
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



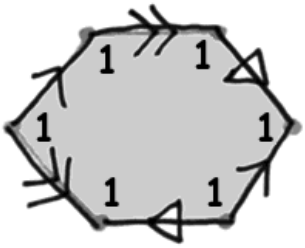
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

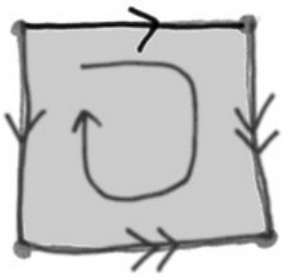
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam HK

Surfaces and Knots, Dave Bayer, February 21, 2002

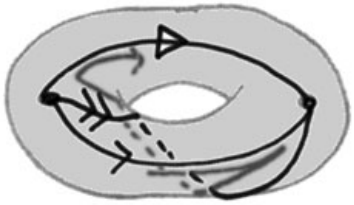
Answer Key

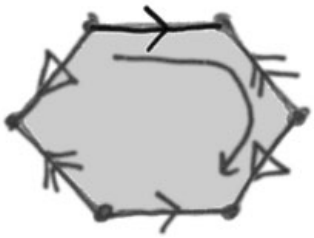
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

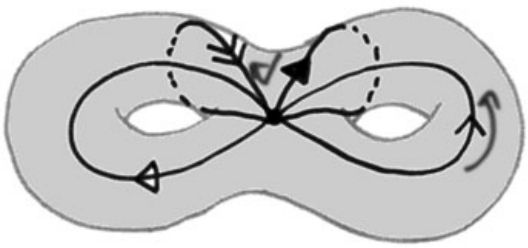
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

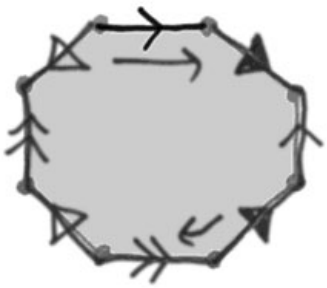




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

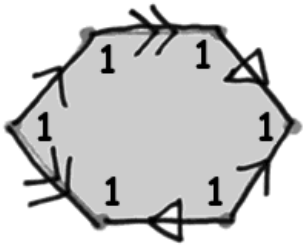
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



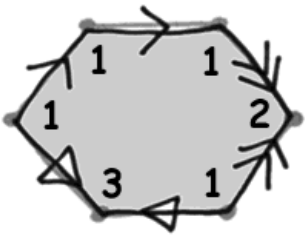


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

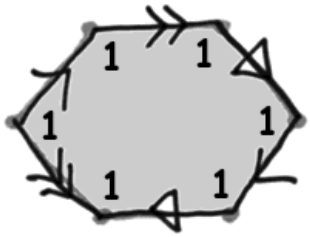
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



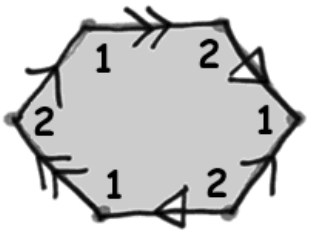
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



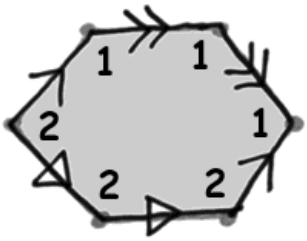
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



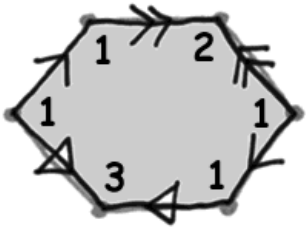
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



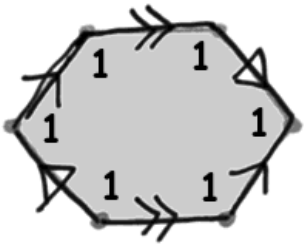
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



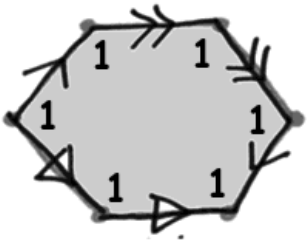
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

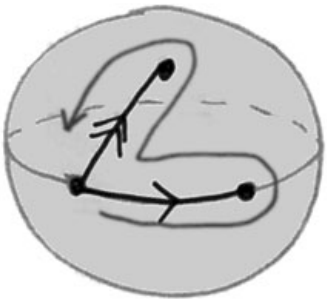
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

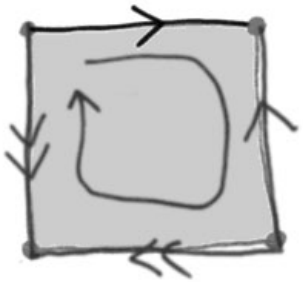
First Exam HL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

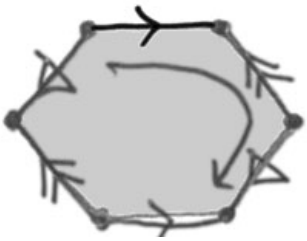
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





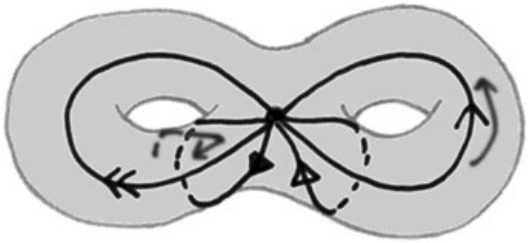
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

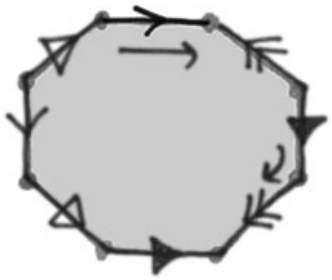
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

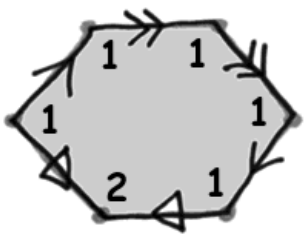
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



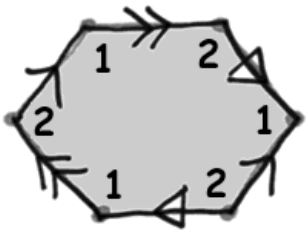


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

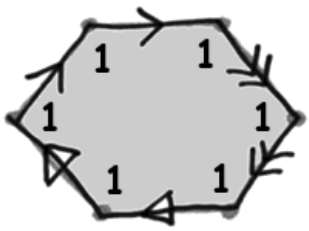
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



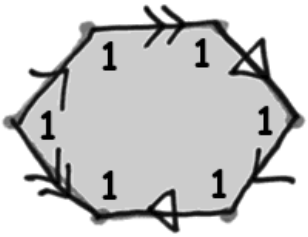
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



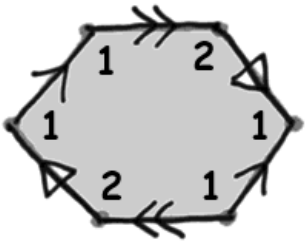
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



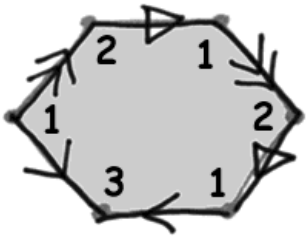
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



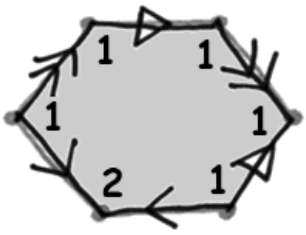
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



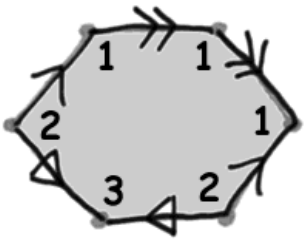
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

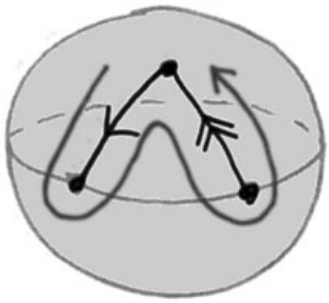
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

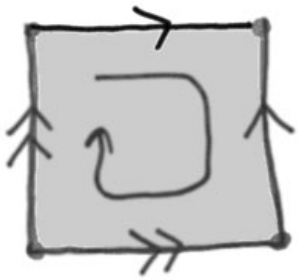
First Exam HM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

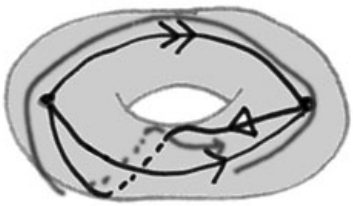
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

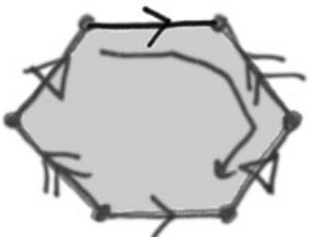




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

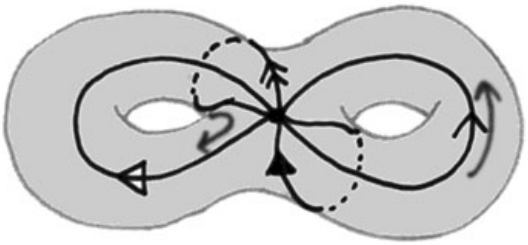
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

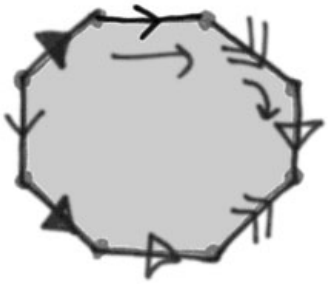




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

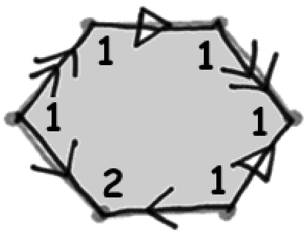
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





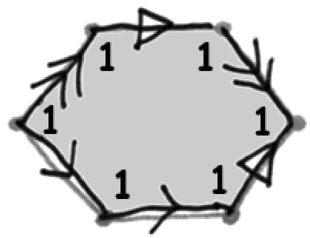
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[**4**] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



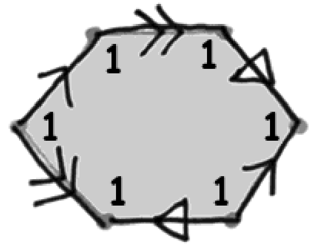
$$\begin{array}{rcl} +\ v & = & 2 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable



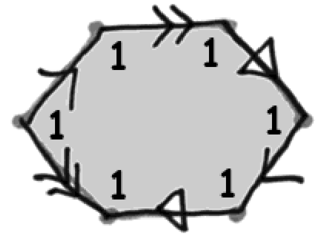
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



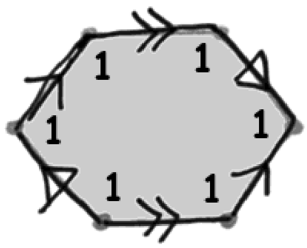
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



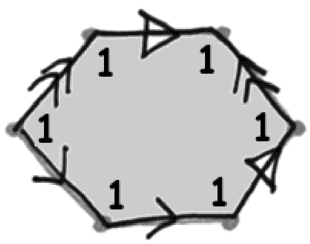
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



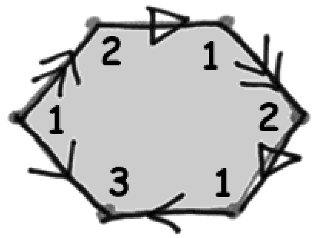
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



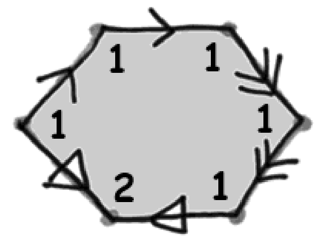
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\ v & = & 3 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & 1 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\ v & = & 2 \\ -\ e & = & 3 \\ +\ f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable

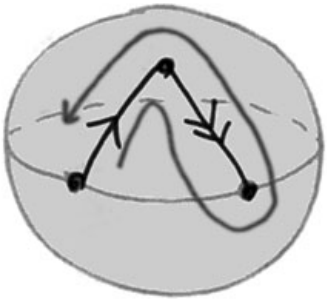
[**5**] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

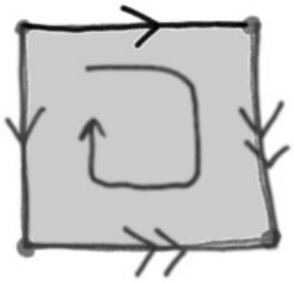
First Exam HN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

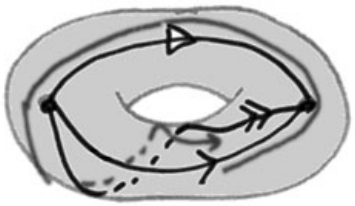
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

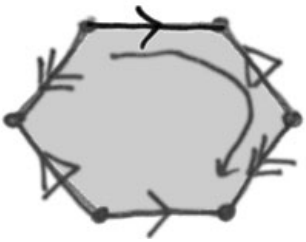




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

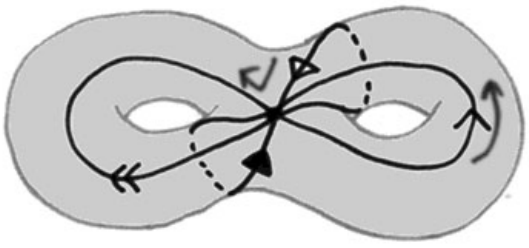
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

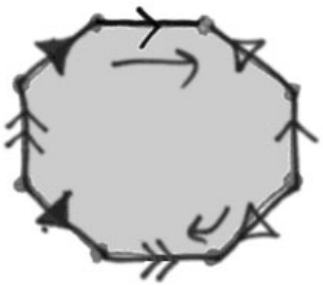




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

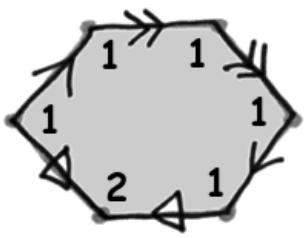
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



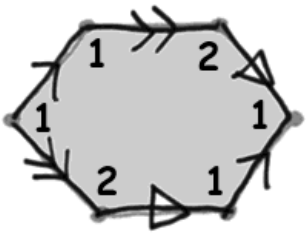


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

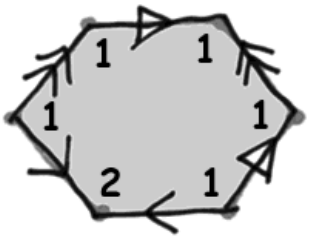
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



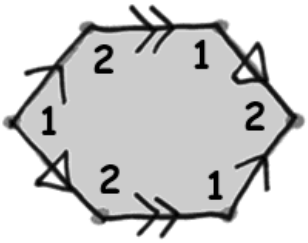
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



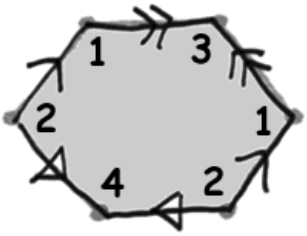
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



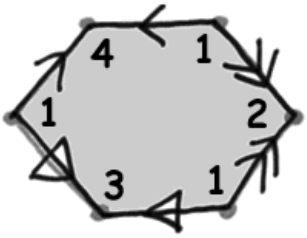
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



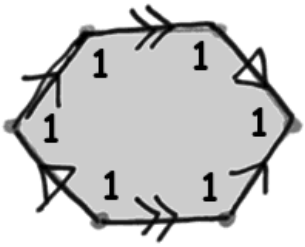
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



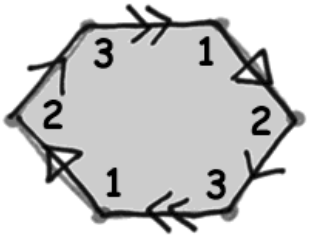
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

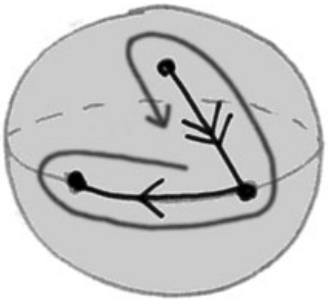
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

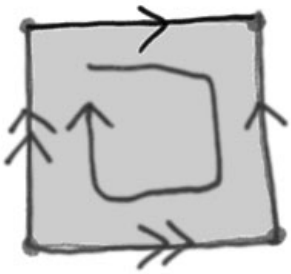
First Exam IA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

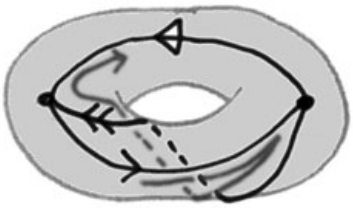
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

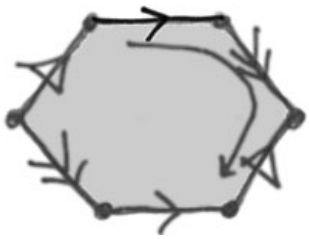




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

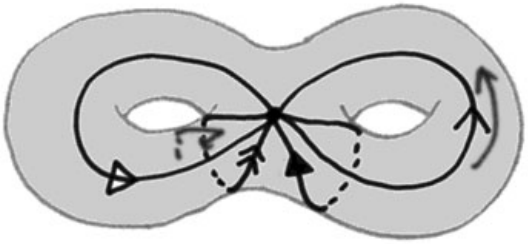
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

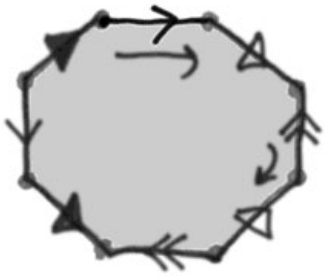




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

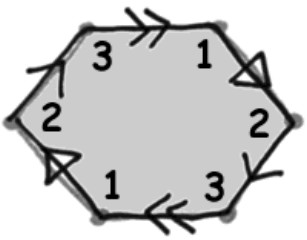
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



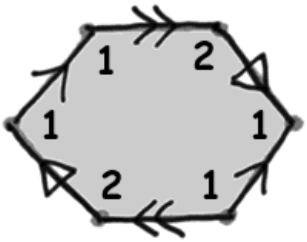


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

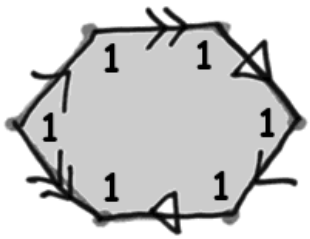
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



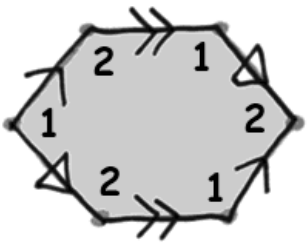
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



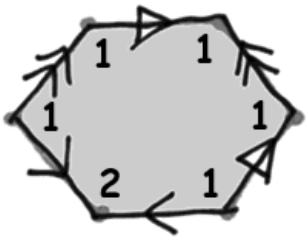
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



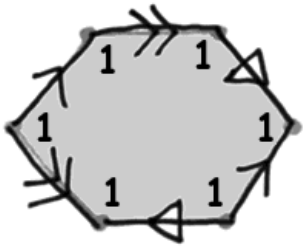
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



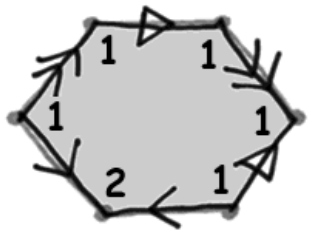
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



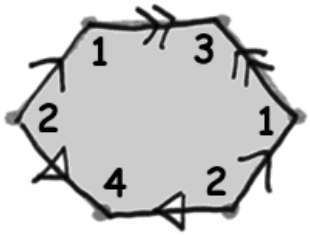
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

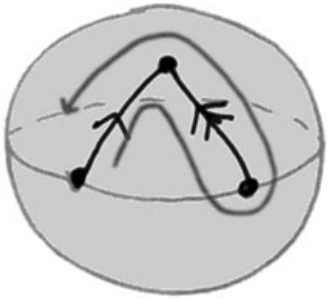
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

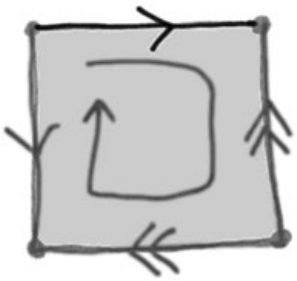
First Exam IB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

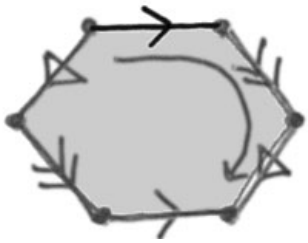
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





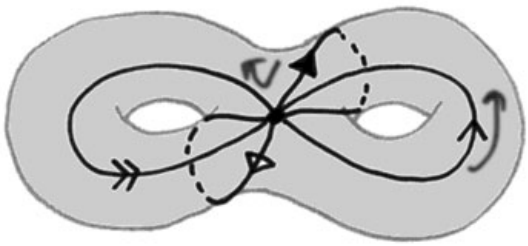
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

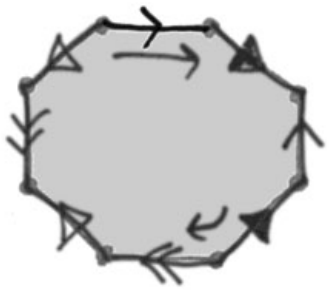
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

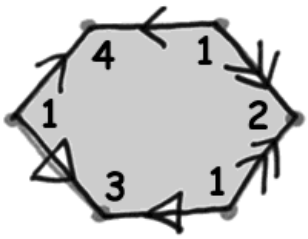
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



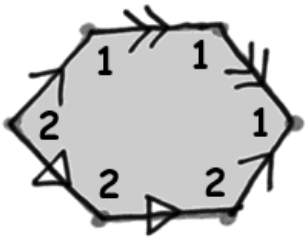


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

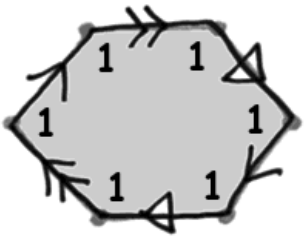
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



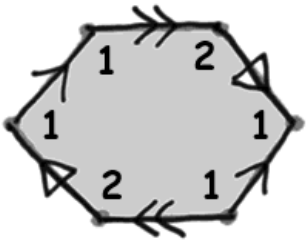
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



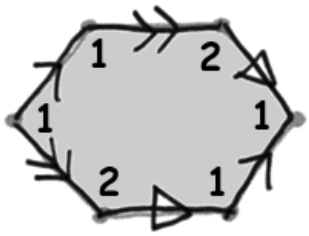
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



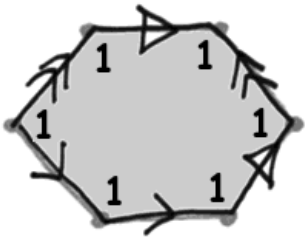
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



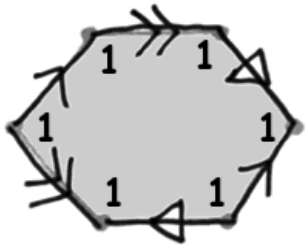
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



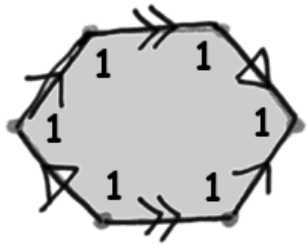
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

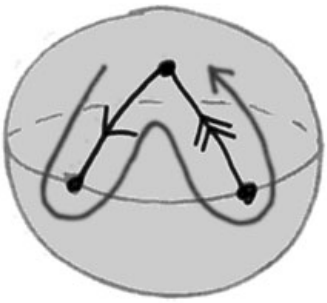
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

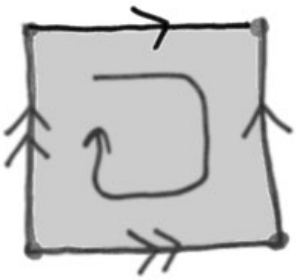
First Exam IC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

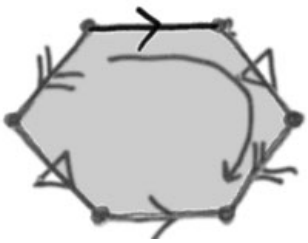
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





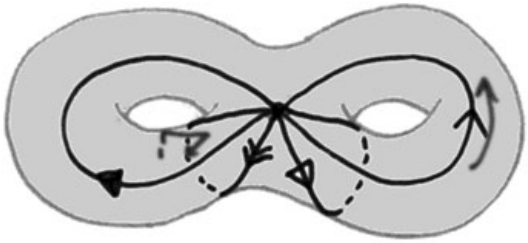
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

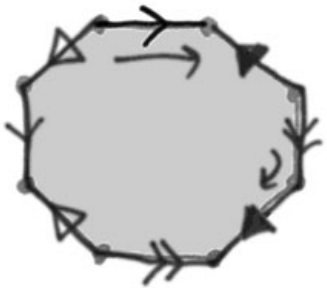
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

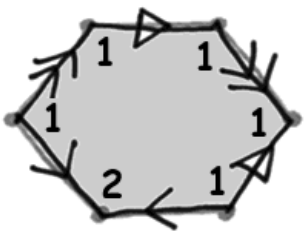
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



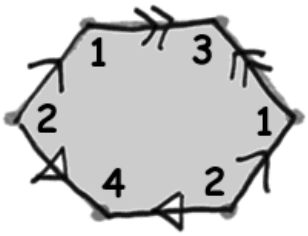


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

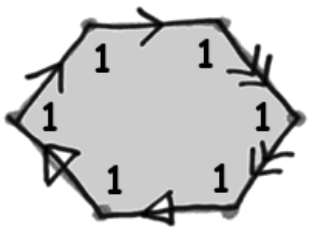
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



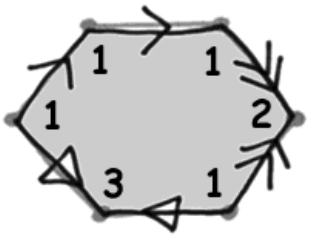
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



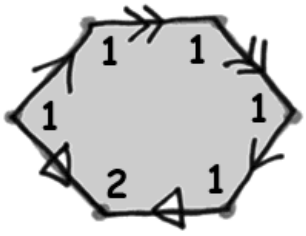
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



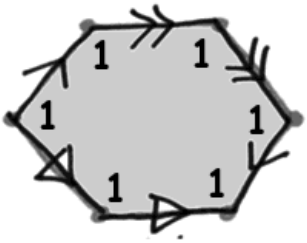
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



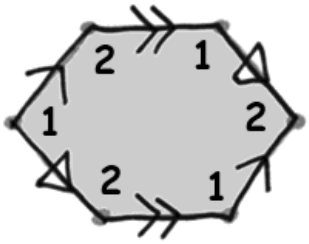
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



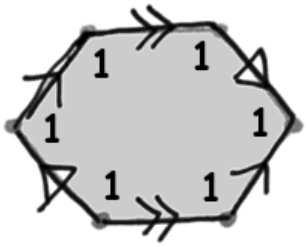
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

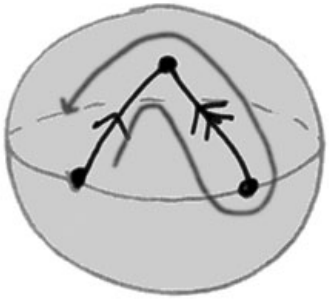
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

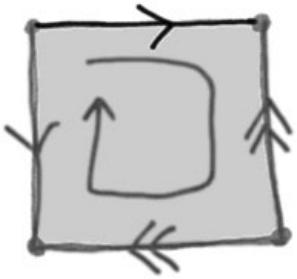
First Exam ID

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

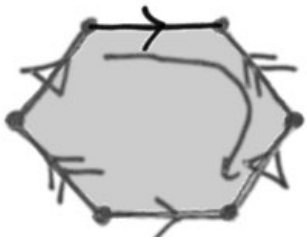
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





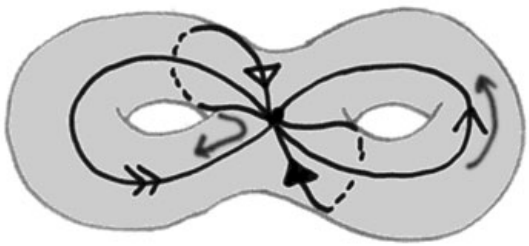
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

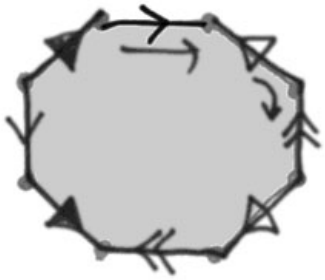
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

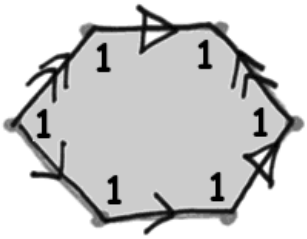
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



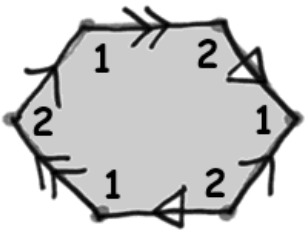


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

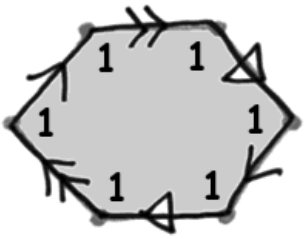
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



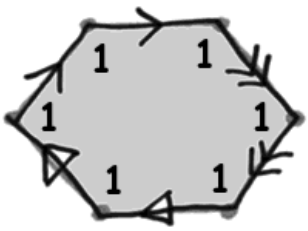
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



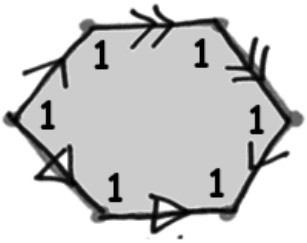
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



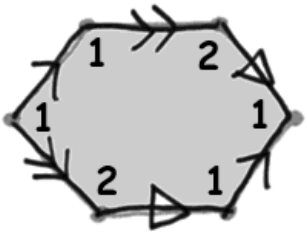
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



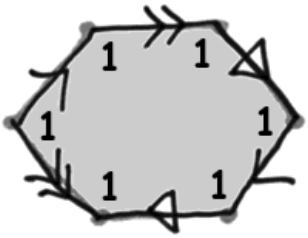
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



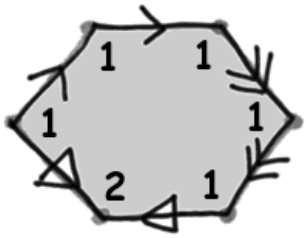
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

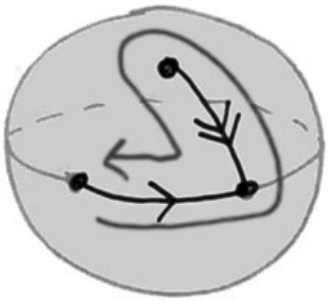
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

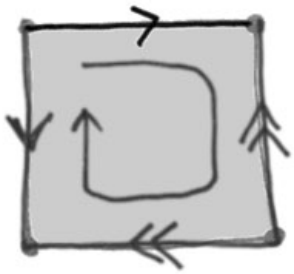
First Exam IE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

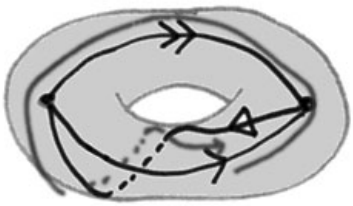
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

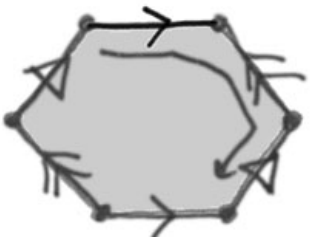




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

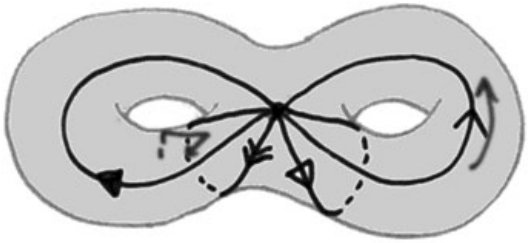
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

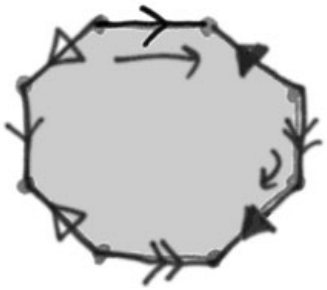




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

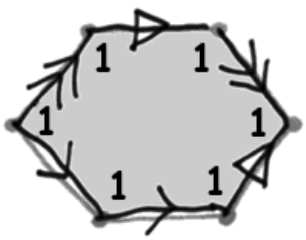
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



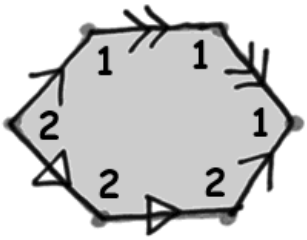


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

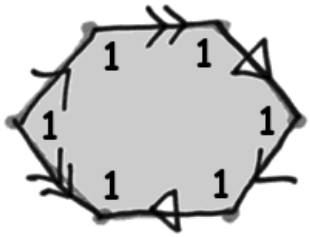
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



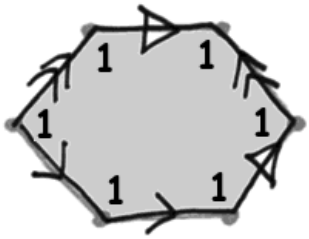
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



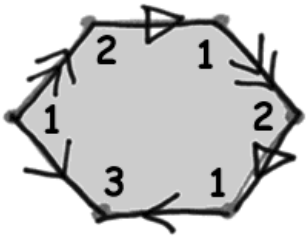
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



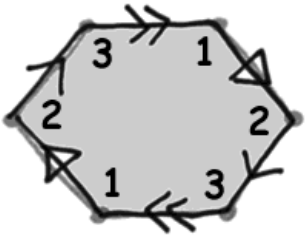
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



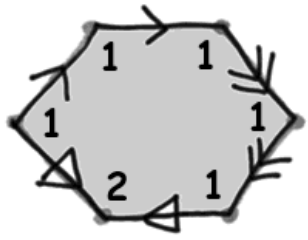
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



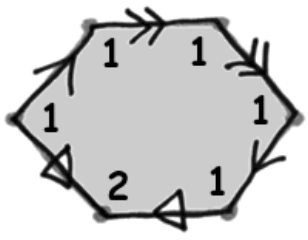
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

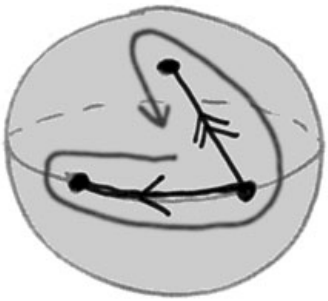
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

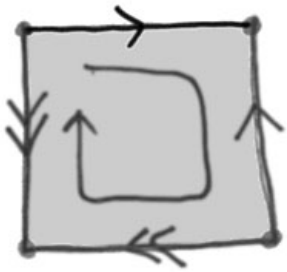
First Exam IF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

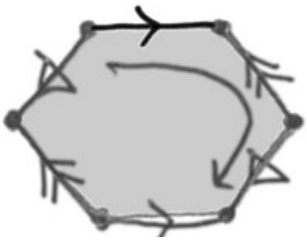
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





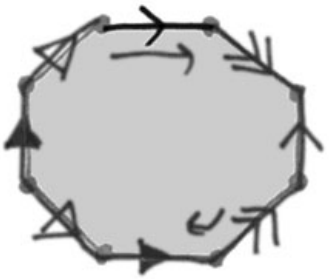
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



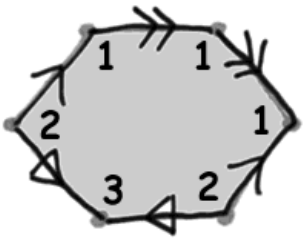
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

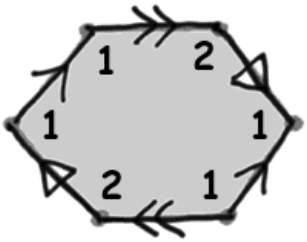


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

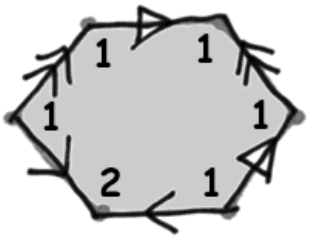
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



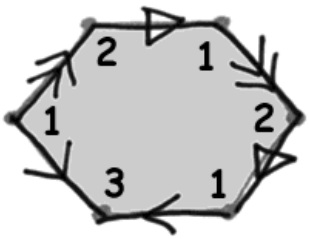
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



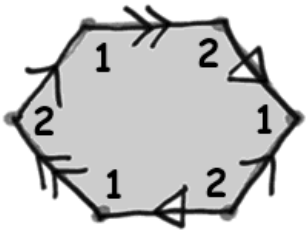
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



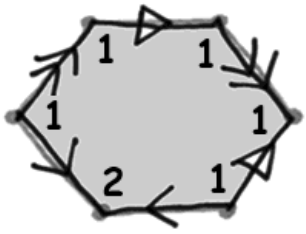
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



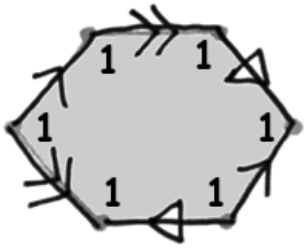
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



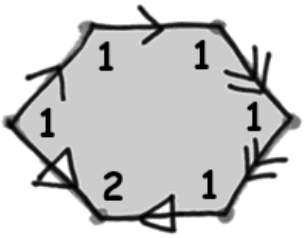
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

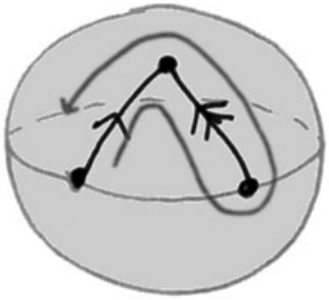
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

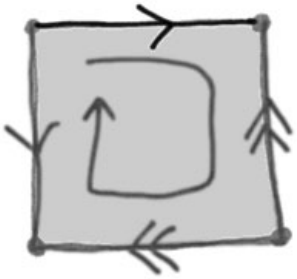
First Exam IG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

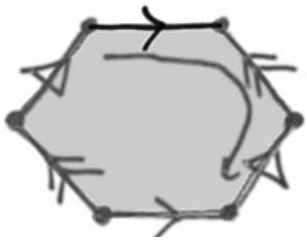
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





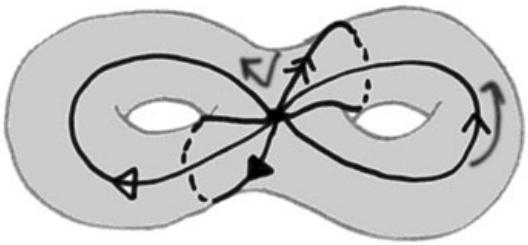
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

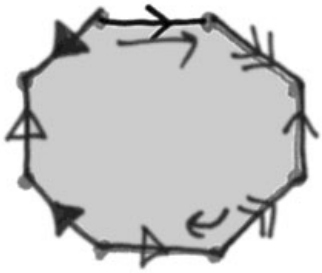
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

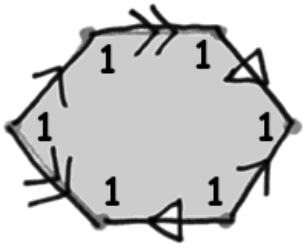
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



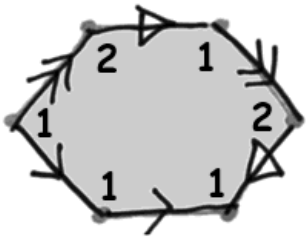


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

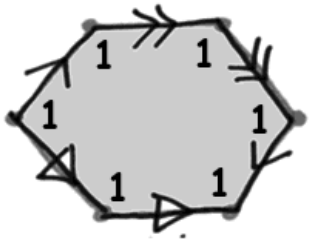
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



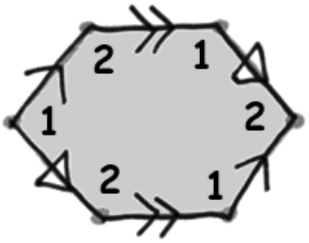
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



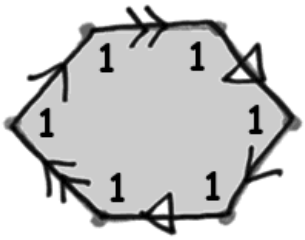
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



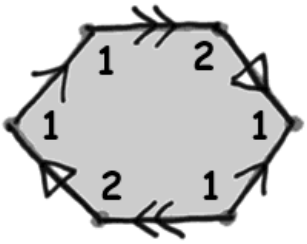
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



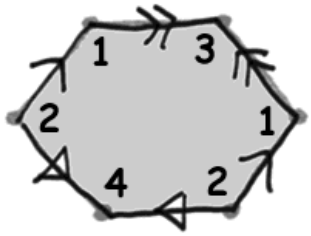
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



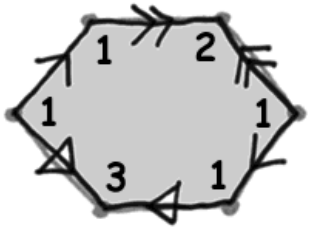
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

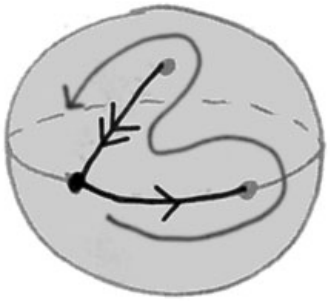
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

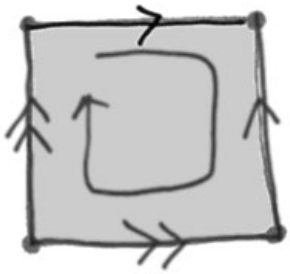
First Exam IH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

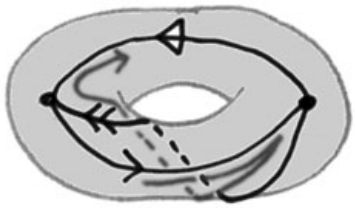
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

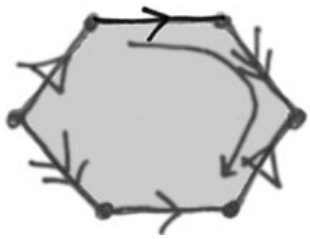




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

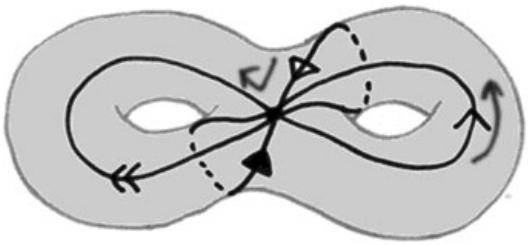
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

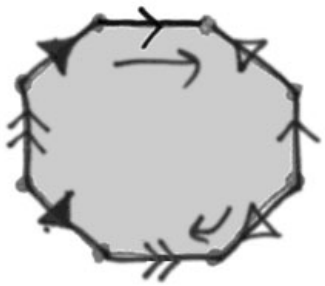




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

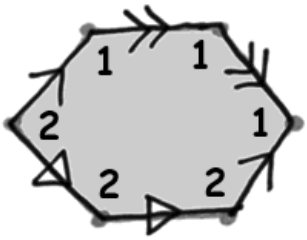
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



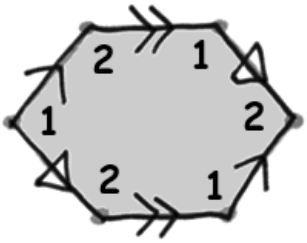


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

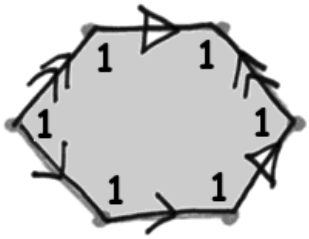
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



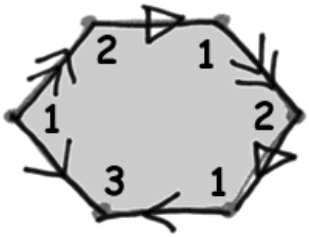
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



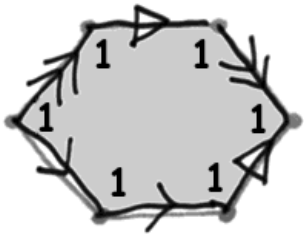
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



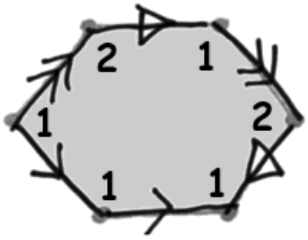
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



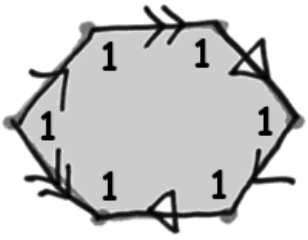
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



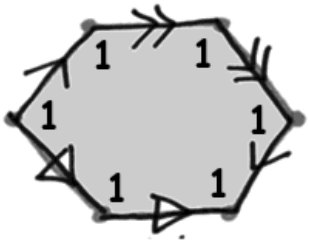
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

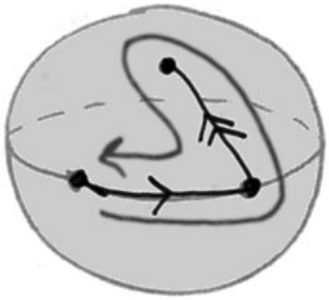
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

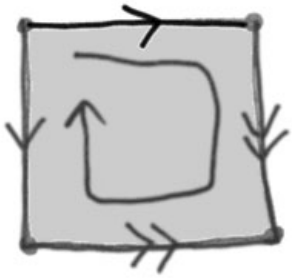
First Exam II

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

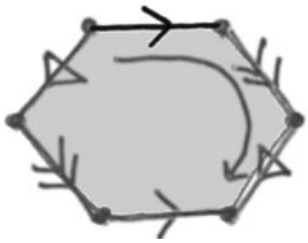
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





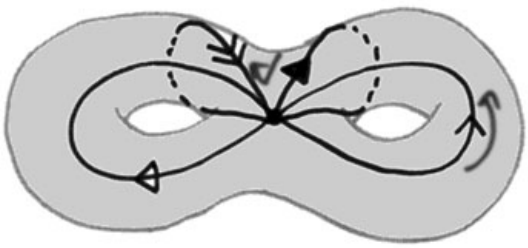
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

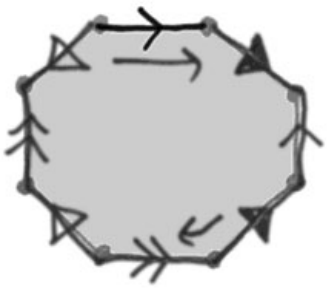
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

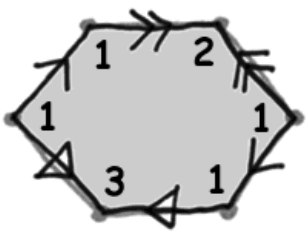
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



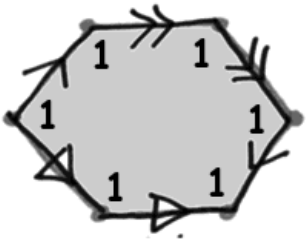


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

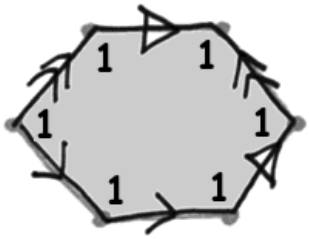
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



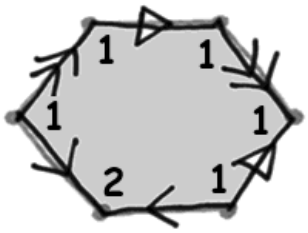
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



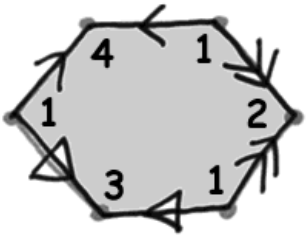
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



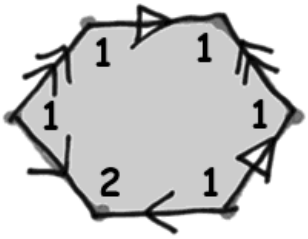
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



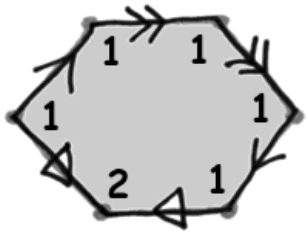
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



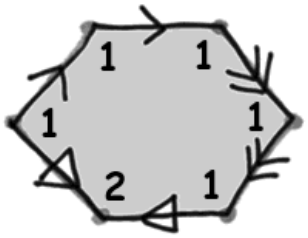
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

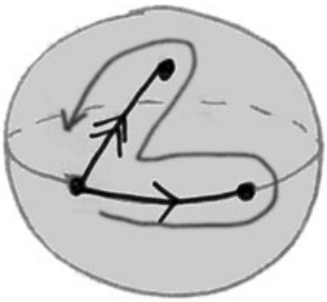
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

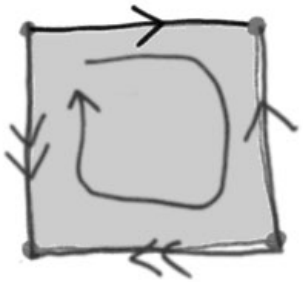
First Exam IJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

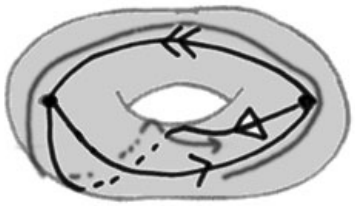
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

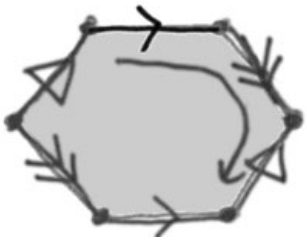




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

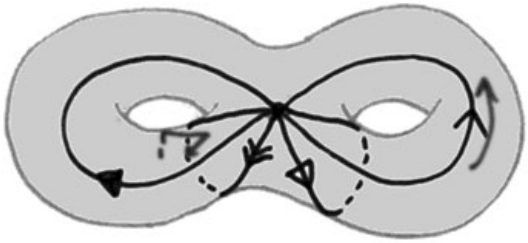
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

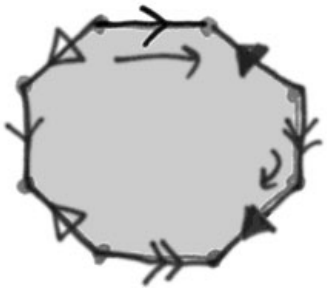




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

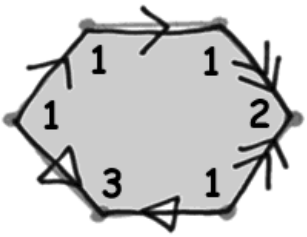
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





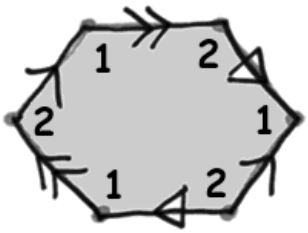
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



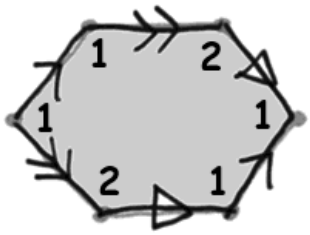
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 1 \end{aligned}$$

nonorientable



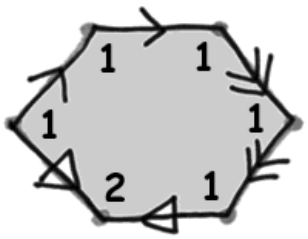
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

nonorientable



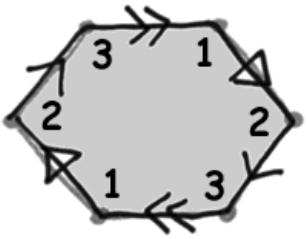
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

orientable



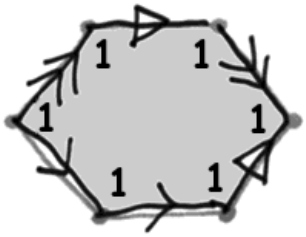
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

nonorientable



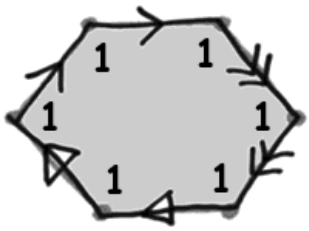
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 1 \end{aligned}$$

nonorientable



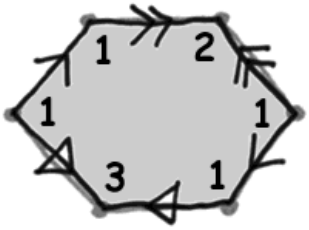
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= -1 \end{aligned}$$

nonorientable



$$\begin{aligned} +\ v &= 1 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= -1 \end{aligned}$$

nonorientable



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 1 \end{aligned}$$

nonorientable

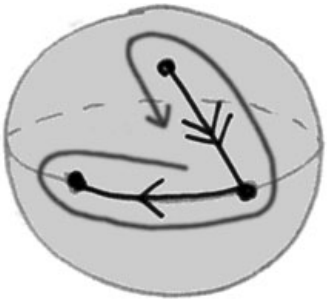
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

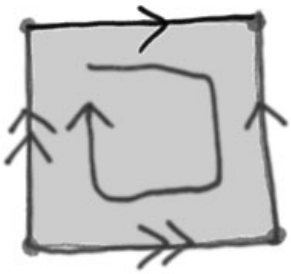
First Exam IK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

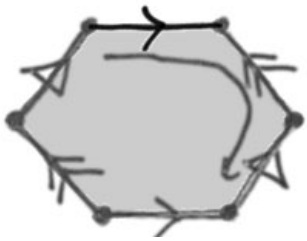
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





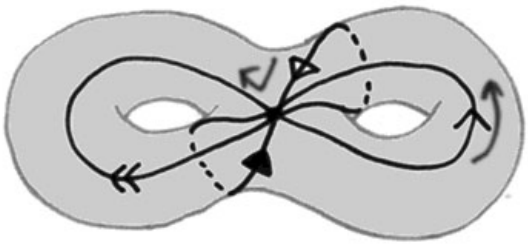
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

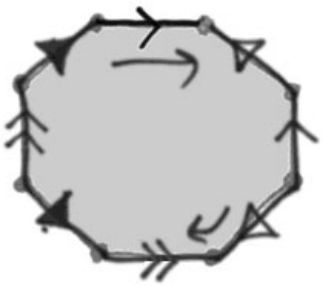
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

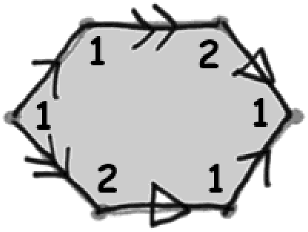
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





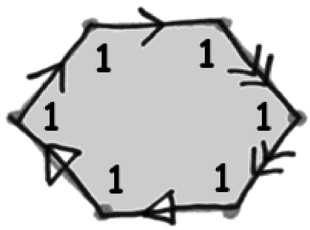
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[**4**] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



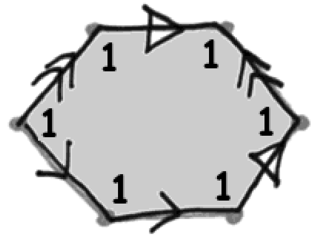
$$\begin{array}{rcr} +\ v &=& 2\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& 0\end{array}$$

orientable



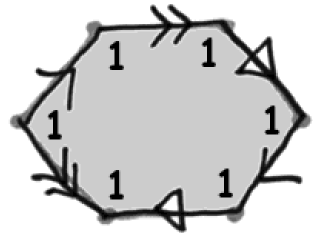
$$\begin{array}{rcr} +\ v &=& 1\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



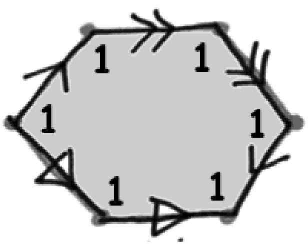
$$\begin{array}{rcr} +\ v &=& 1\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



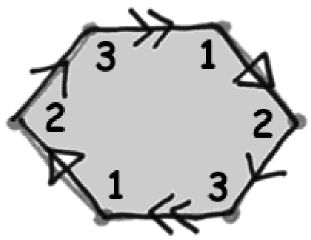
$$\begin{array}{rcr} +\ v &=& 1\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



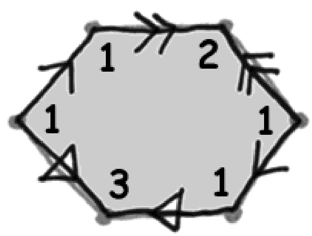
$$\begin{array}{rcr} +\ v &=& 1\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& -1\end{array}$$

nonorientable



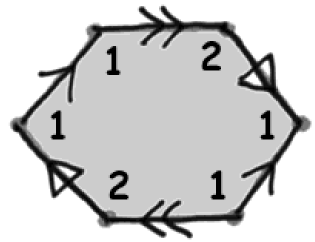
$$\begin{array}{rcr} +\ v &=& 3\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& 1\end{array}$$

nonorientable



$$\begin{array}{rcr} +\ v &=& 3\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& 1\end{array}$$

nonorientable



$$\begin{array}{rcr} +\ v &=& 2\\ -\ e &=& 3\\ +\ f &=& 1\\ \hline \chi &=& 0\end{array}$$

nonorientable

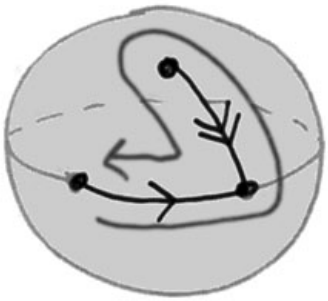
[**5**] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

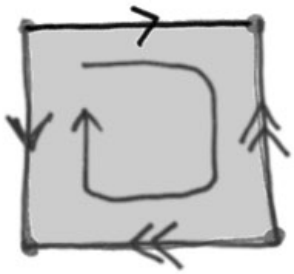
First Exam IL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

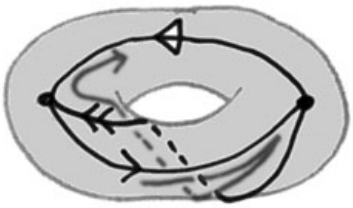
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

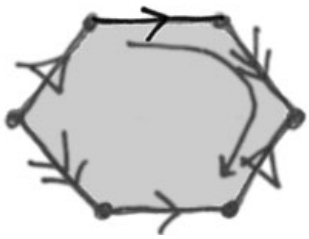




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

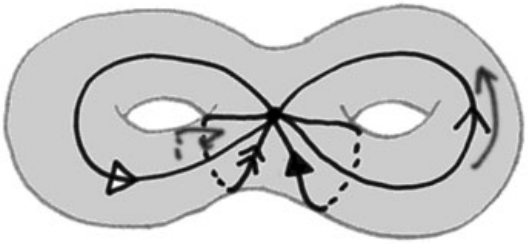
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

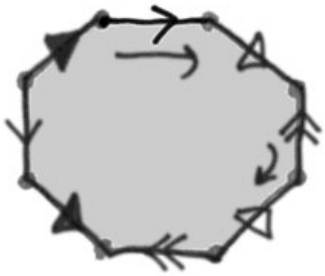




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

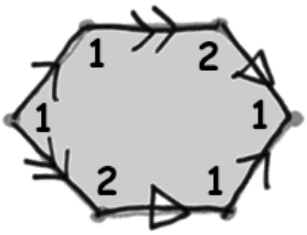
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



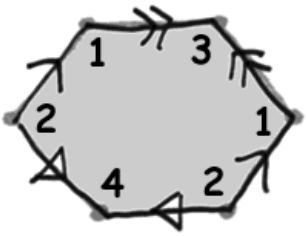


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

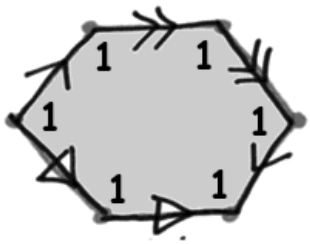
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



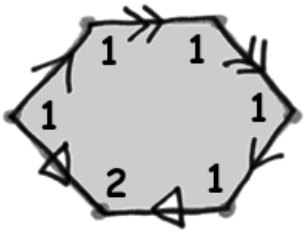
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



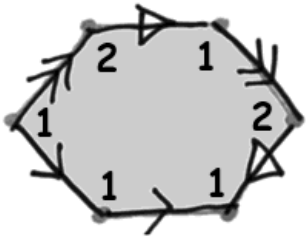
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



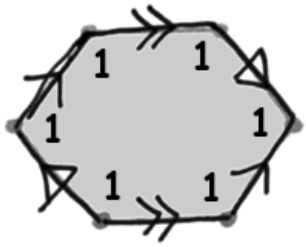
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



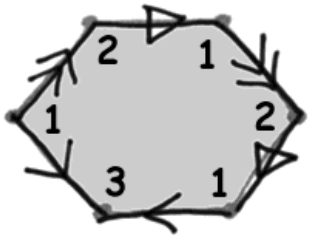
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



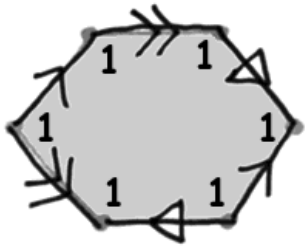
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

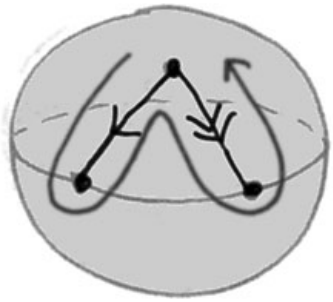
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

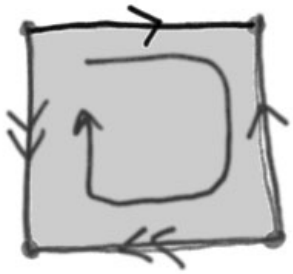
First Exam IM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

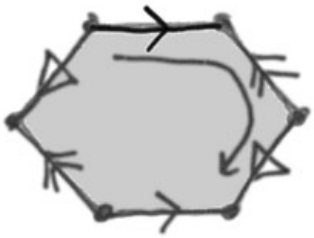
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





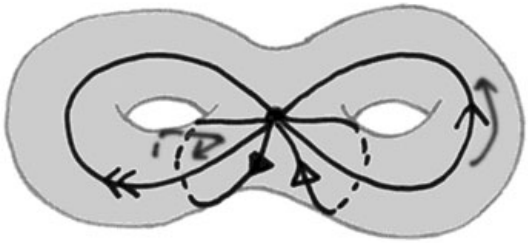
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

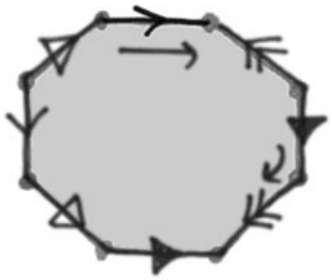
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

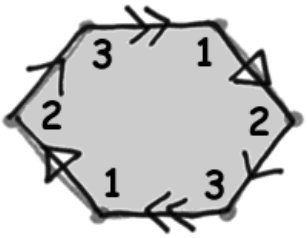
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



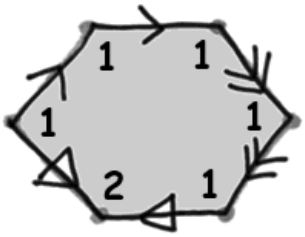


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

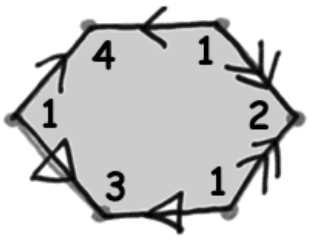
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



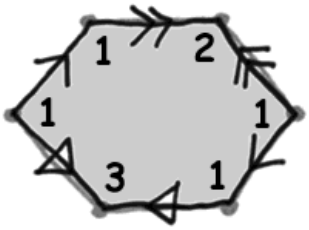
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



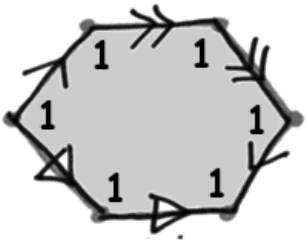
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



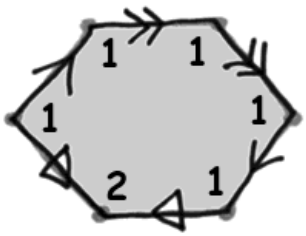
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



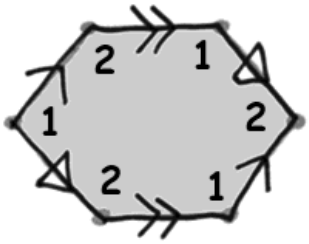
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



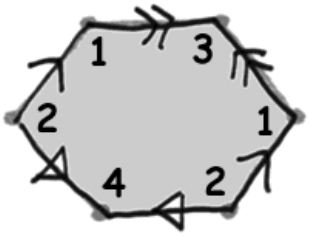
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

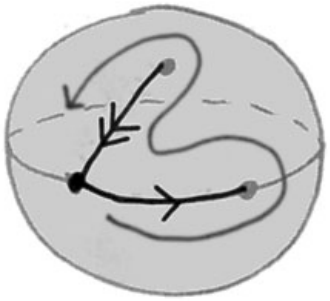
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

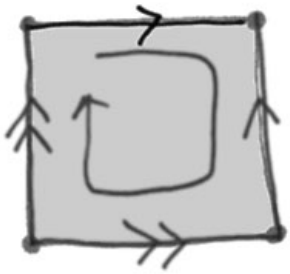
First Exam IN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

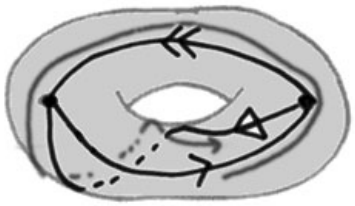
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

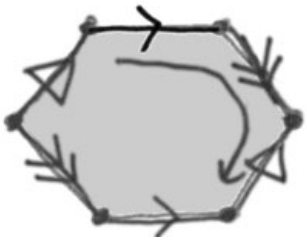




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

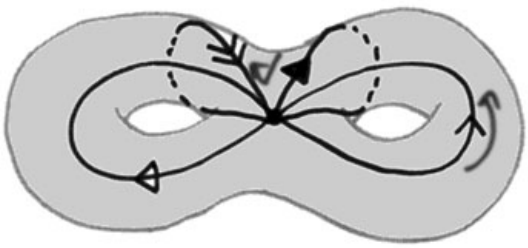
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

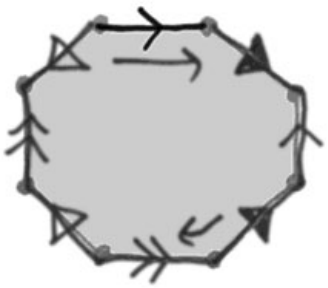




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

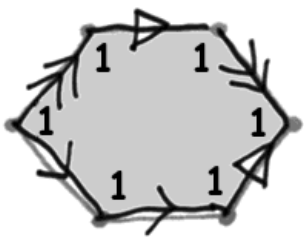
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



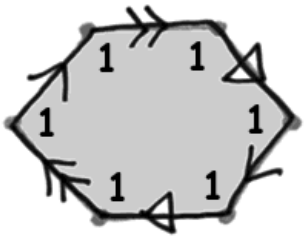


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

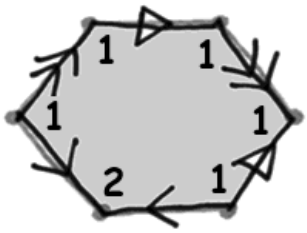
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



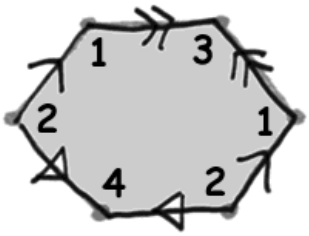
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



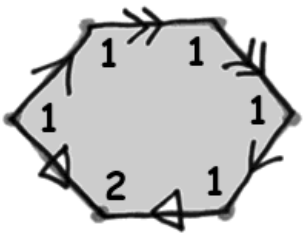
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



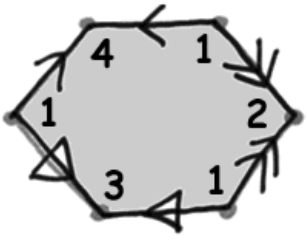
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



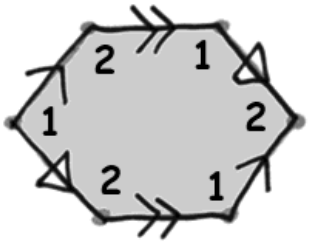
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



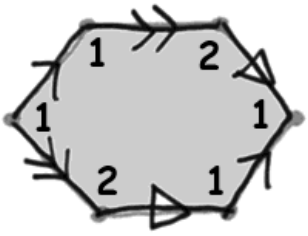
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

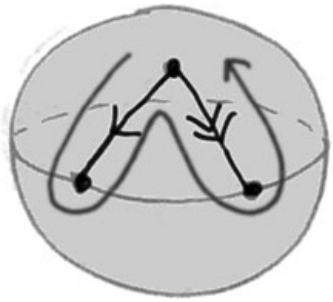
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

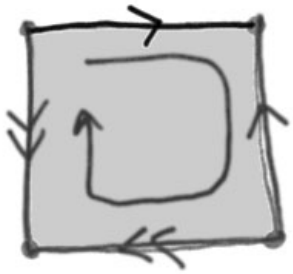
First Exam JA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

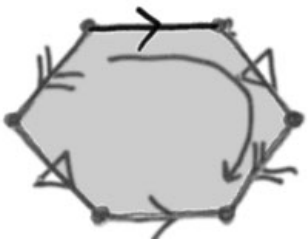
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





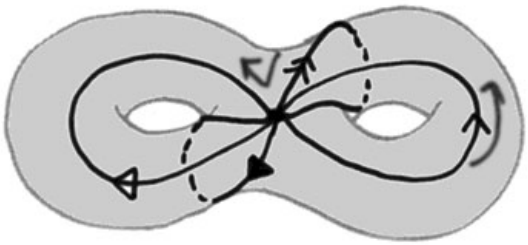
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

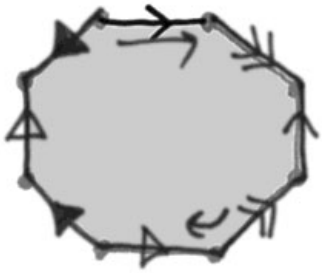
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

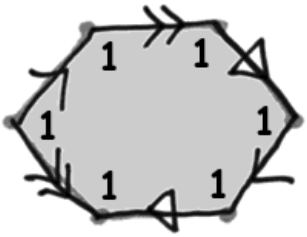
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



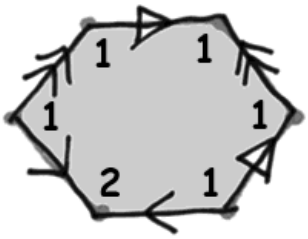


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

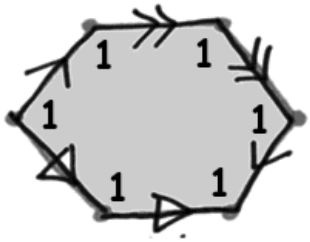
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



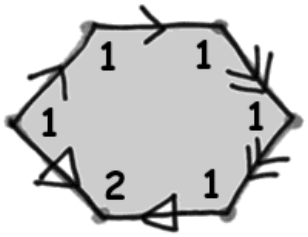
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



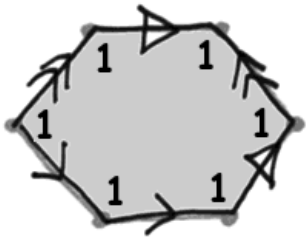
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



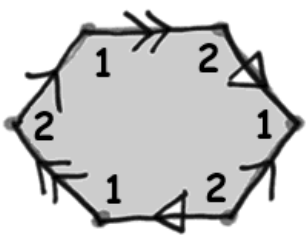
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



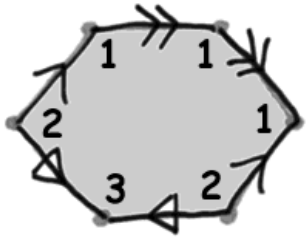
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



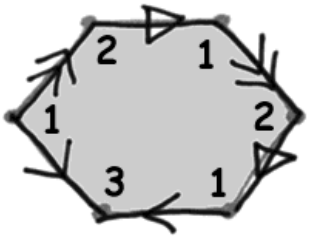
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

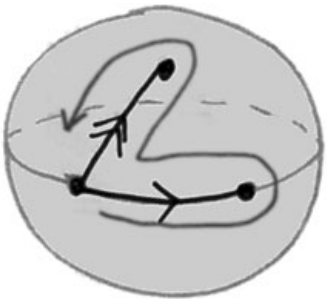
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

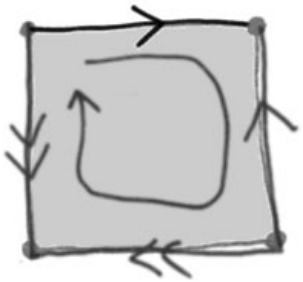
First Exam JB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

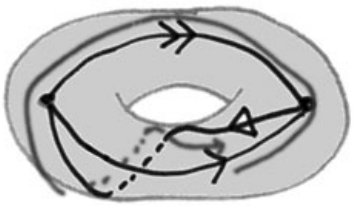
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

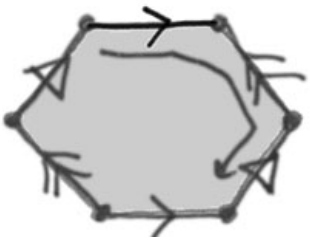




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

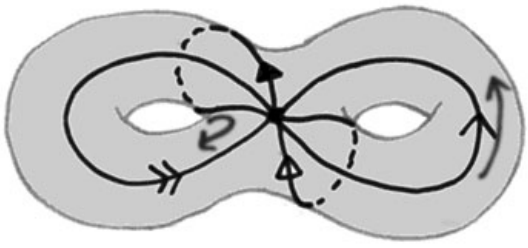
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

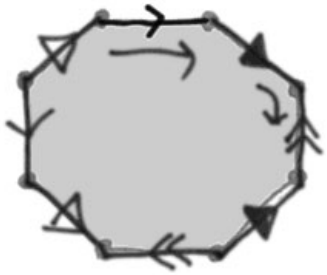




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

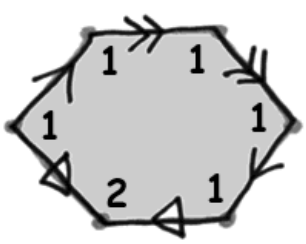
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



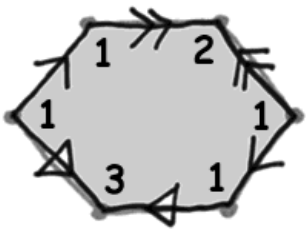


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

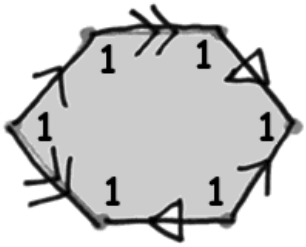
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



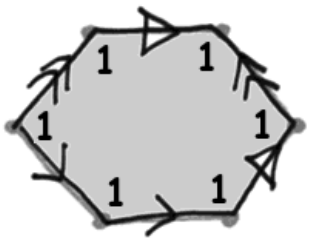
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



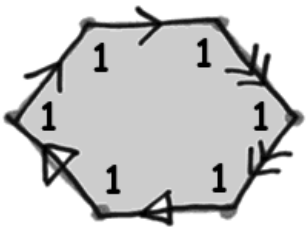
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



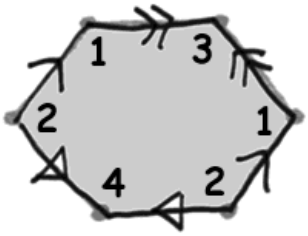
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



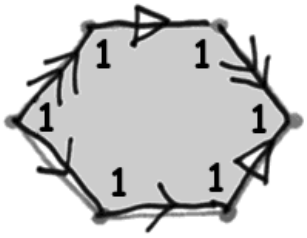
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



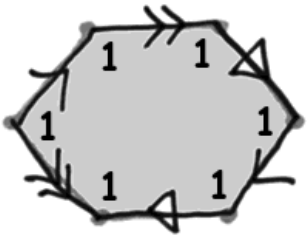
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

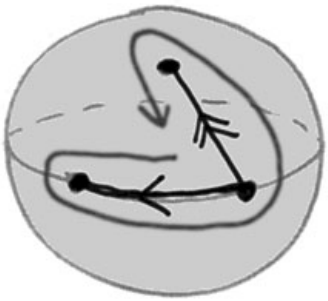
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

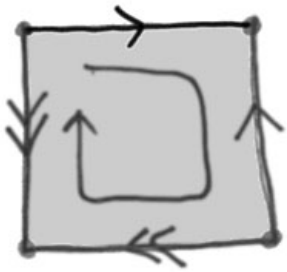
First Exam JC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

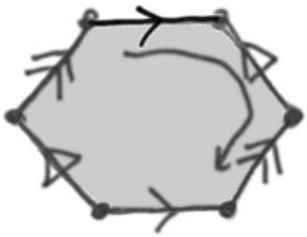
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





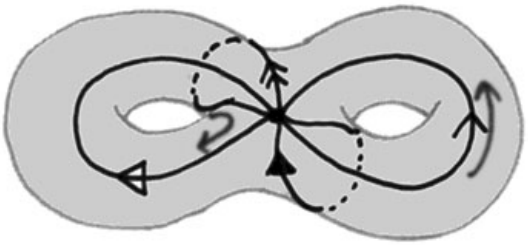
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

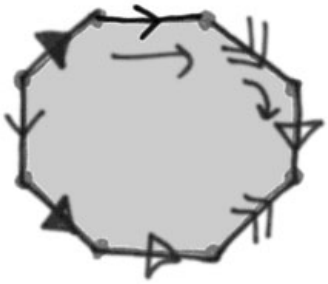
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

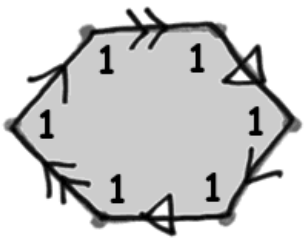
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



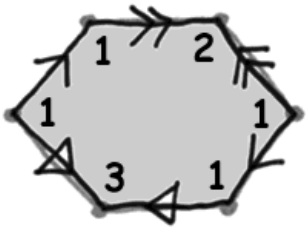


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

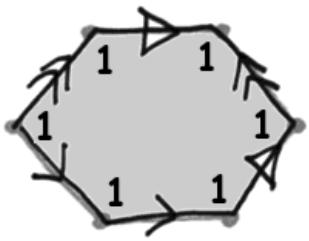
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



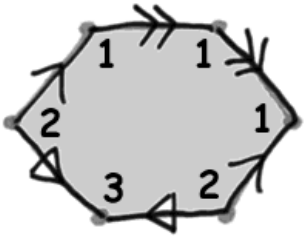
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



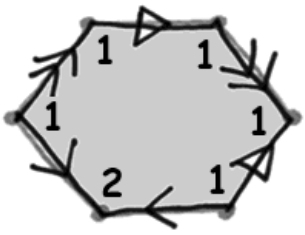
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



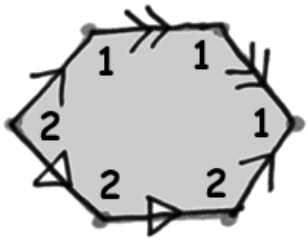
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



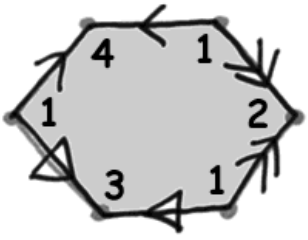
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



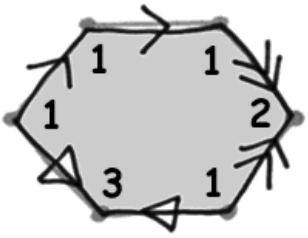
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

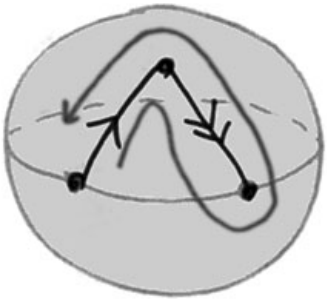
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

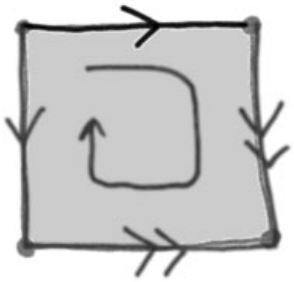
First Exam JD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



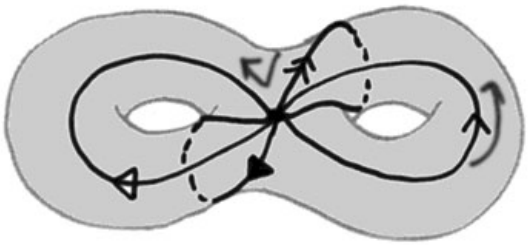


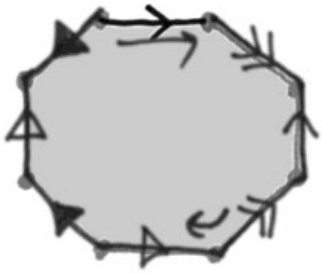
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

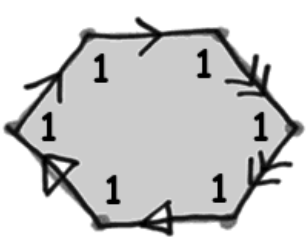
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



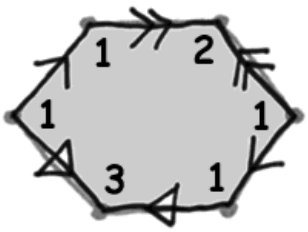


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

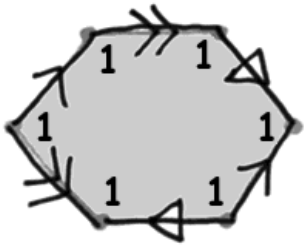
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



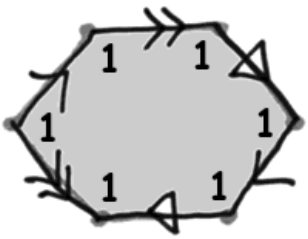
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



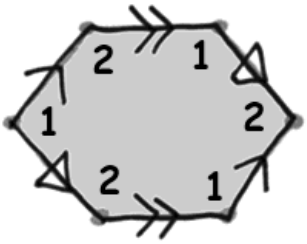
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



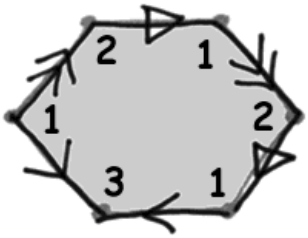
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



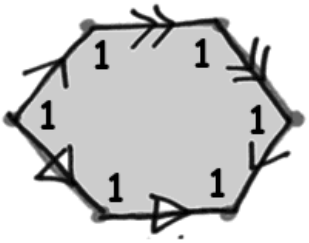
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



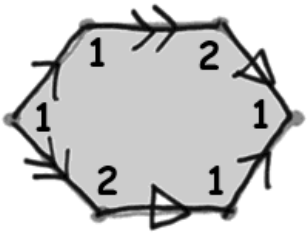
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

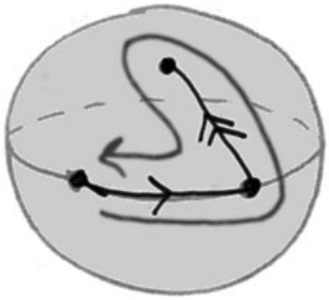
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

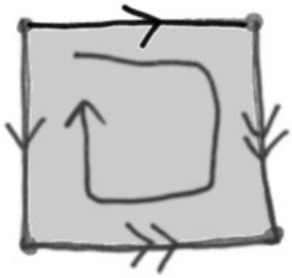
First Exam JE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

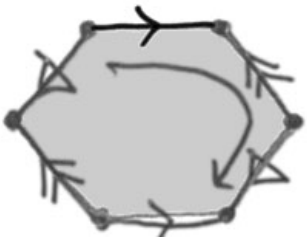
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





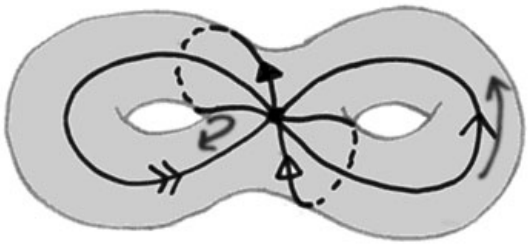
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

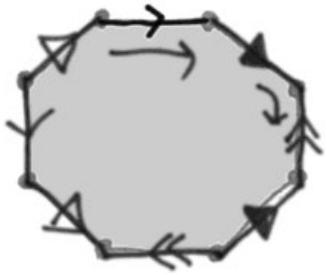
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

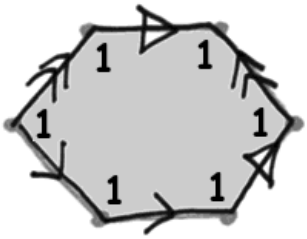
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



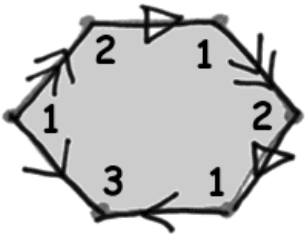


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

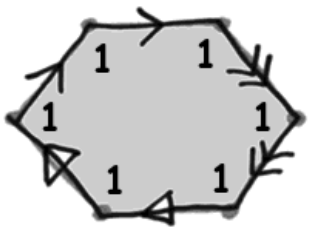
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



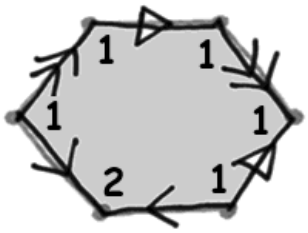
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



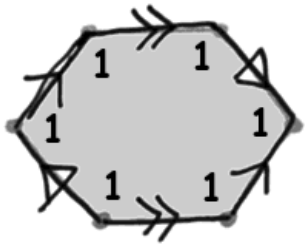
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



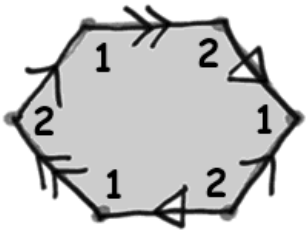
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



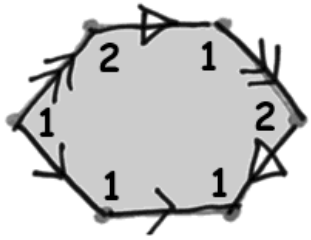
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



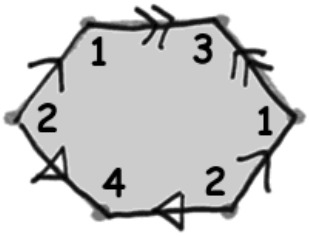
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

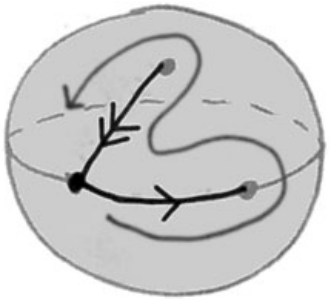
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

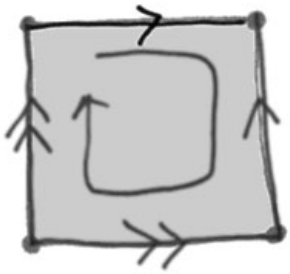
First Exam JF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

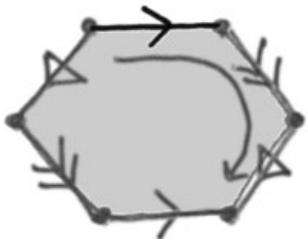
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





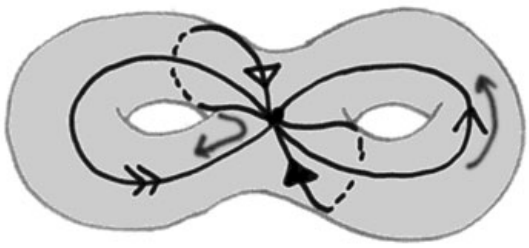
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

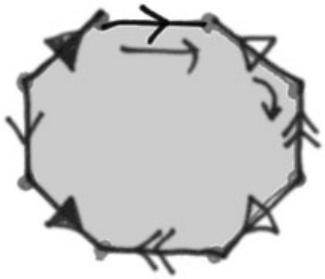
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

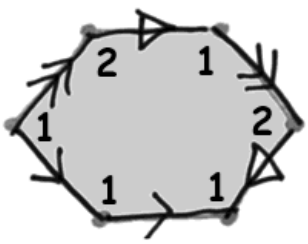
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



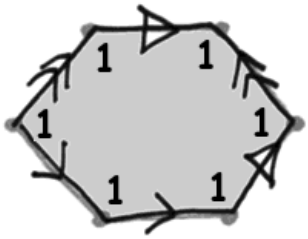


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

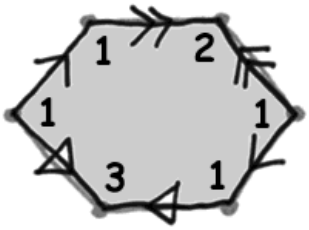
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



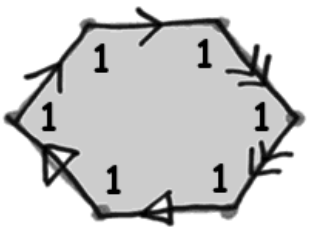
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



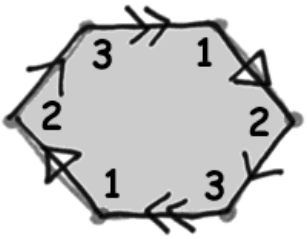
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



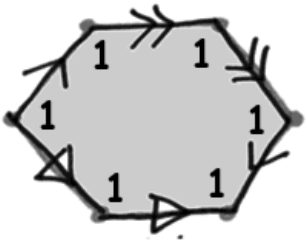
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



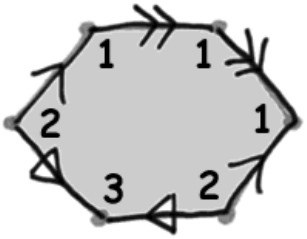
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



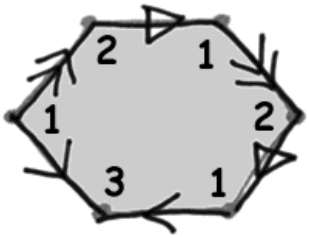
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

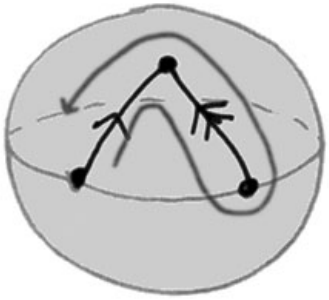
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

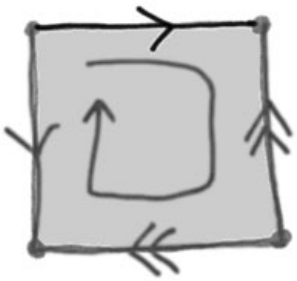
First Exam JG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

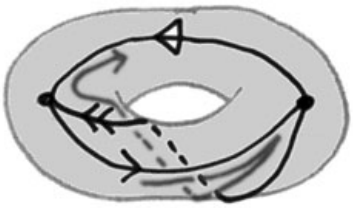
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

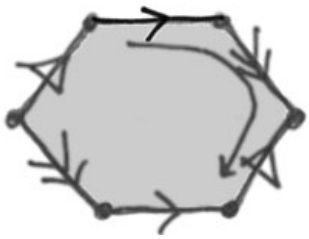




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

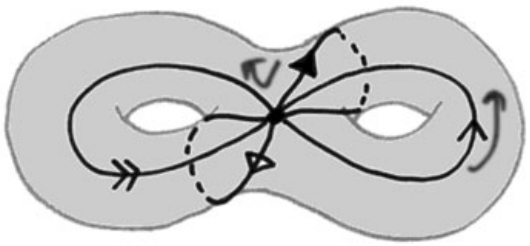
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

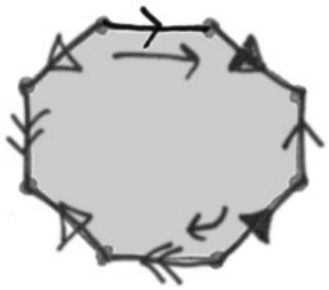




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

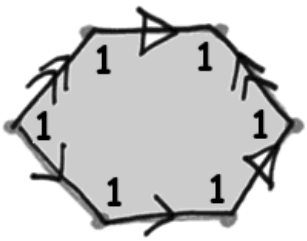
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



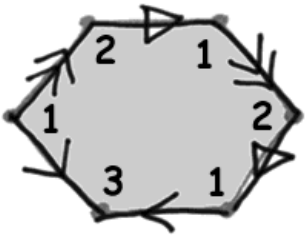


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

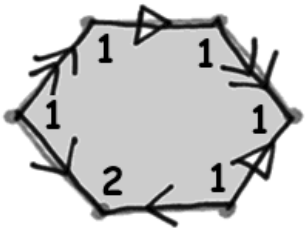
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



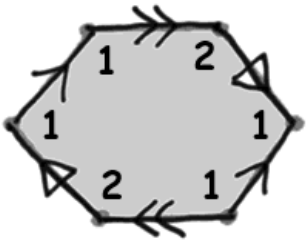
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



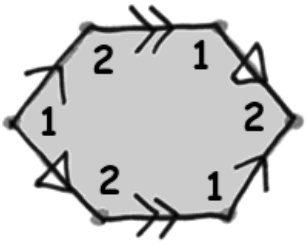
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



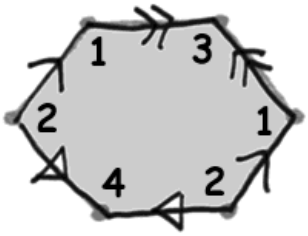
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



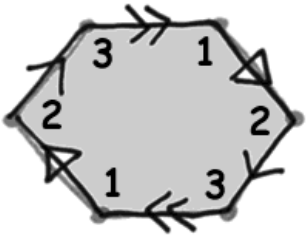
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



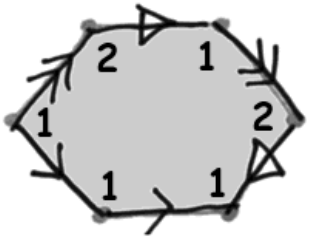
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

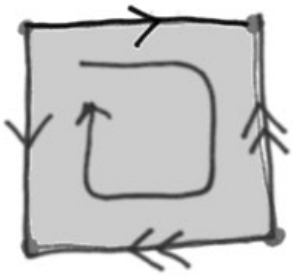
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam JH

Surfaces and Knots, Dave Bayer, February 21, 2002

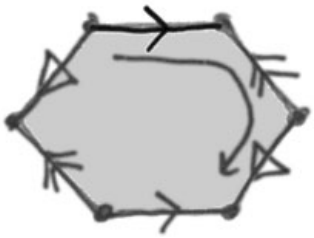
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



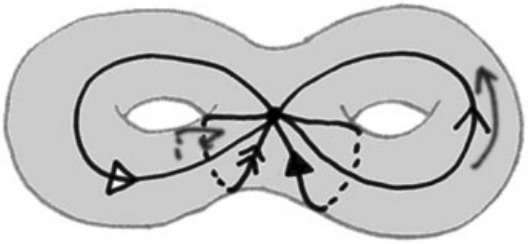
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

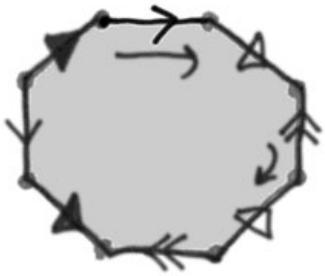
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

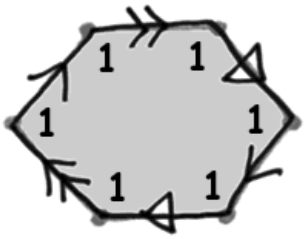
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



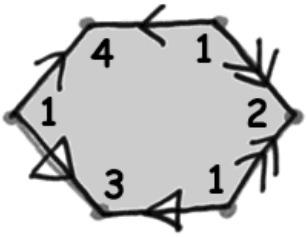


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

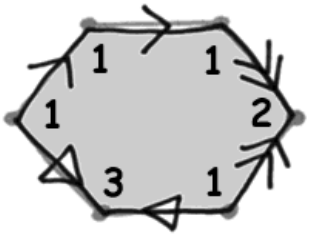
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



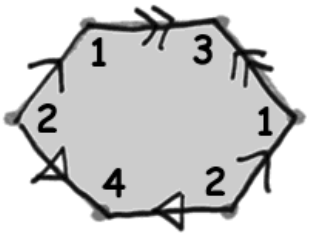
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



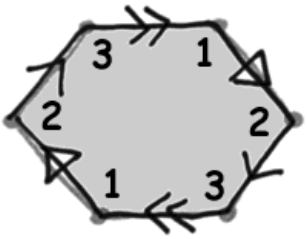
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



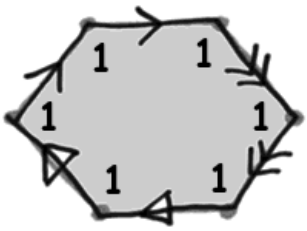
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



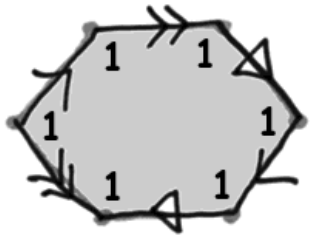
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



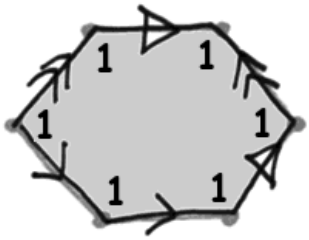
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

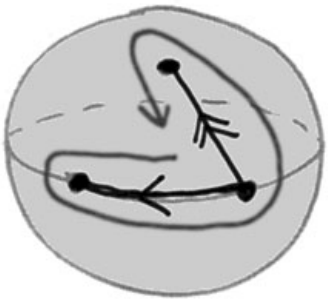
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

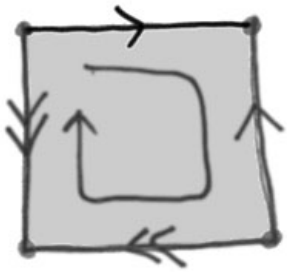
First Exam JI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

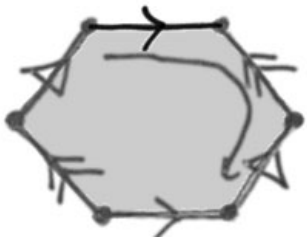
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





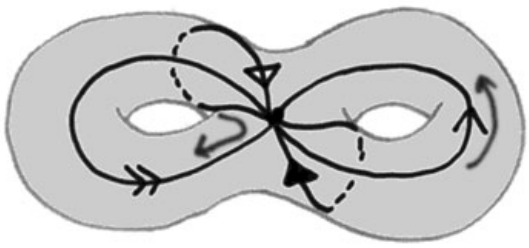
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

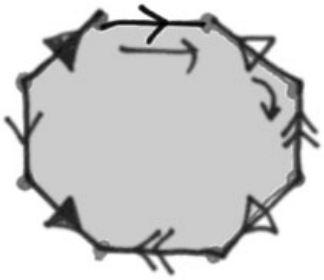
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

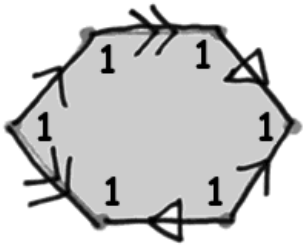
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



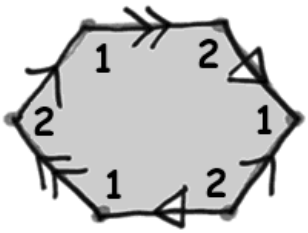


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

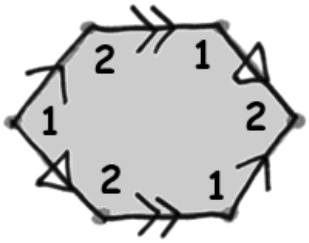
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



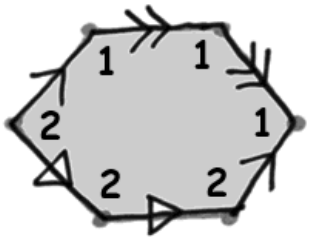
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



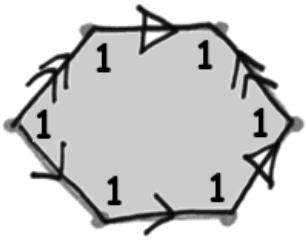
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



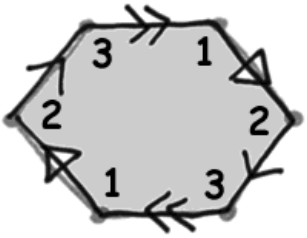
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



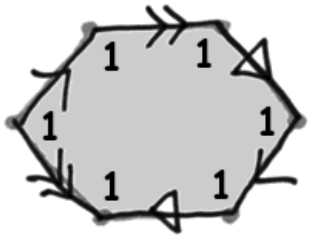
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



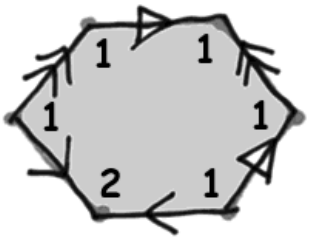
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

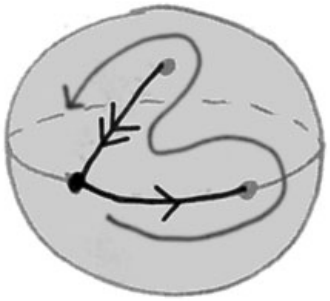
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

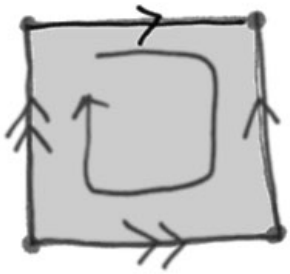
First Exam JJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

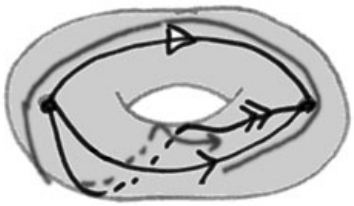
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

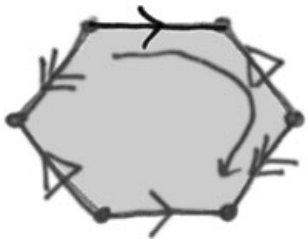




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

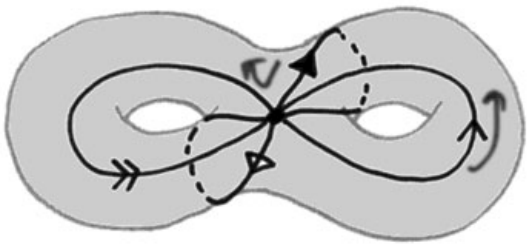
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

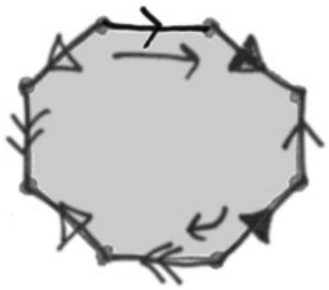




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

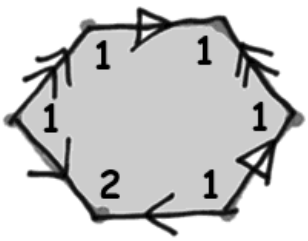
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



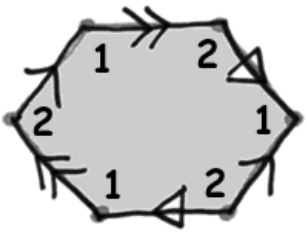


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

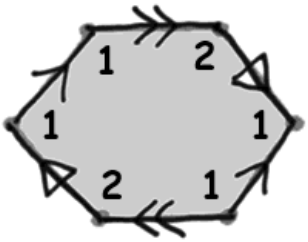
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



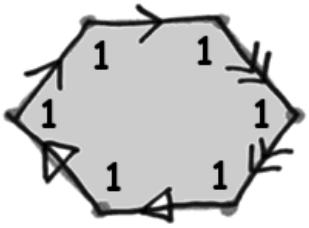
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



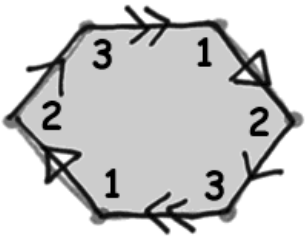
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



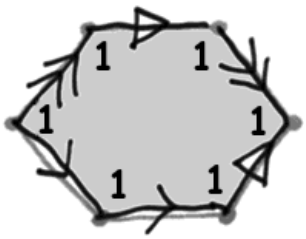
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



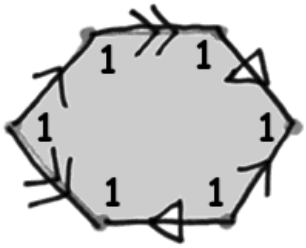
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



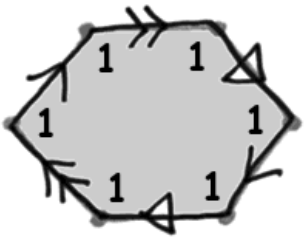
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

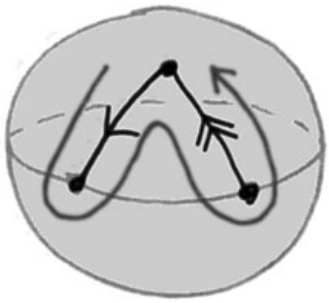
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

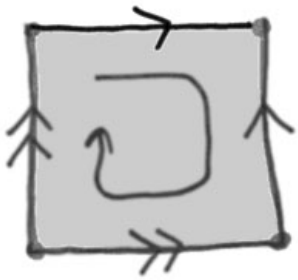
First Exam JK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

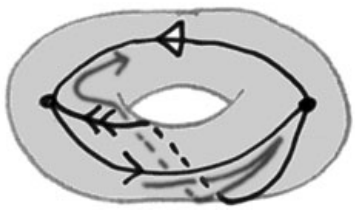
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

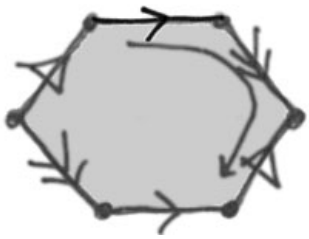




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

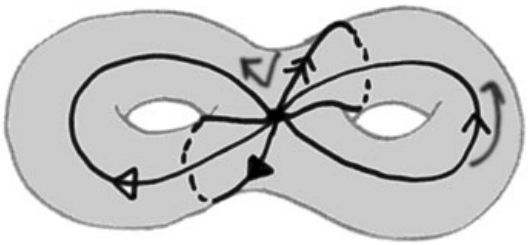
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

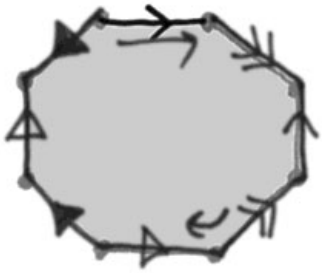




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

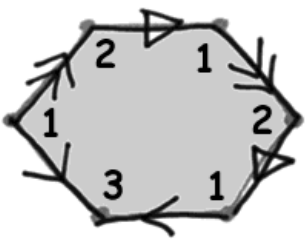
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



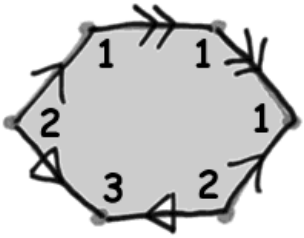


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

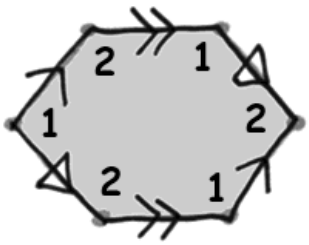
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



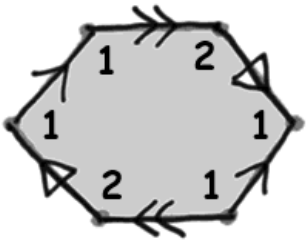
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



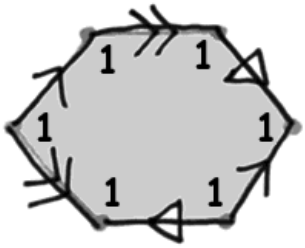
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



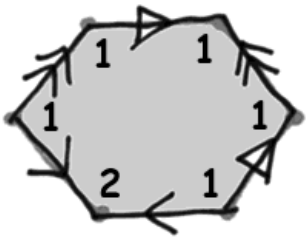
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



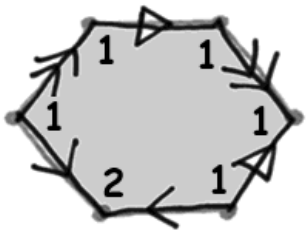
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



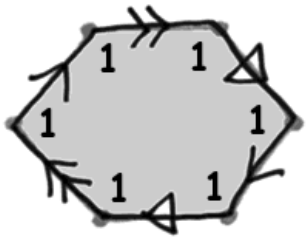
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

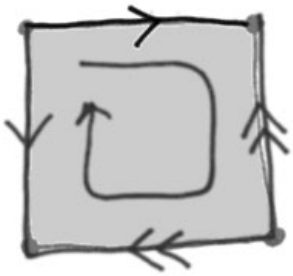
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam JL

Surfaces and Knots, Dave Bayer, February 21, 2002

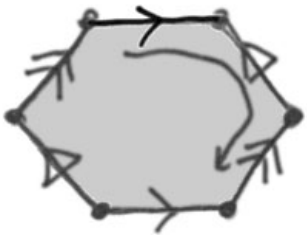
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



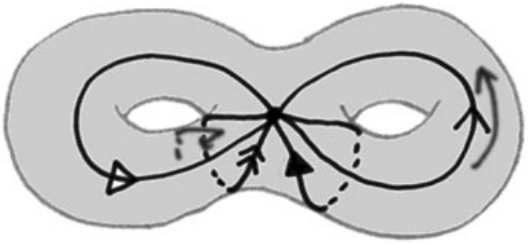
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

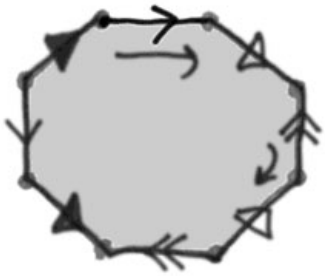
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

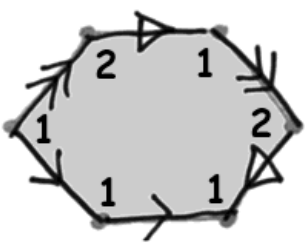
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



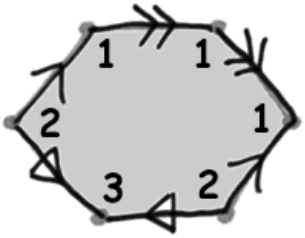


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

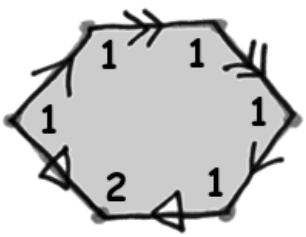
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



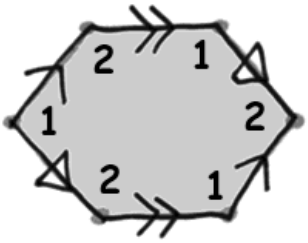
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



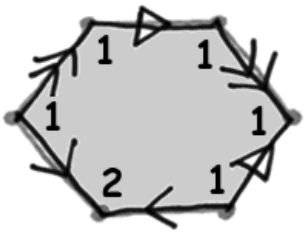
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



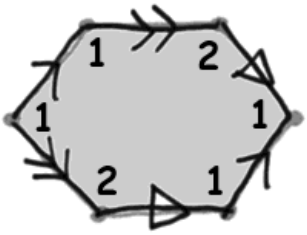
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



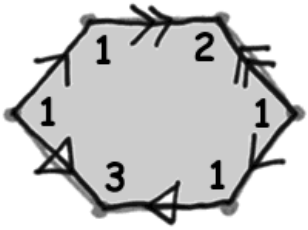
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



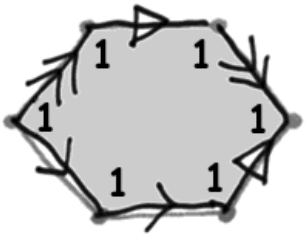
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

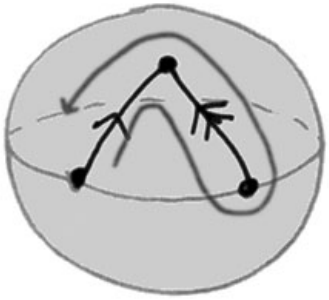
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

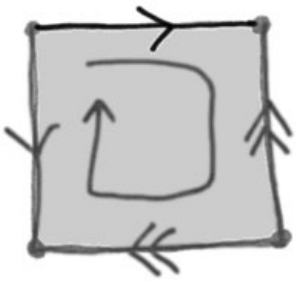
First Exam JM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



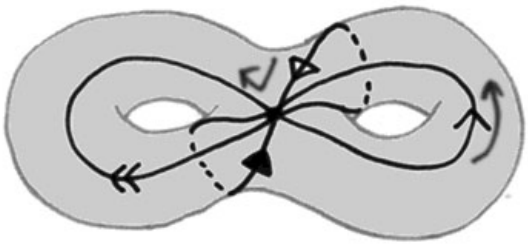


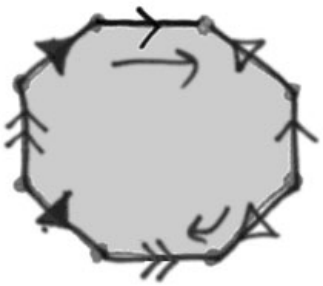
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

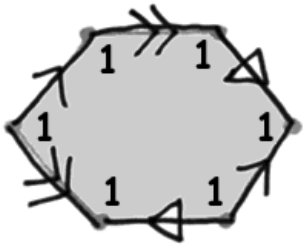
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



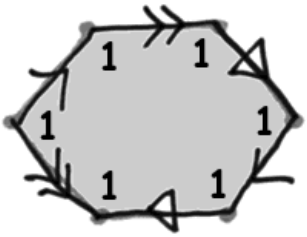


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

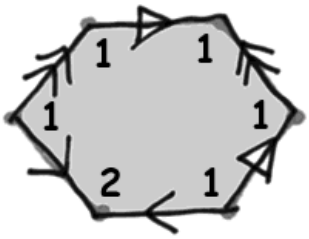
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



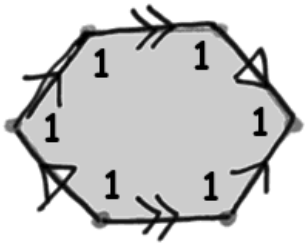
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



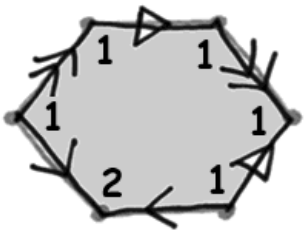
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



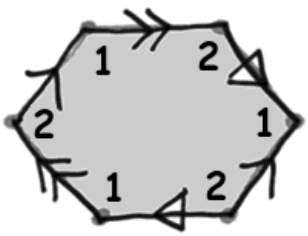
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



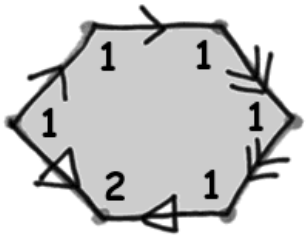
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



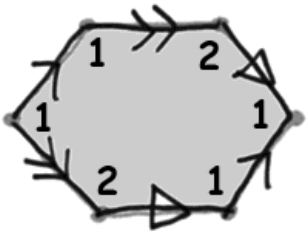
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

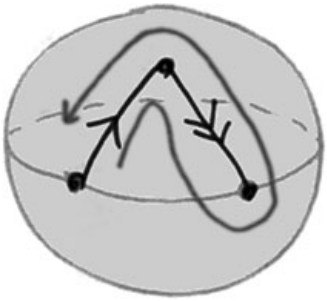
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

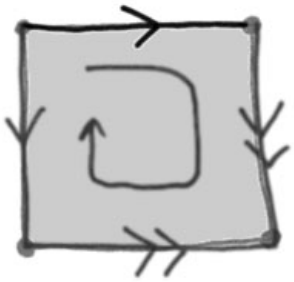
First Exam JN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

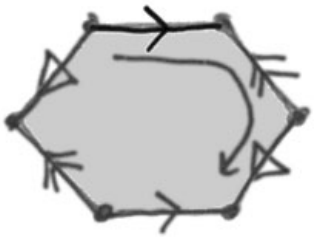
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





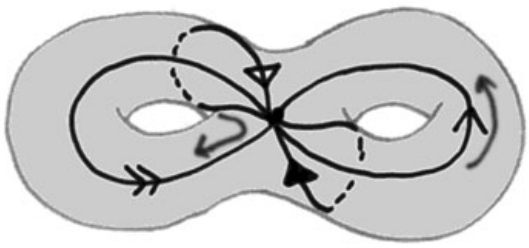
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

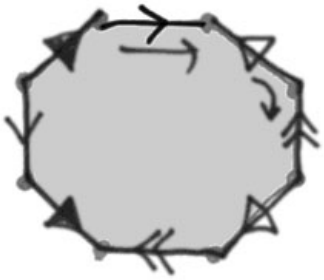
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

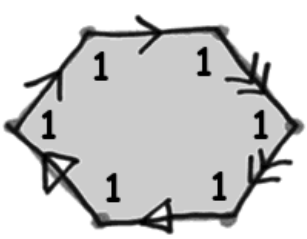
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



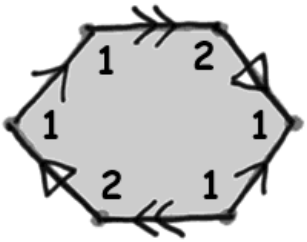


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

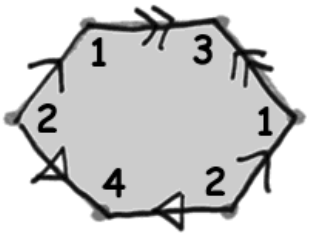
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



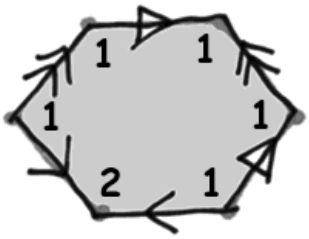
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



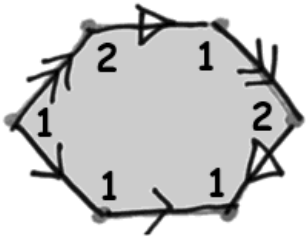
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



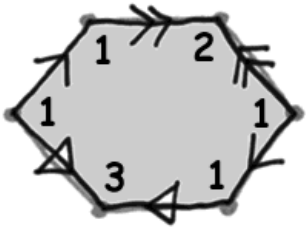
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



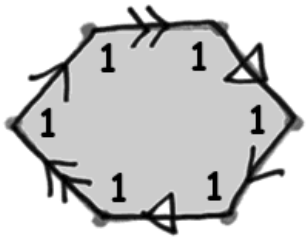
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



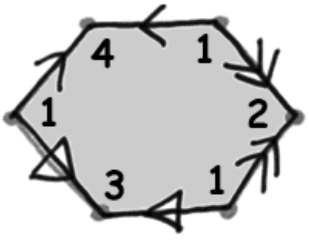
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

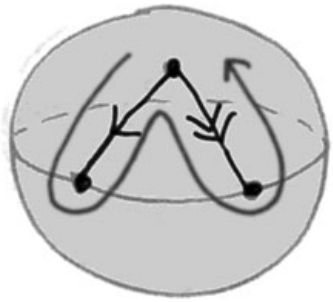
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

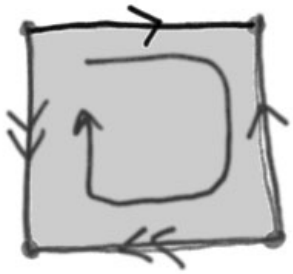
First Exam KA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



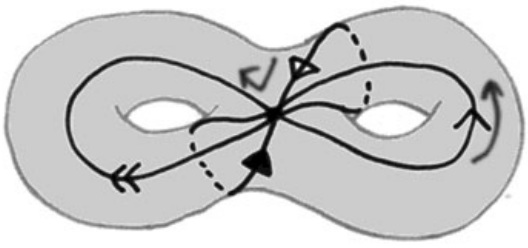


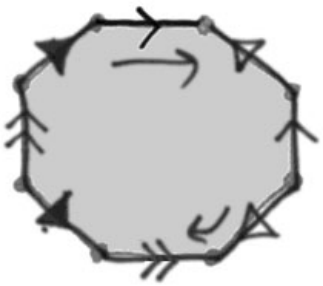
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

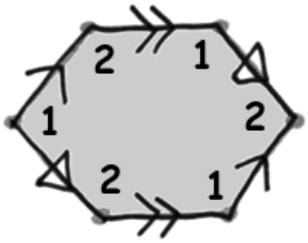
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



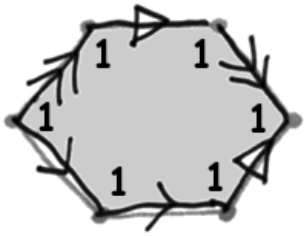


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

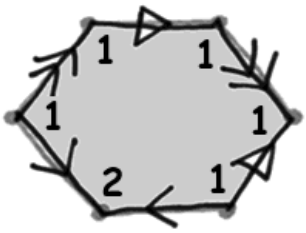
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



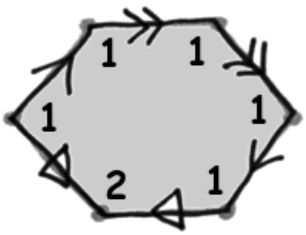
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



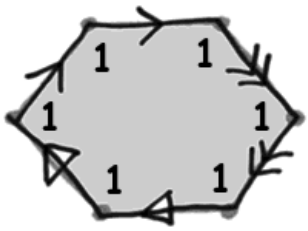
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



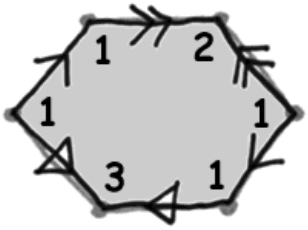
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



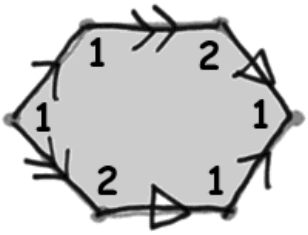
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



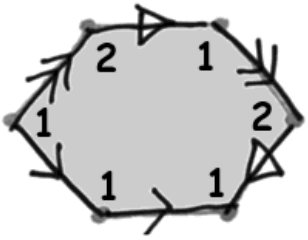
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

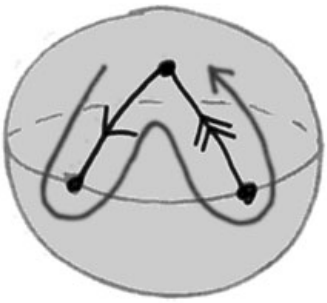
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

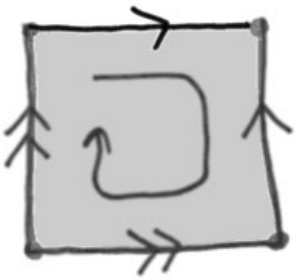
First Exam KB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

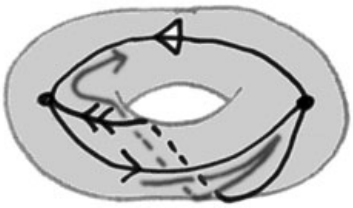
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

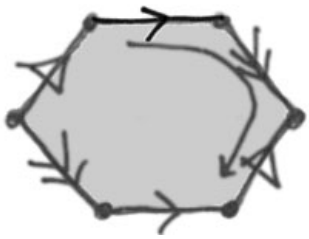




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

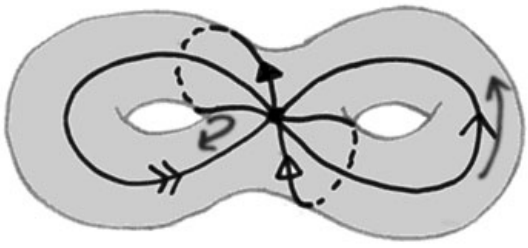
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

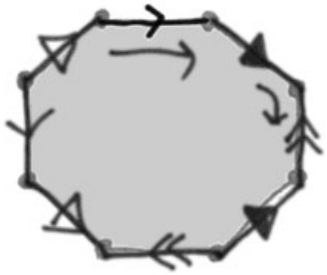




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

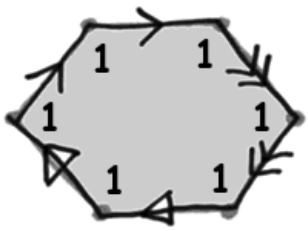
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



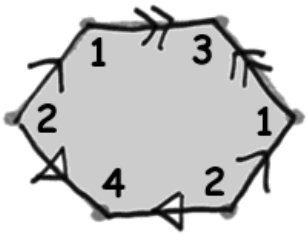


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

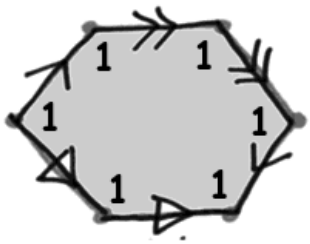
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



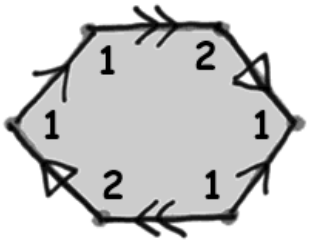
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



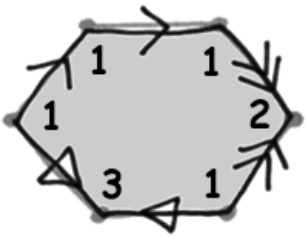
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



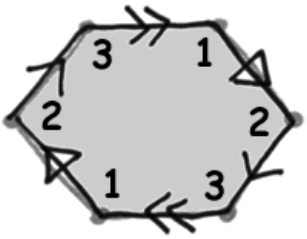
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



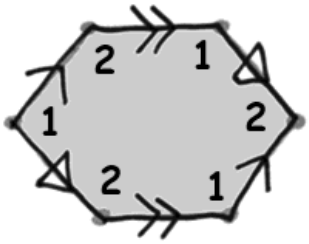
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



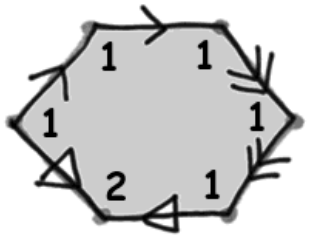
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

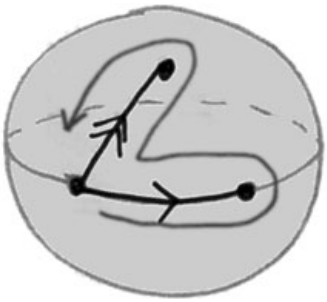
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

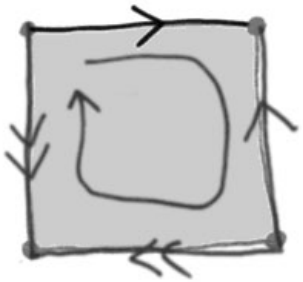
First Exam KC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



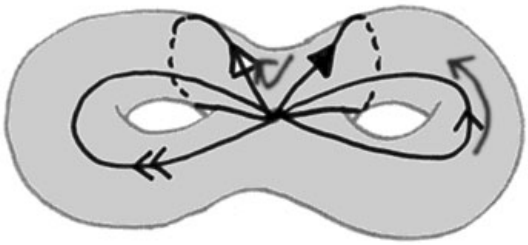


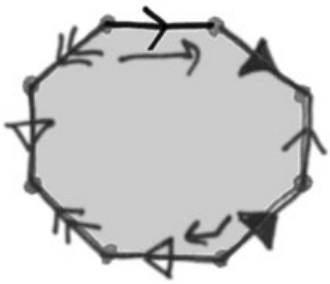
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

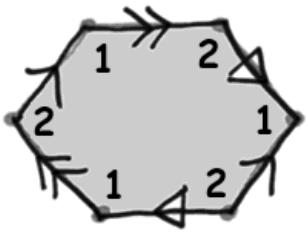
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



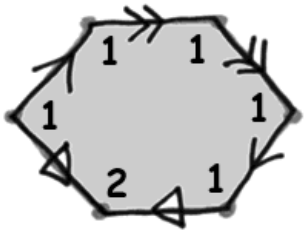


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

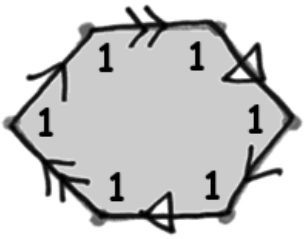
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



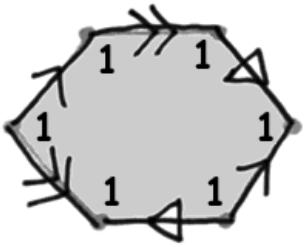
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



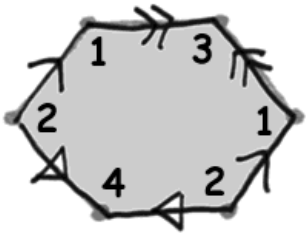
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



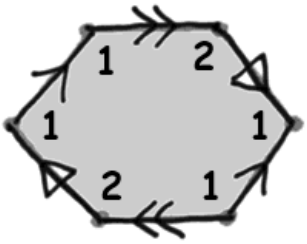
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



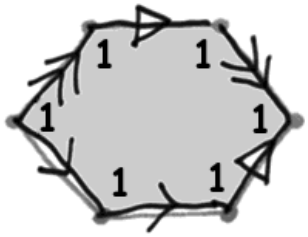
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



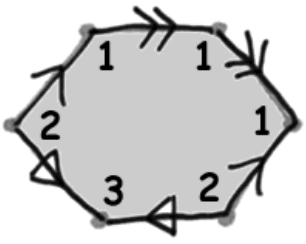
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

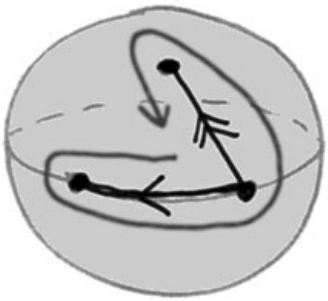
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

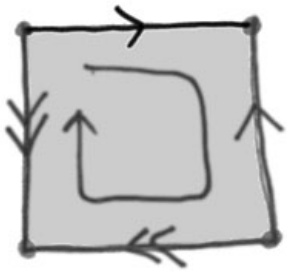
First Exam KD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

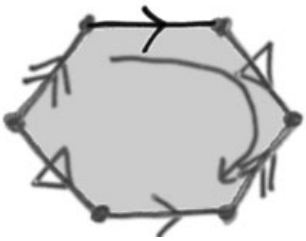
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





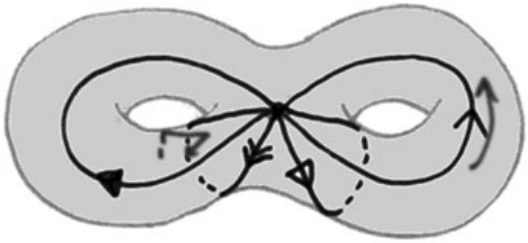
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

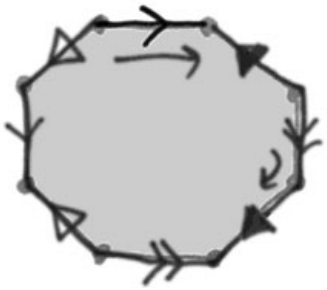
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

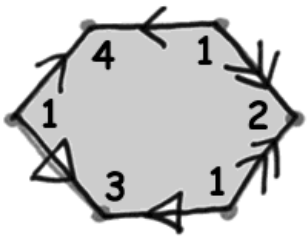
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



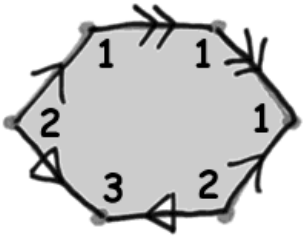


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

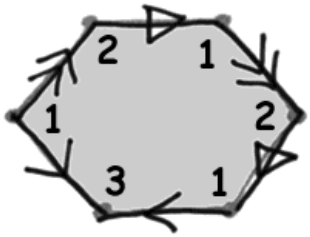
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



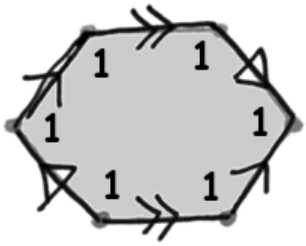
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



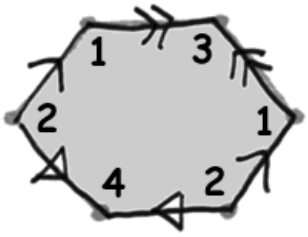
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



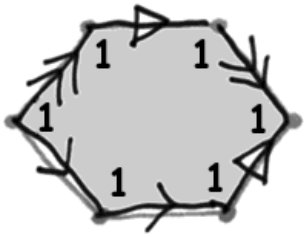
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



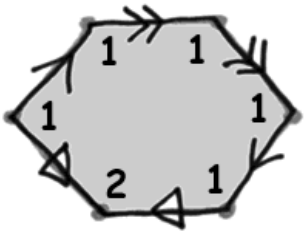
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



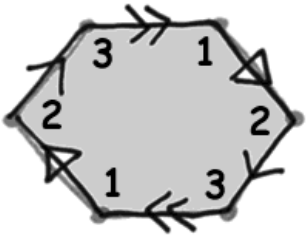
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

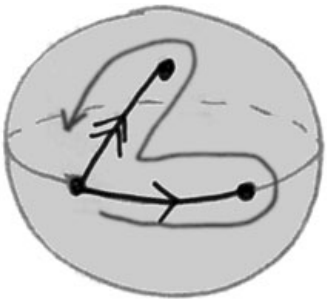
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

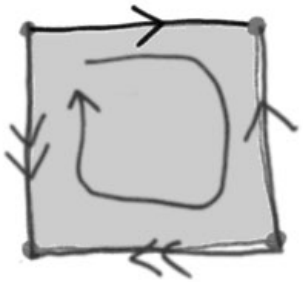
First Exam KE

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

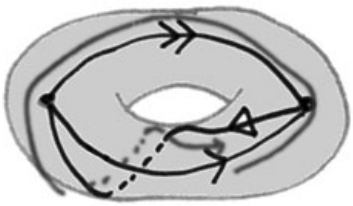
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

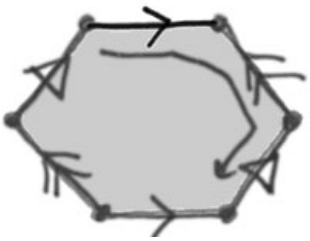




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

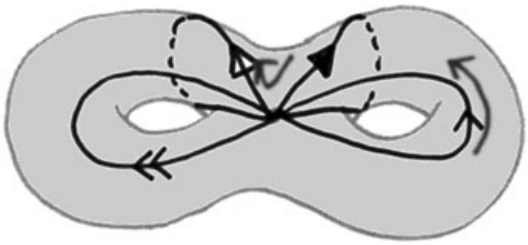
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

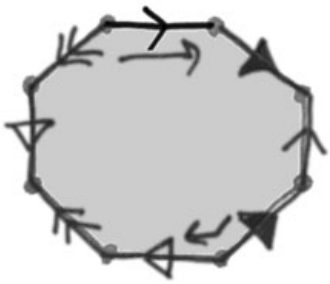




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

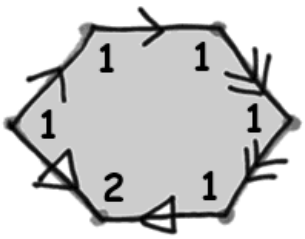
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



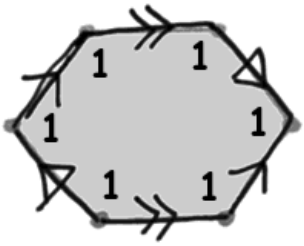


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

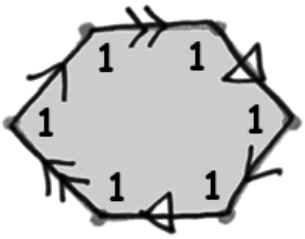
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



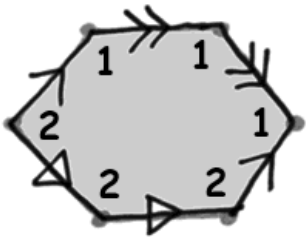
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



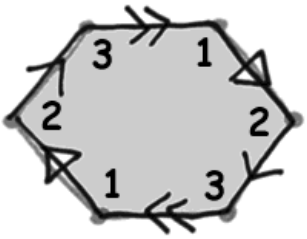
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



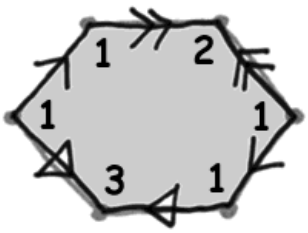
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



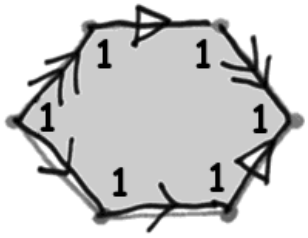
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



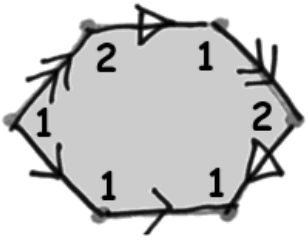
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

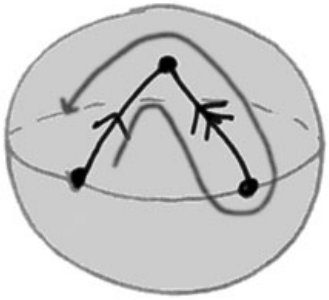
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

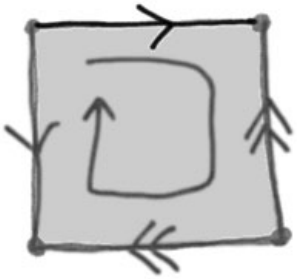
First Exam KF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

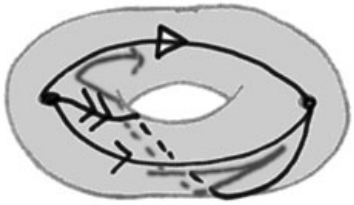
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

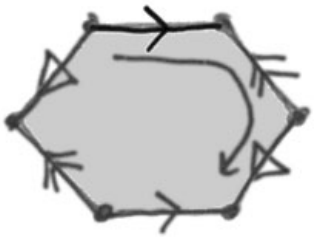




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

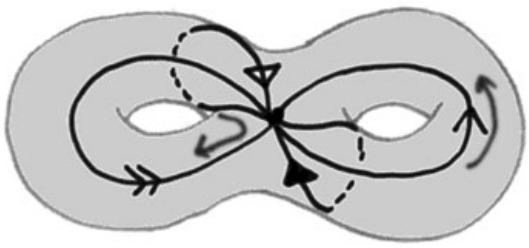
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

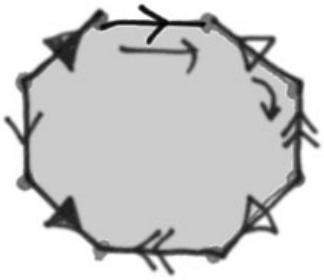




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

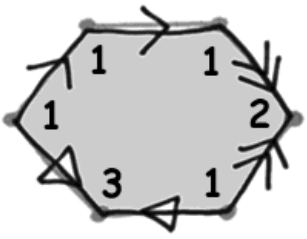
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



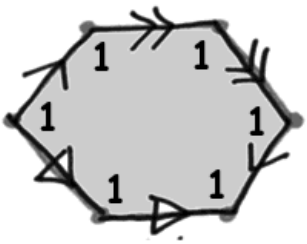


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

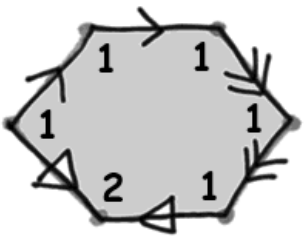
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



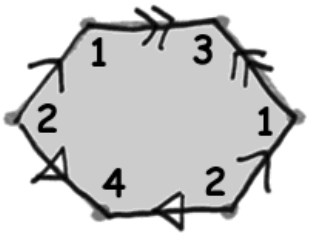
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



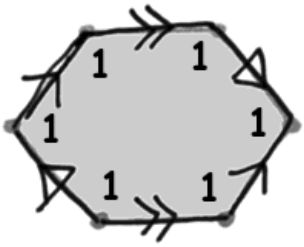
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



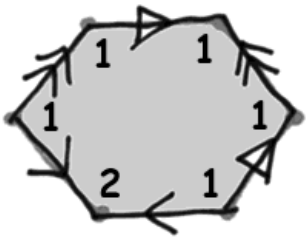
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



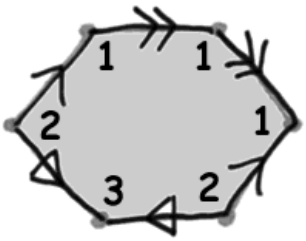
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



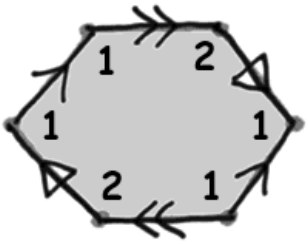
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

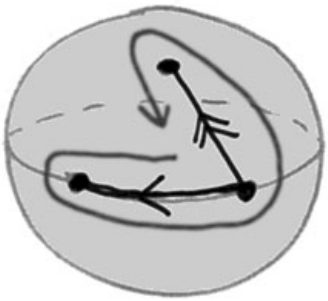
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

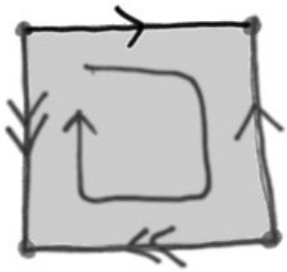
First Exam KG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

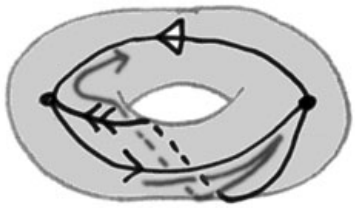
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

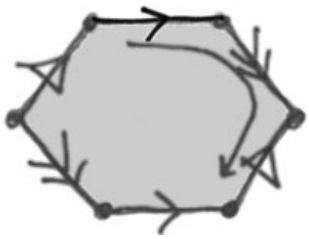




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

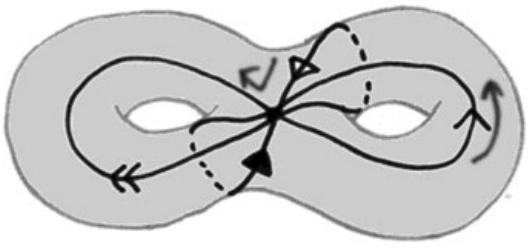
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

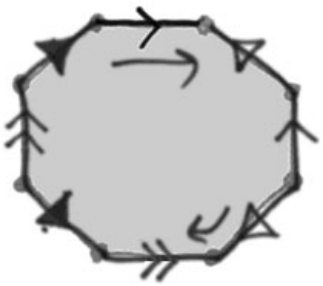




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

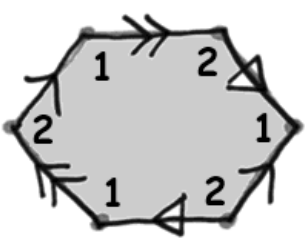
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



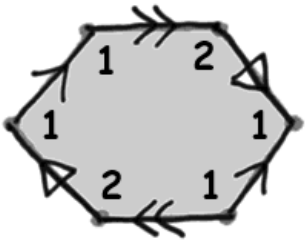


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

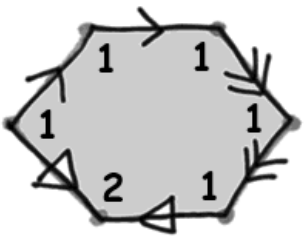
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



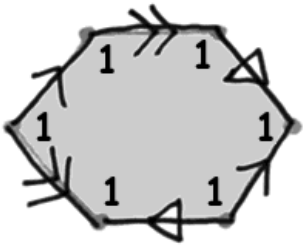
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



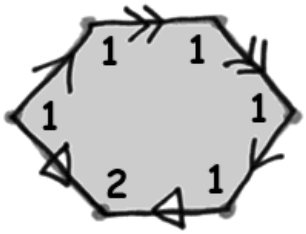
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



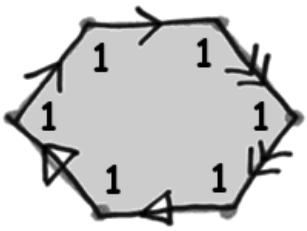
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



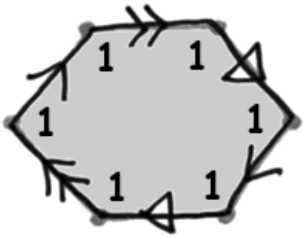
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



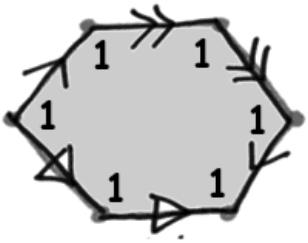
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

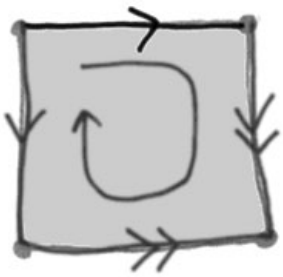
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam KH

Surfaces and Knots, Dave Bayer, February 21, 2002

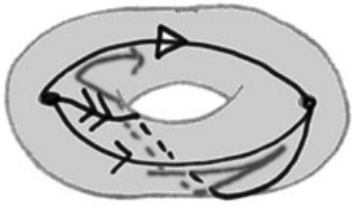
Answer Key

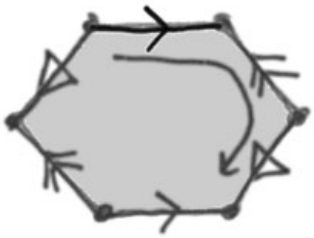
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

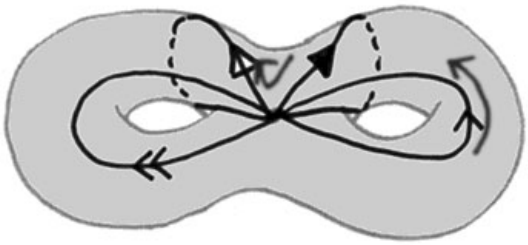
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

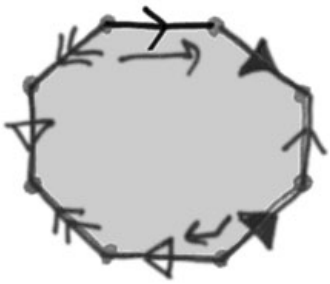




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

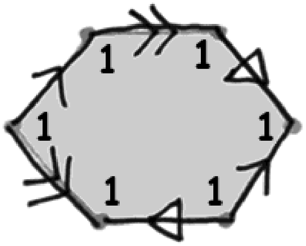
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





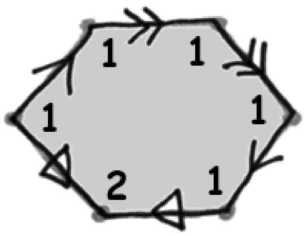
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[**4**] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



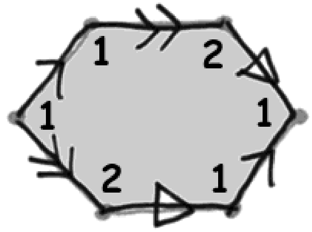
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



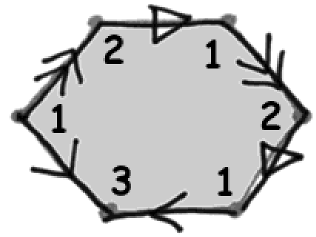
$$\begin{array}{rcr} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0 \end{array}$$

nonorientable



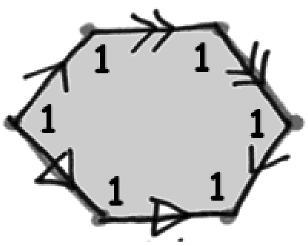
$$\begin{array}{rcr} +\,v &=& 2\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 0 \end{array}$$

orientable



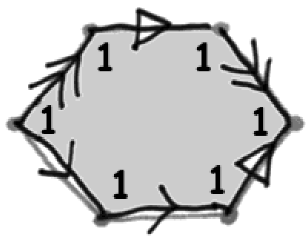
$$\begin{array}{rcr} +\,v &=& 3\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& 1 \end{array}$$

nonorientable



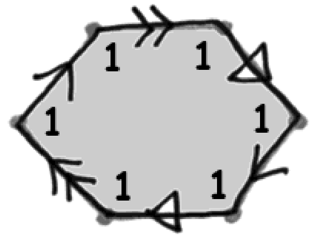
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



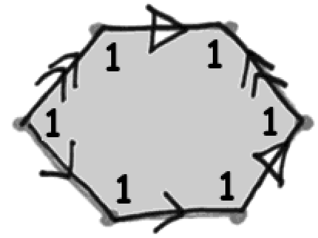
$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable



$$\begin{array}{rcr} +\,v &=& 1\\ -\,e &=& 3\\ +\,f &=& 1\\ \hline \chi &=& -1 \end{array}$$

nonorientable

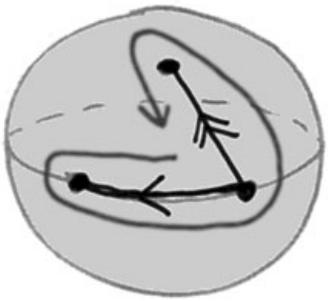
[**5**] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

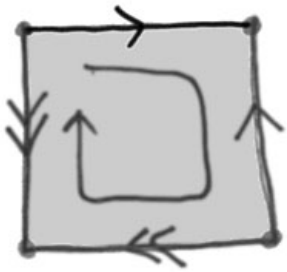
First Exam KI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

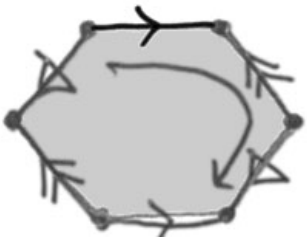
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





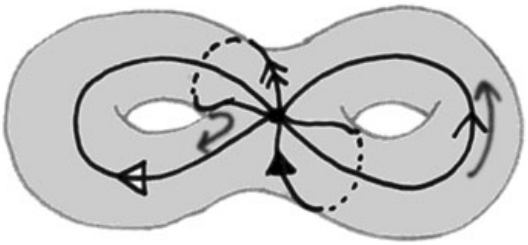
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

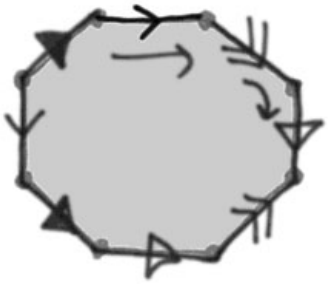
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

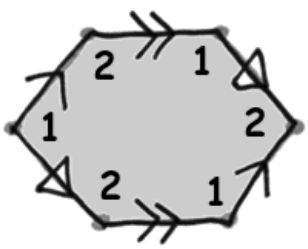
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



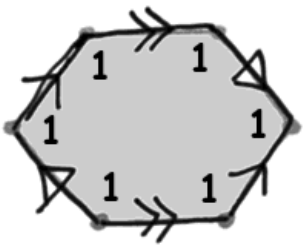


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

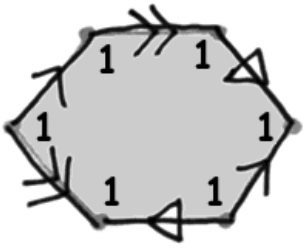
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



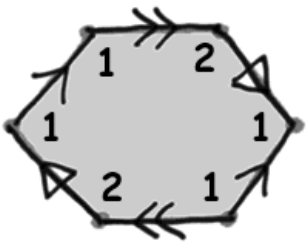
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



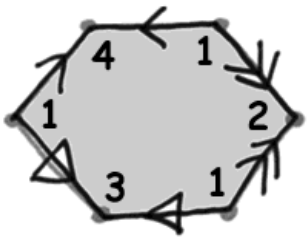
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



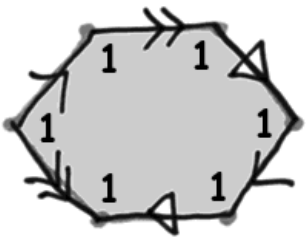
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



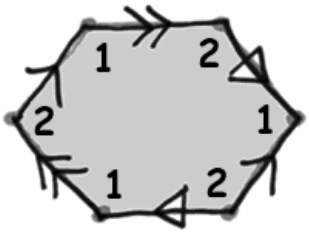
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



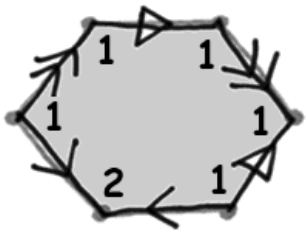
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

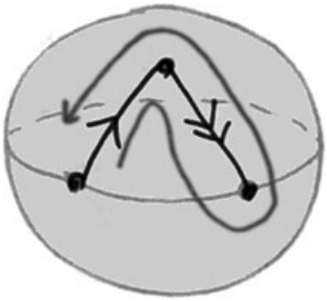
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

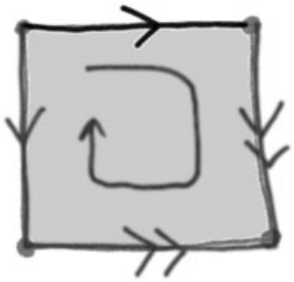
First Exam KJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

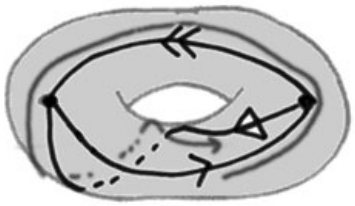
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

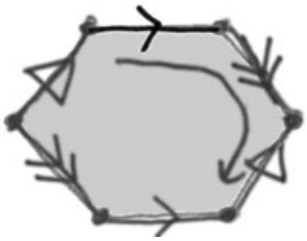




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

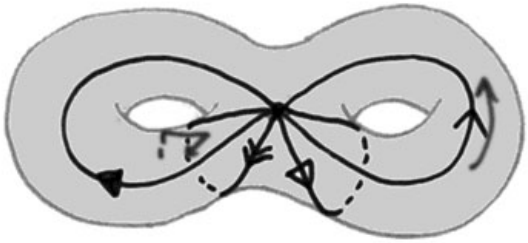
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

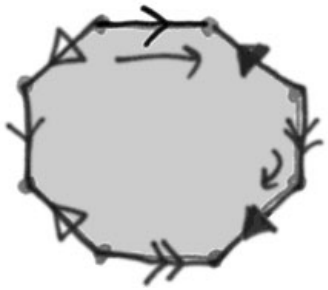




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

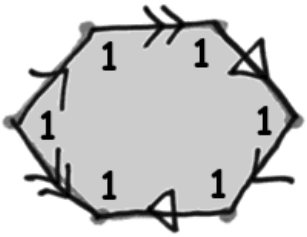
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



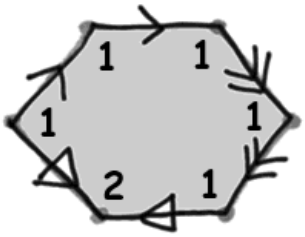


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

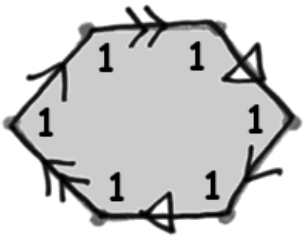
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



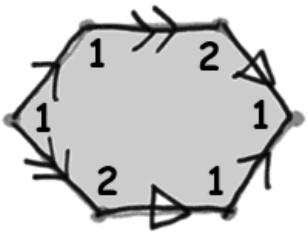
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



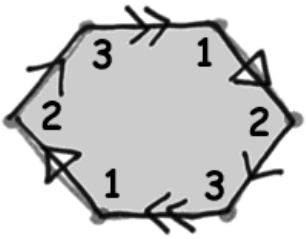
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



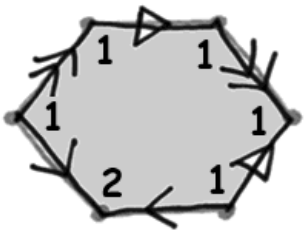
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



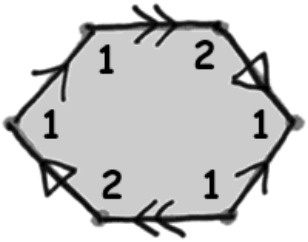
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



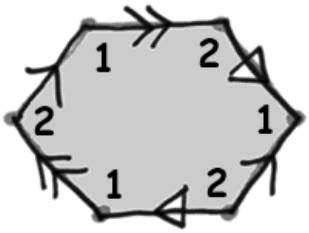
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

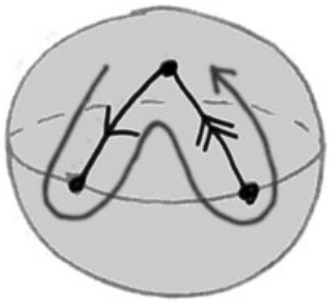
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

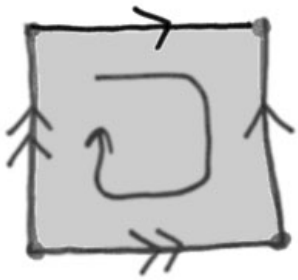
First Exam KK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

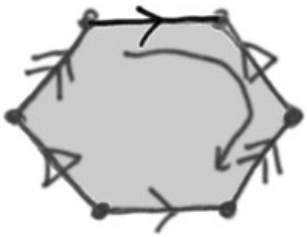
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





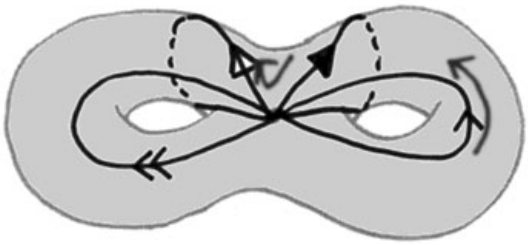
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

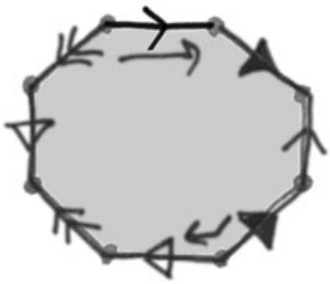
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

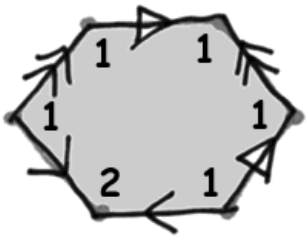
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



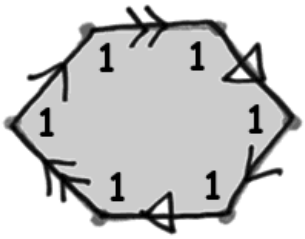


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

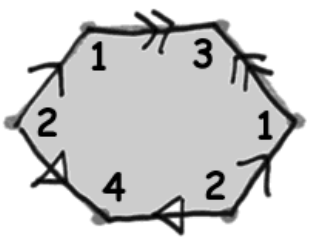
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



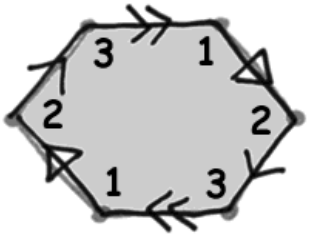
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



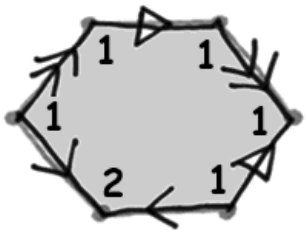
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



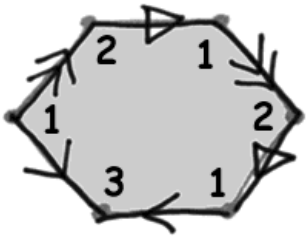
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



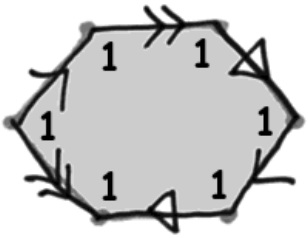
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



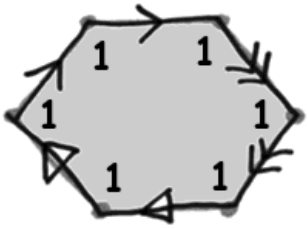
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

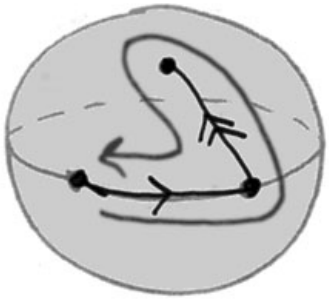
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

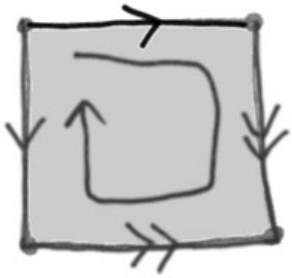
First Exam KL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

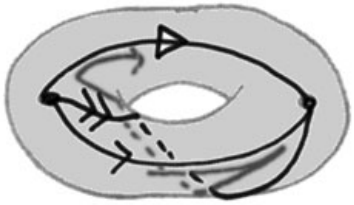
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

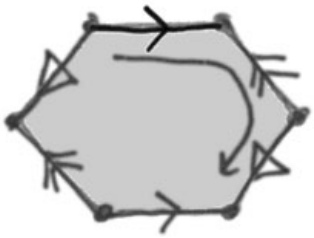




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

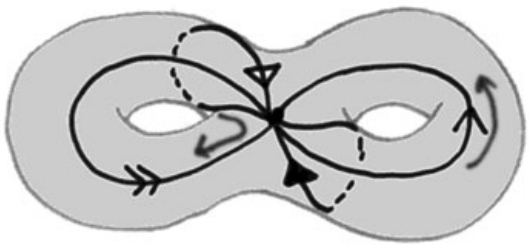
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

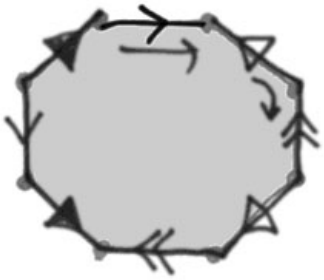




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

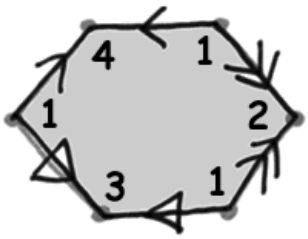
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



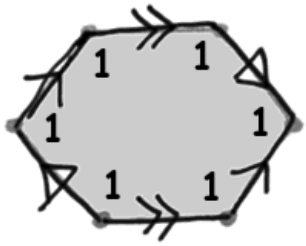


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

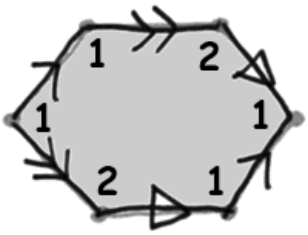
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



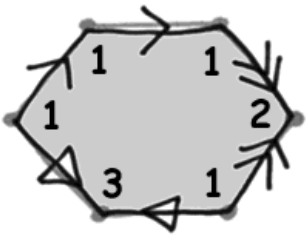
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



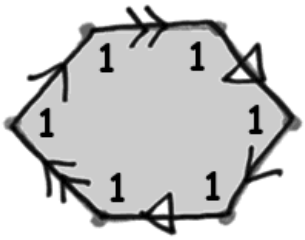
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



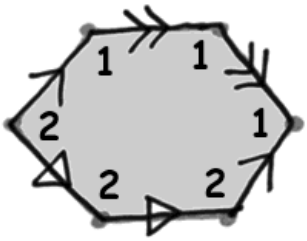
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



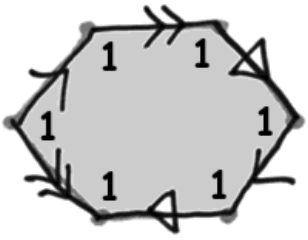
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



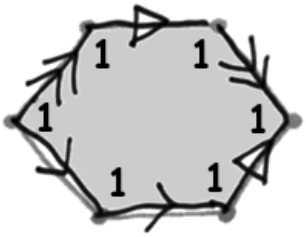
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

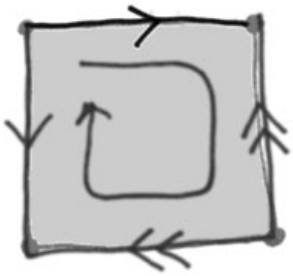
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam KM

Surfaces and Knots, Dave Bayer, February 21, 2002

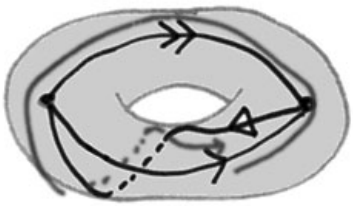
Answer Key

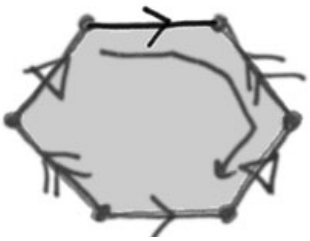
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

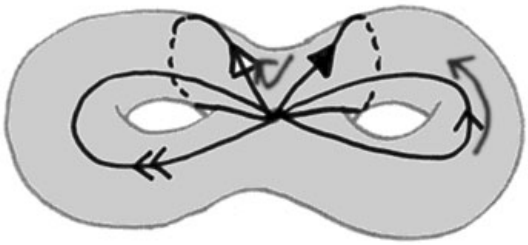
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

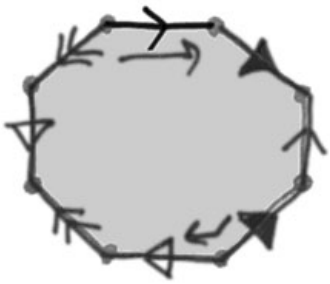




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

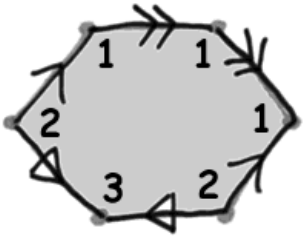
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



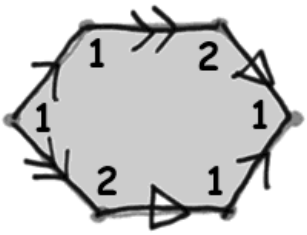


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

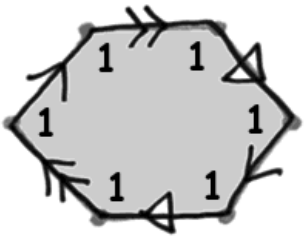
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



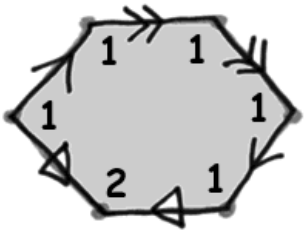
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



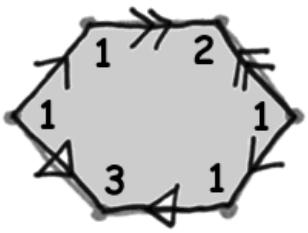
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



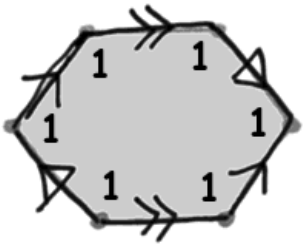
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



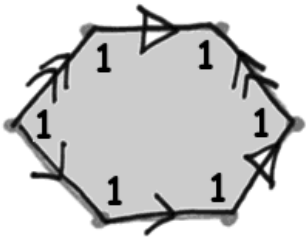
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



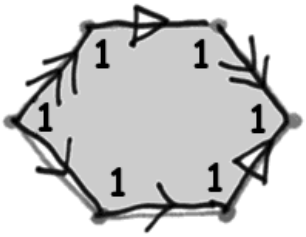
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

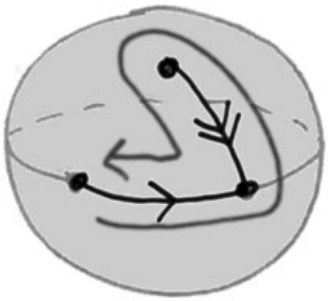
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

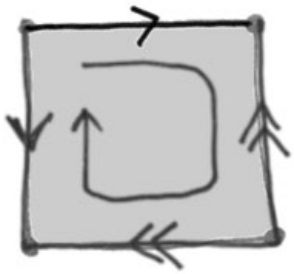
First Exam KN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



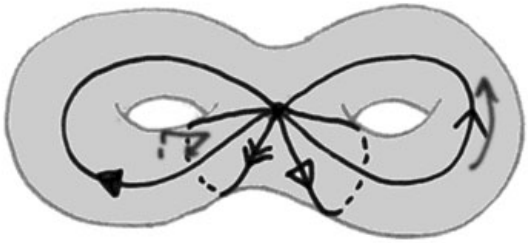


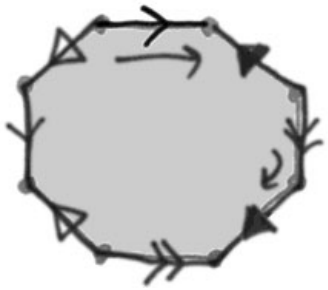
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

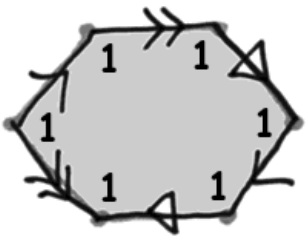
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



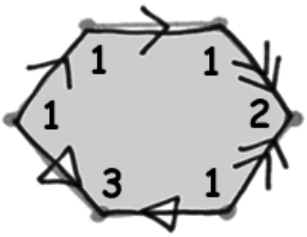


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

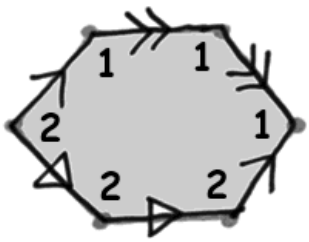
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



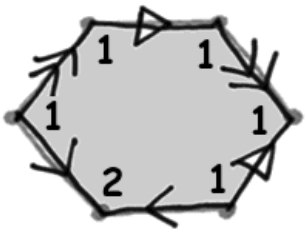
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



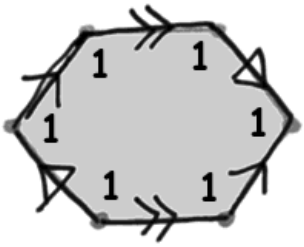
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



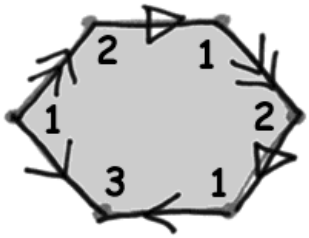
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



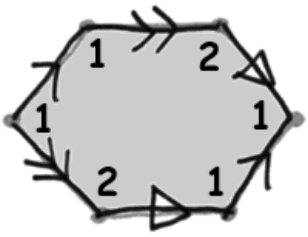
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



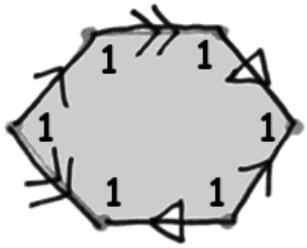
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

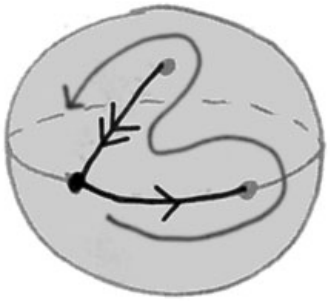
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

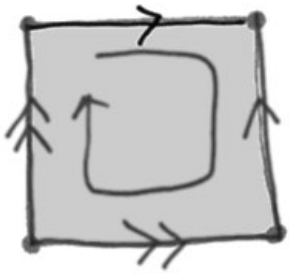
First Exam LA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

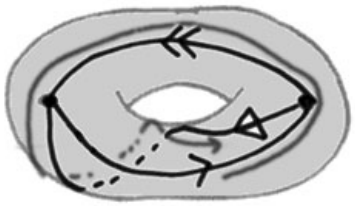
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

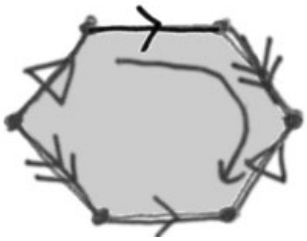




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

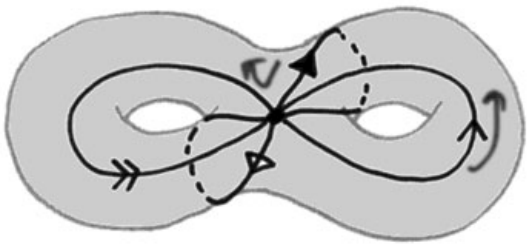
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

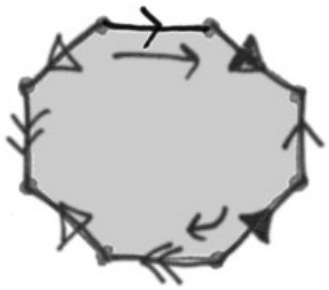




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

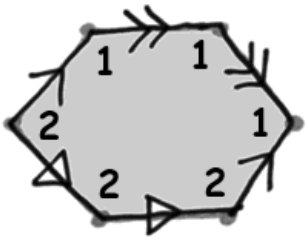
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



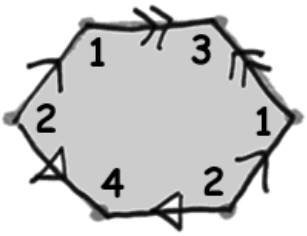


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

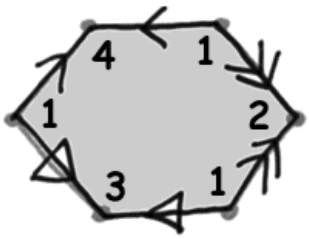
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



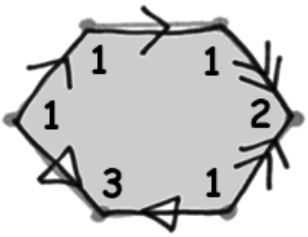
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



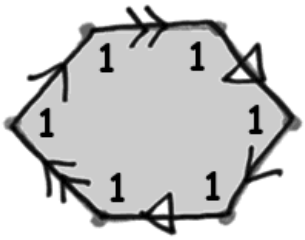
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



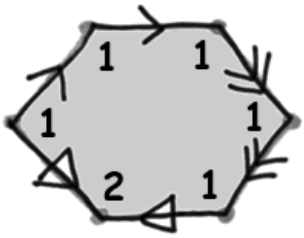
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



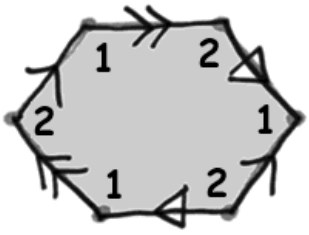
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



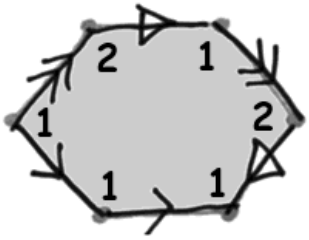
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

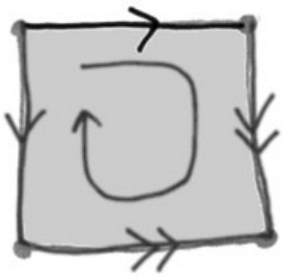
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam LB

Surfaces and Knots, Dave Bayer, February 21, 2002

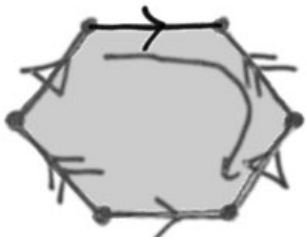
Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



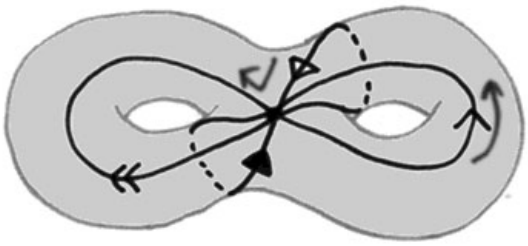
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

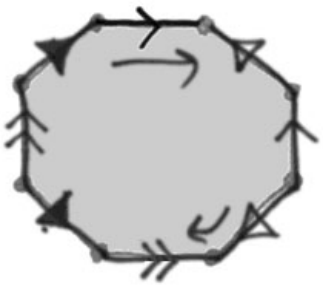
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

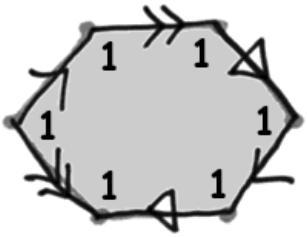
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



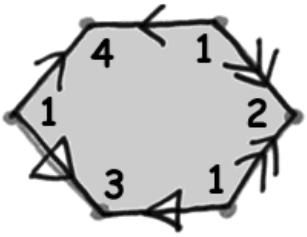


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

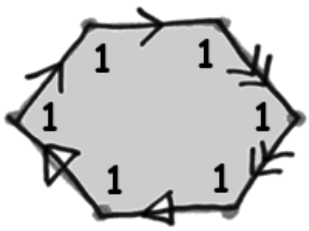
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



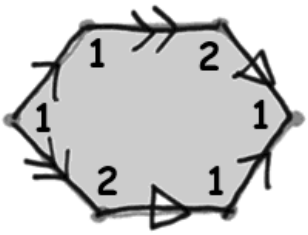
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



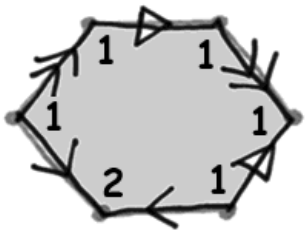
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



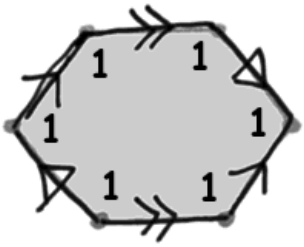
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



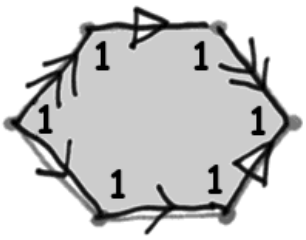
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



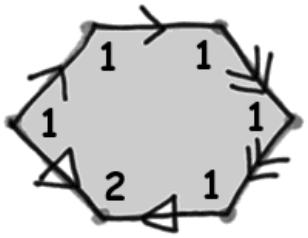
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

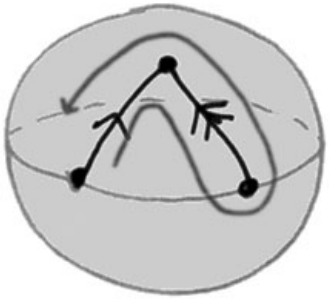
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

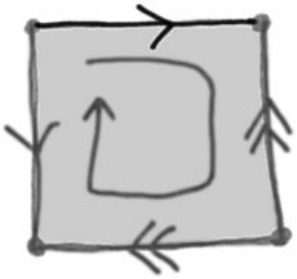
First Exam LC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

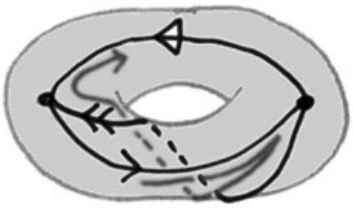
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

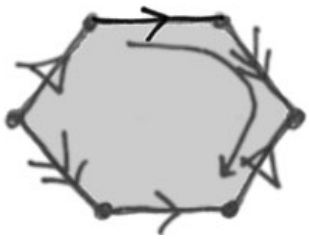




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

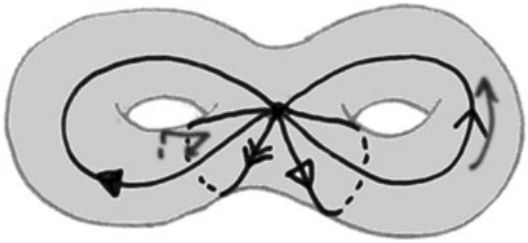
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

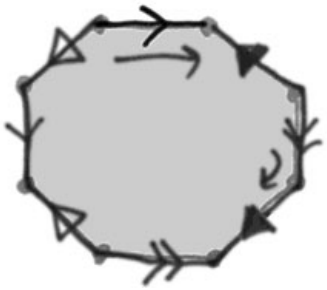




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

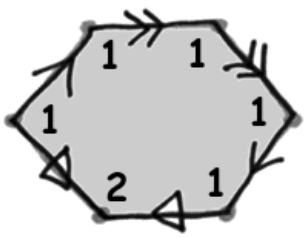
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



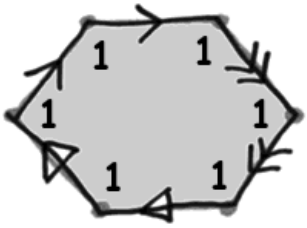


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

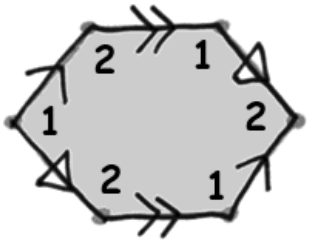
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



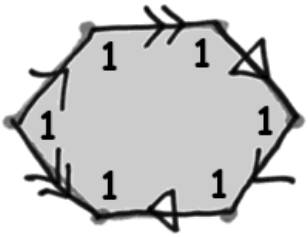
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



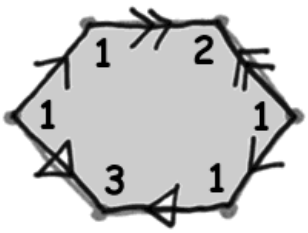
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



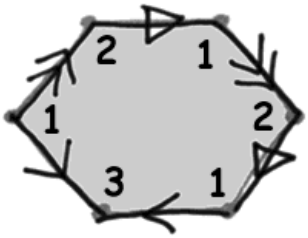
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



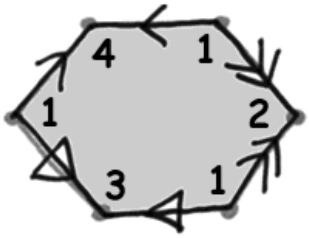
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



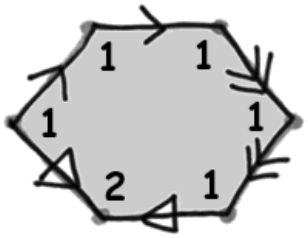
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

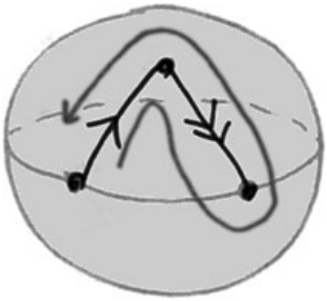
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

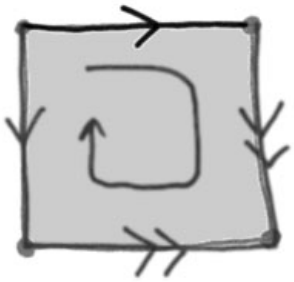
First Exam LD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

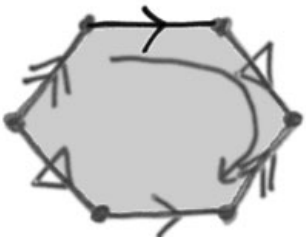
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





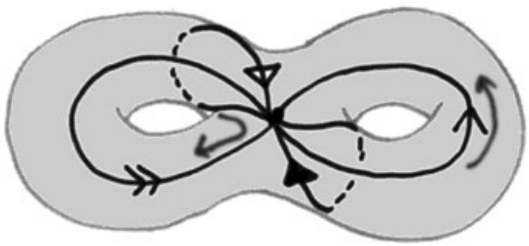
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

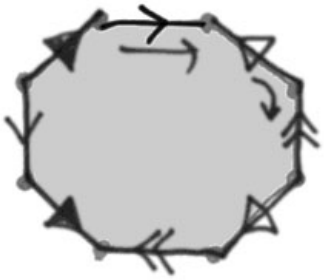
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

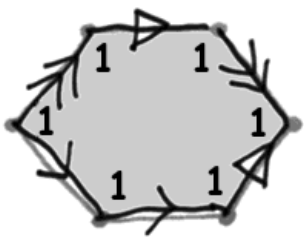
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



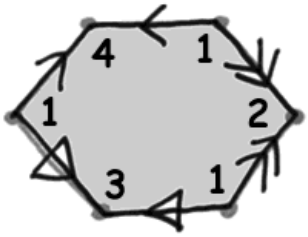


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

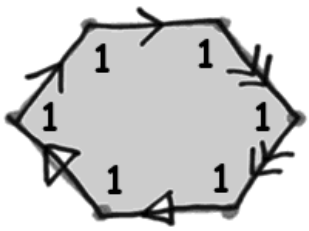
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



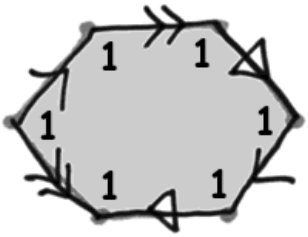
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



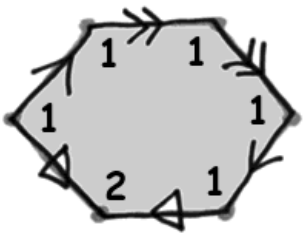
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



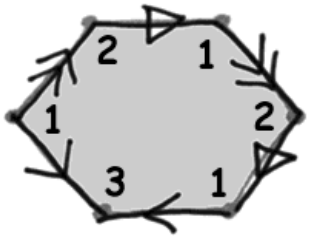
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



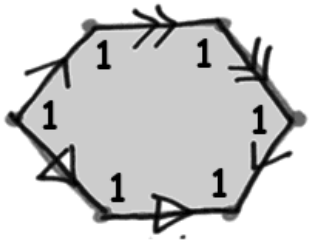
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



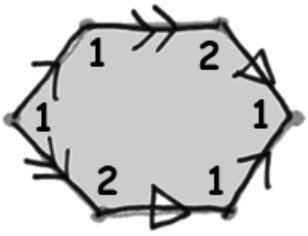
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

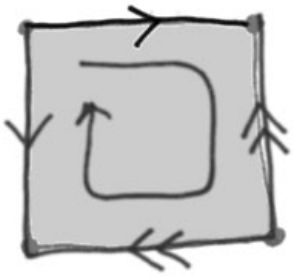
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam LE

Surfaces and Knots, Dave Bayer, February 21, 2002

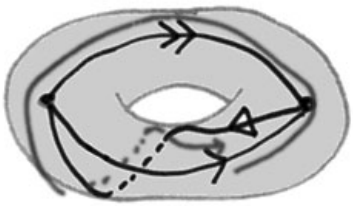
Answer Key

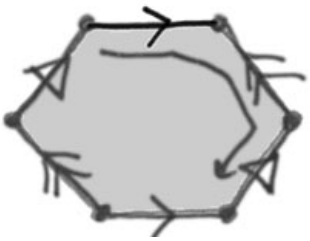
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

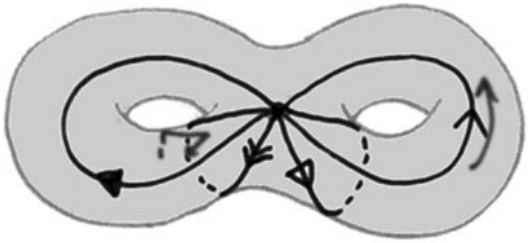
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

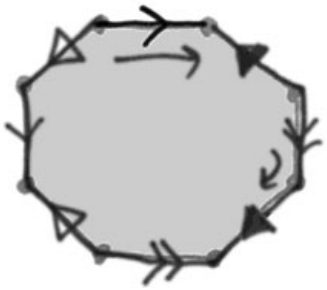




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

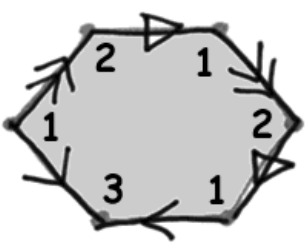
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





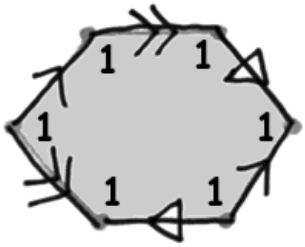
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



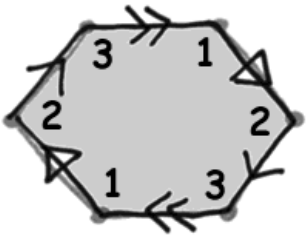
$$\begin{array}{rcl} +\ v & = & 3 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & 1 \end{array}$$

nonorientable



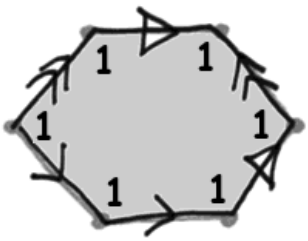
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



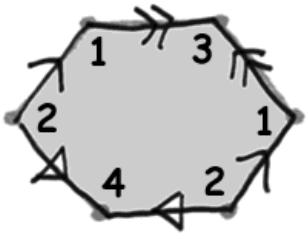
$$\begin{array}{rcl} +\ v & = & 3 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & 1 \end{array}$$

nonorientable



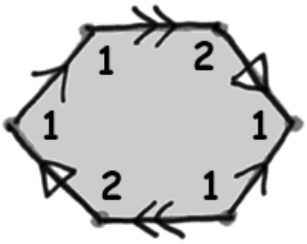
$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable



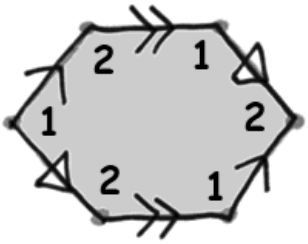
$$\begin{array}{rcl} +\ v & = & 4 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & 2 \end{array}$$

orientable



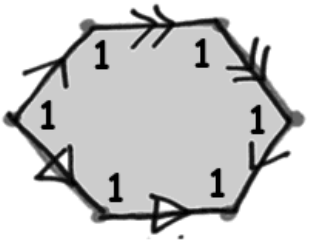
$$\begin{array}{rcl} +\ v & = & 2 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

nonorientable



$$\begin{array}{rcl} +\ v & = & 2 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & 0 \end{array}$$

orientable



$$\begin{array}{rcl} +\ v & = & 1 \\ -\ e & = & 3 \\ \hline +\ f & = & 1 \\ \hline \chi & = & -1 \end{array}$$

nonorientable

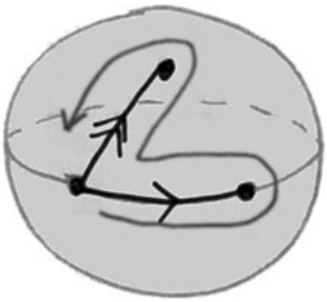
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

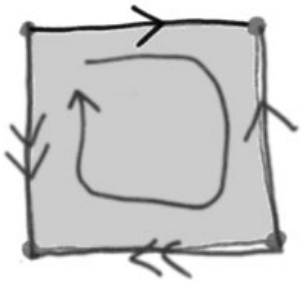
First Exam LF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

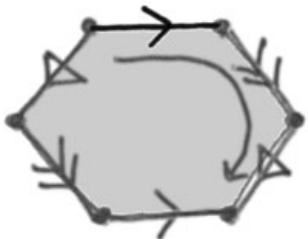
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





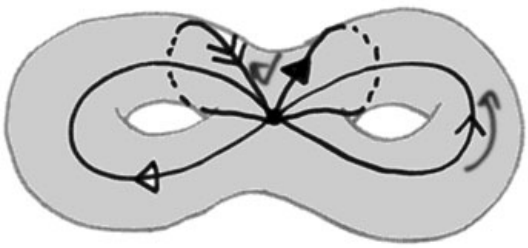
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

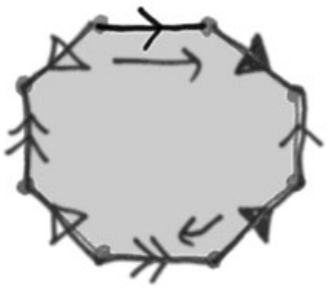
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

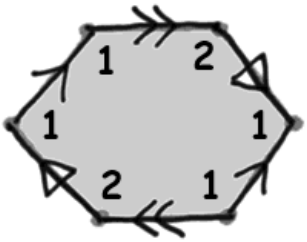
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



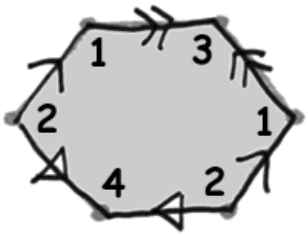


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

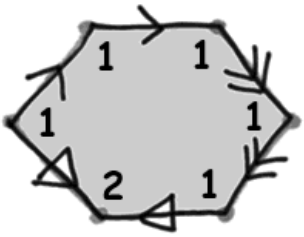
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



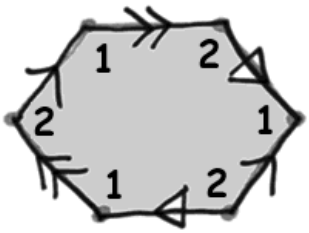
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



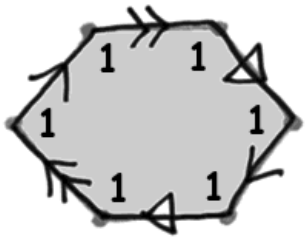
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



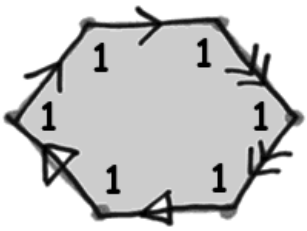
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



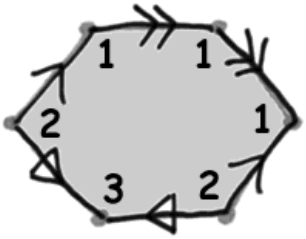
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



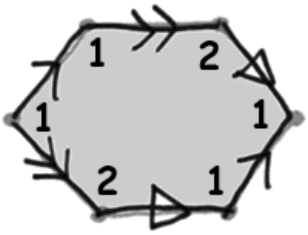
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

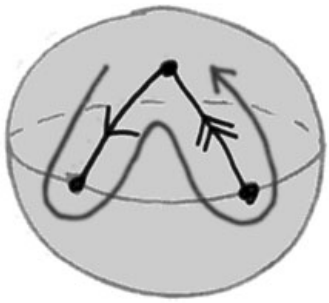
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

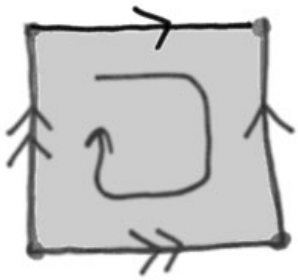
First Exam LG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

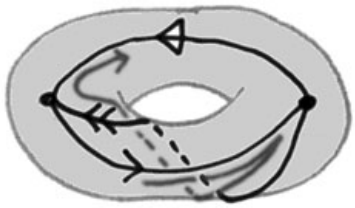
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

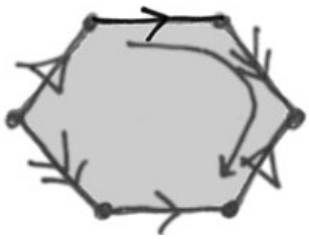




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

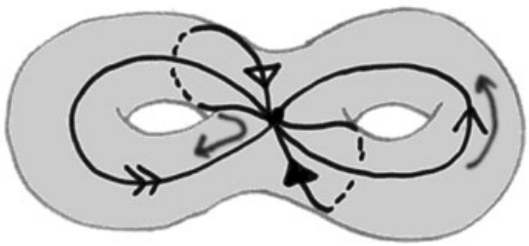
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

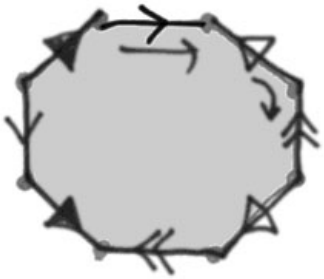




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

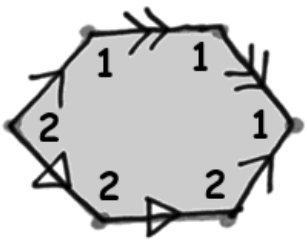
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



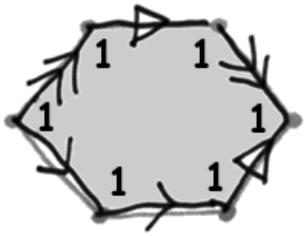


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

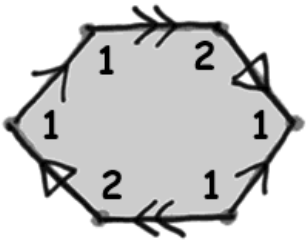
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



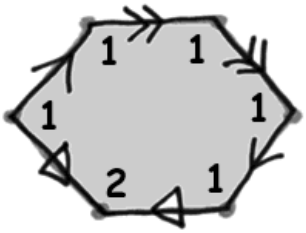
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



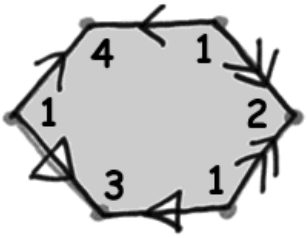
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



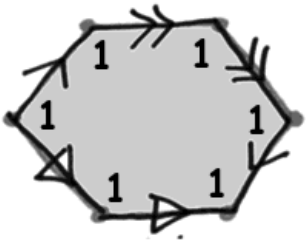
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



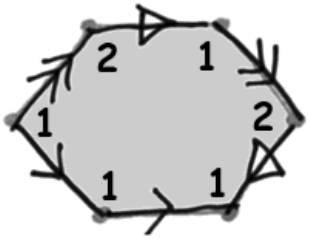
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



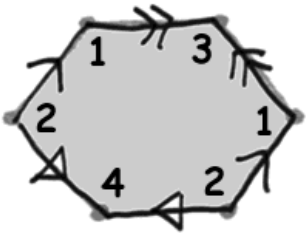
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

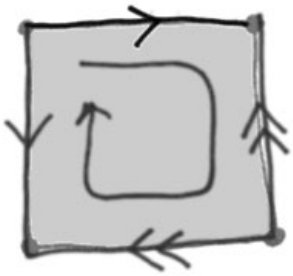
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam LH

Surfaces and Knots, Dave Bayer, February 21, 2002

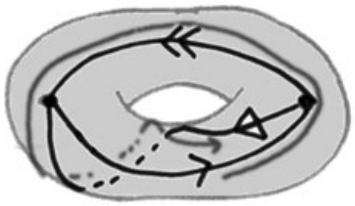
Answer Key

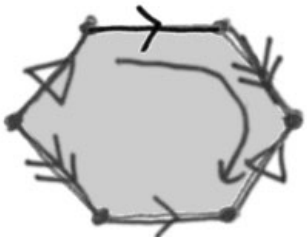
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

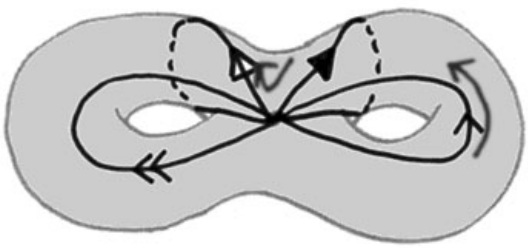
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

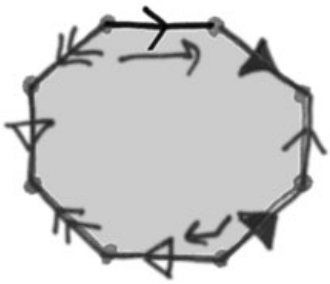




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

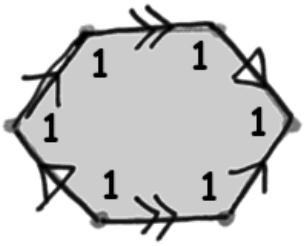
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





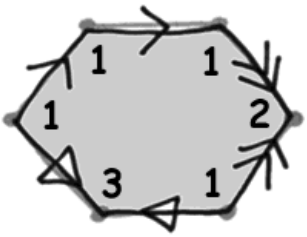
$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



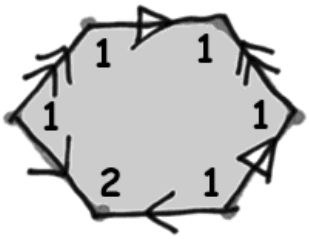
$$\begin{array}{rl} + & v = 1 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = -1 \end{array}$$

nonorientable



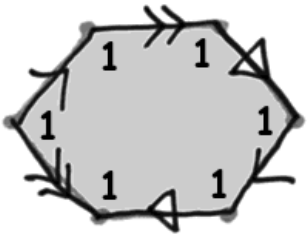
$$\begin{array}{rl} + & v = 3 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 1 \end{array}$$

nonorientable



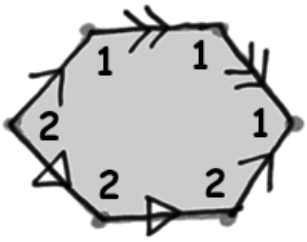
$$\begin{array}{rl} + & v = 2 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 0 \end{array}$$

orientable



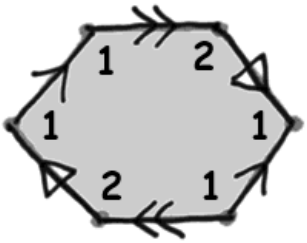
$$\begin{array}{rl} + & v = 1 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = -1 \end{array}$$

nonorientable



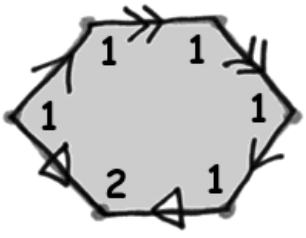
$$\begin{array}{rl} + & v = 2 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 0 \end{array}$$

nonorientable



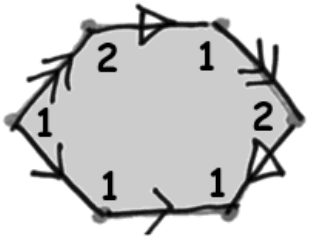
$$\begin{array}{rl} + & v = 2 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 0 \end{array}$$

nonorientable



$$\begin{array}{rl} + & v = 2 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 0 \end{array}$$

nonorientable



$$\begin{array}{rl} + & v = 2 \\ - & e = 3 \\ + & f = 1 \\ \hline & \chi = 0 \end{array}$$

nonorientable

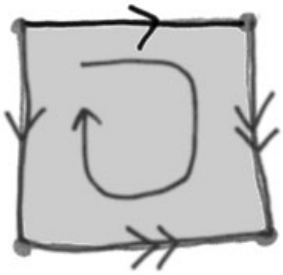
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

First Exam LI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

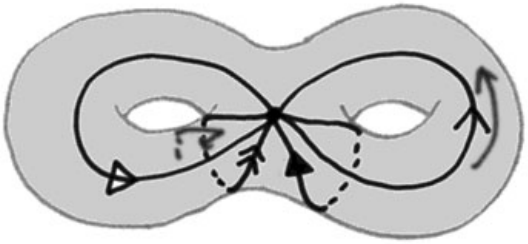


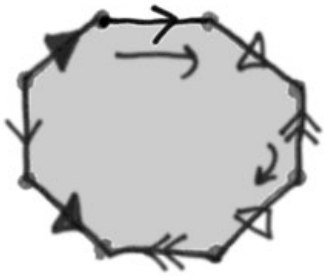
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

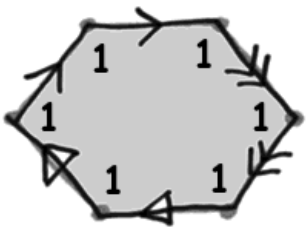
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



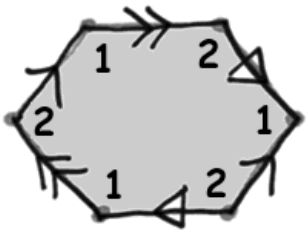


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

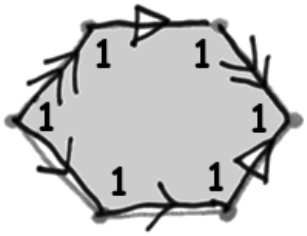
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



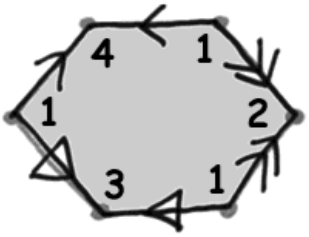
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



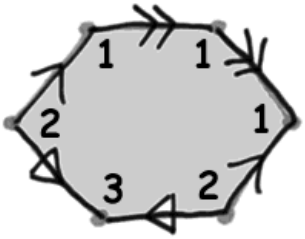
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



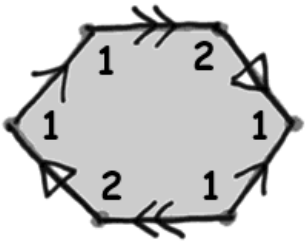
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



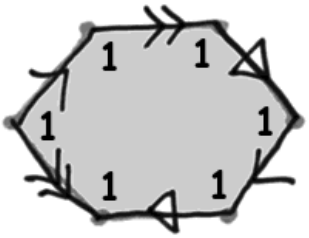
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



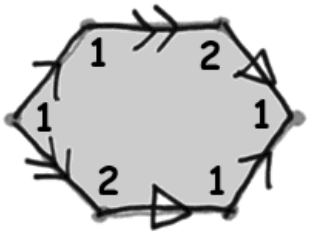
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

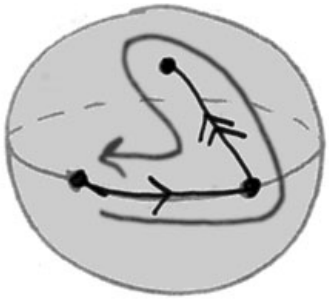
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

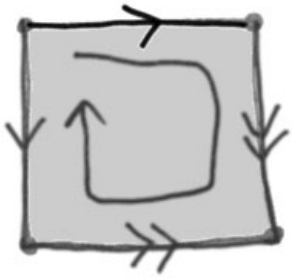
First Exam LJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

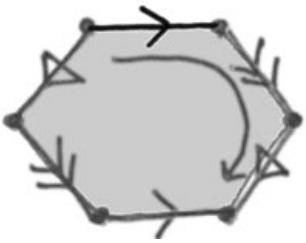
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





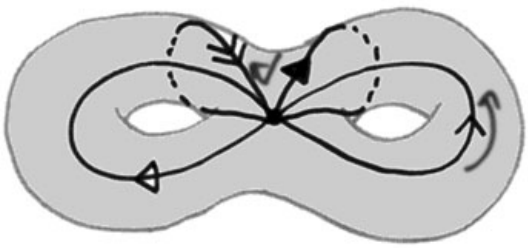
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

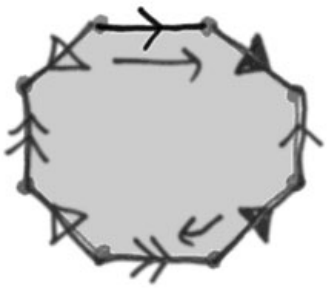
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

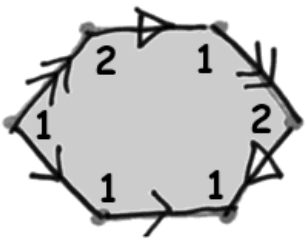
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



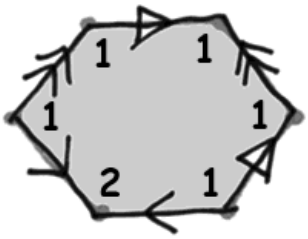


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

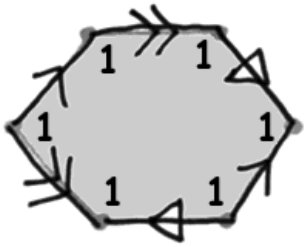
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



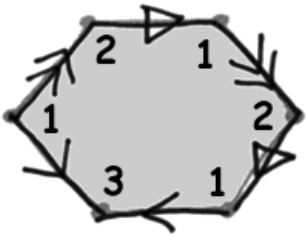
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



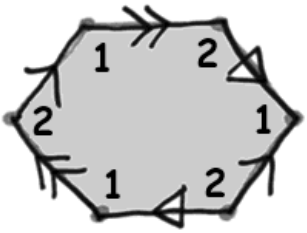
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



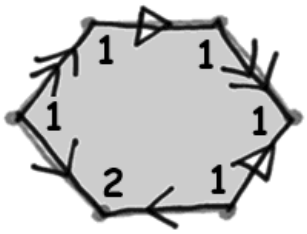
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



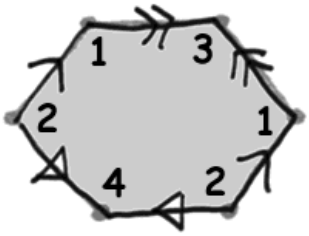
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



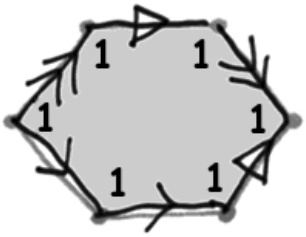
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

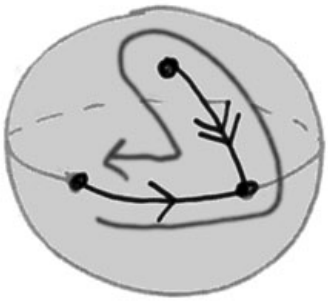
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

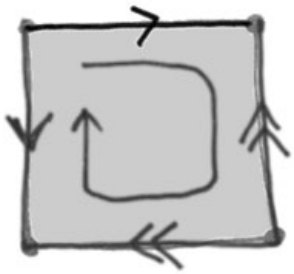
First Exam LK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

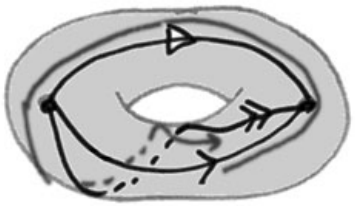
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

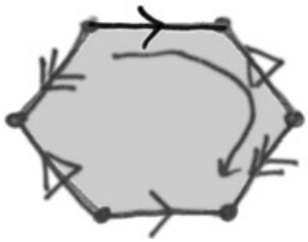




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

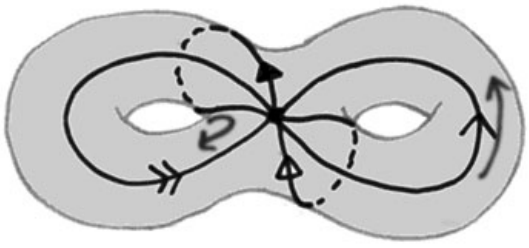
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

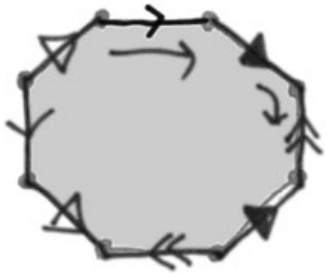




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

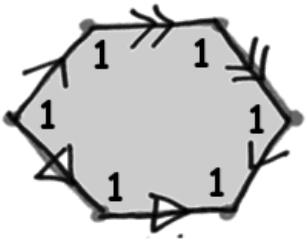
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



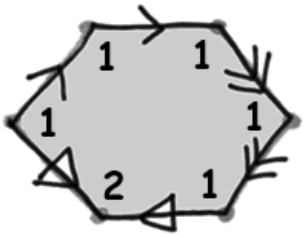


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

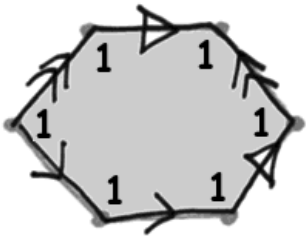
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



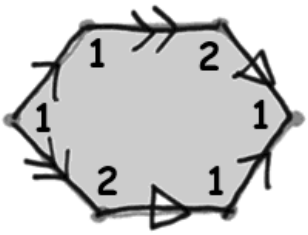
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



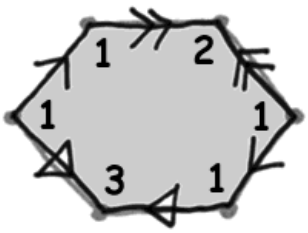
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



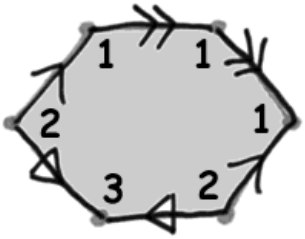
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



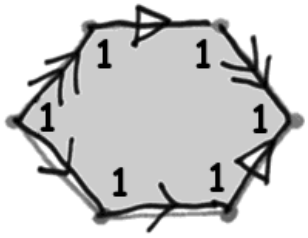
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



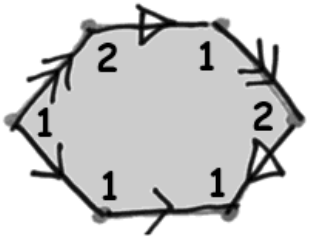
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

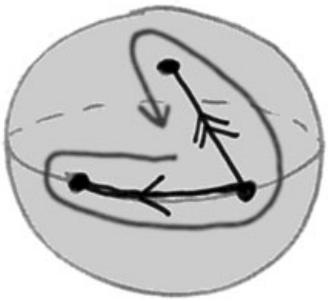
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

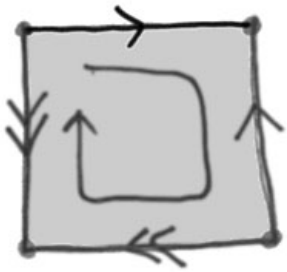
First Exam LL

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

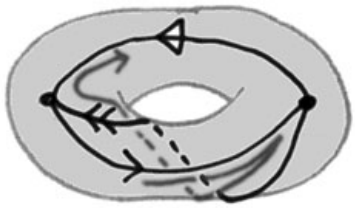
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

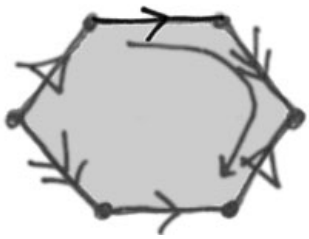




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

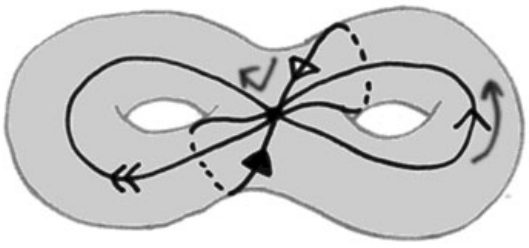
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

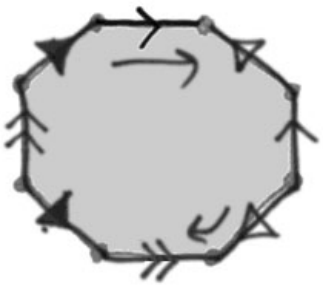




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

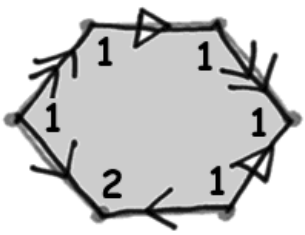
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



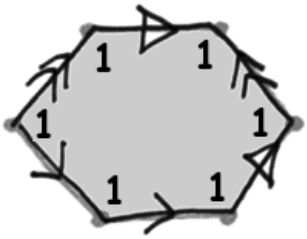


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

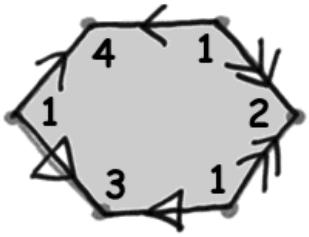
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



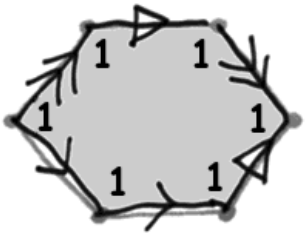
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



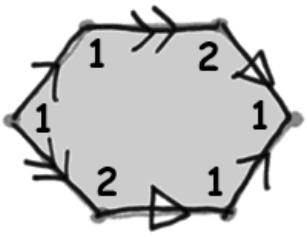
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



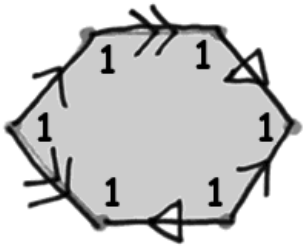
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



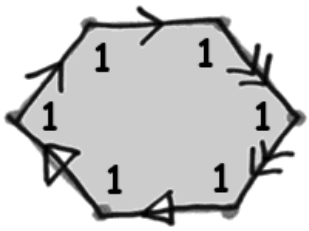
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



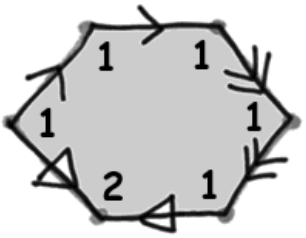
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

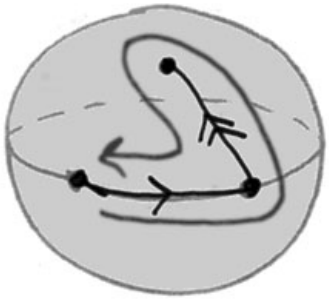
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

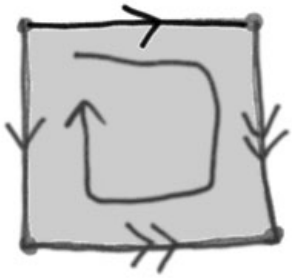
First Exam LM

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



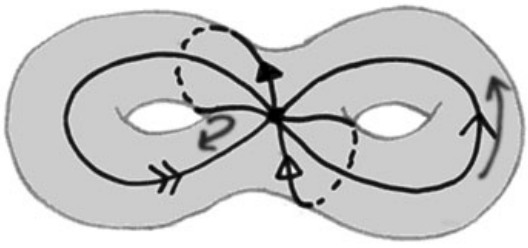


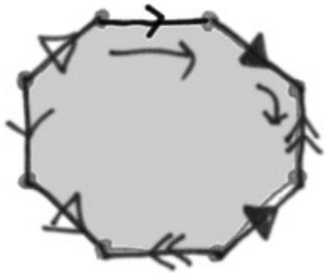
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

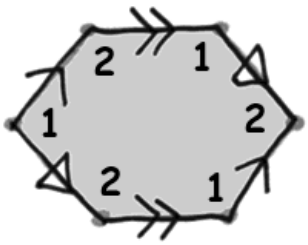
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



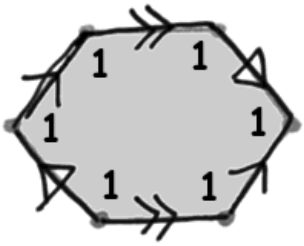


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

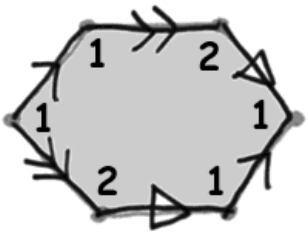
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



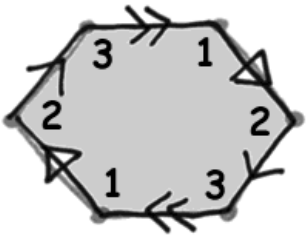
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



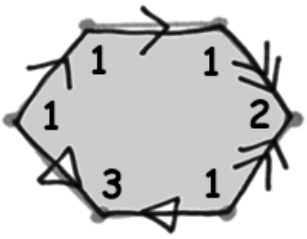
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



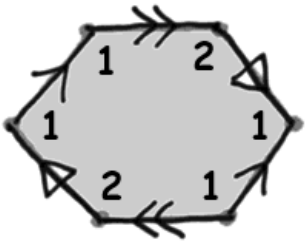
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



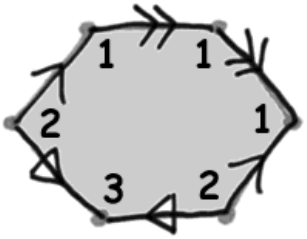
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



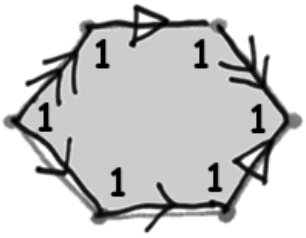
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

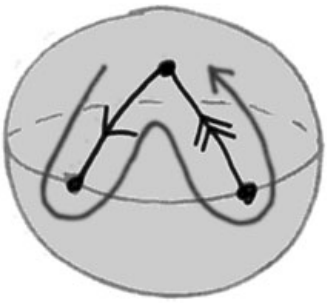
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

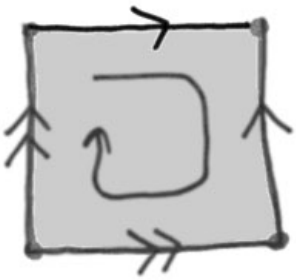
First Exam LN

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

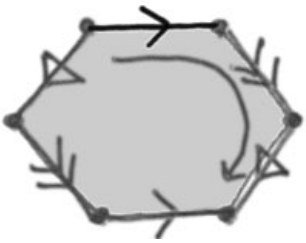
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





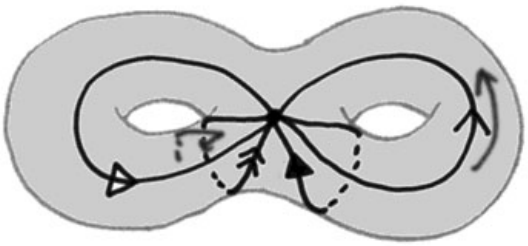
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

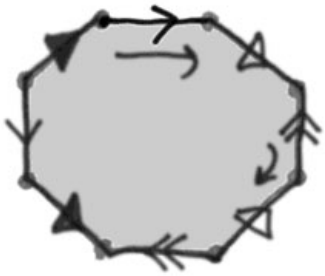
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

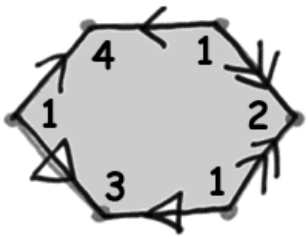
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



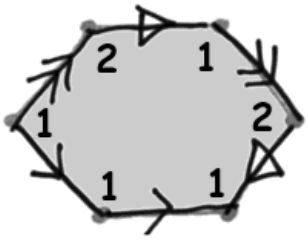


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

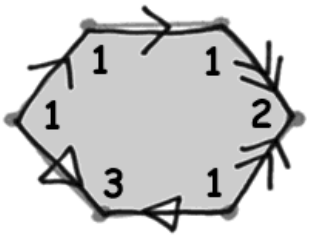
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



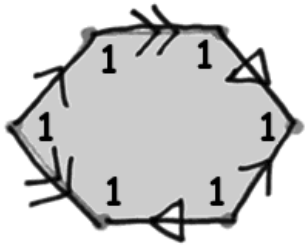
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



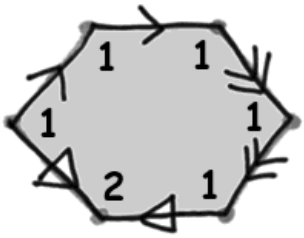
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



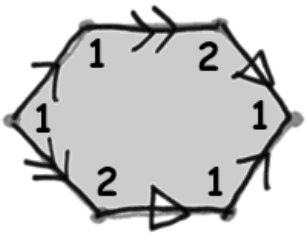
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



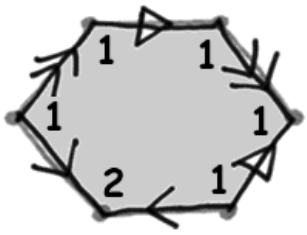
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



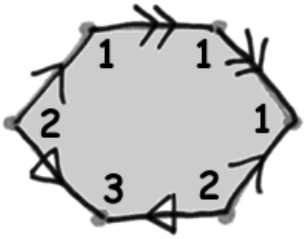
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable

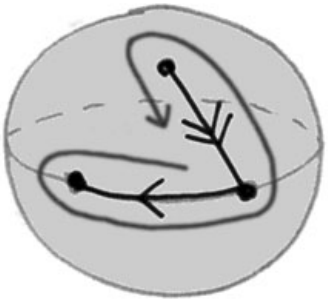
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

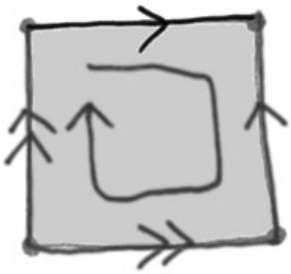
First Exam MA

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

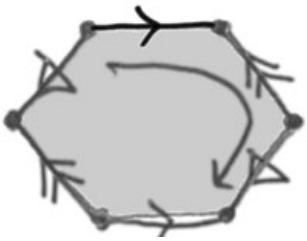
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





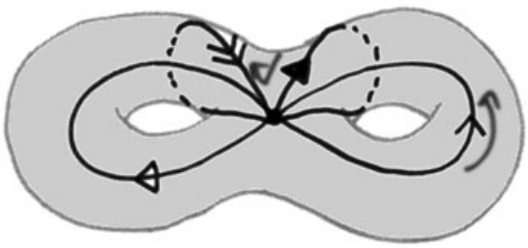
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

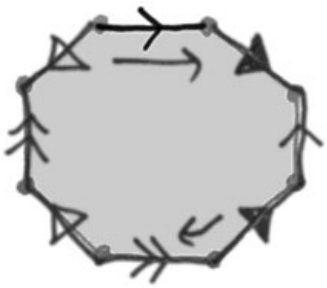
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

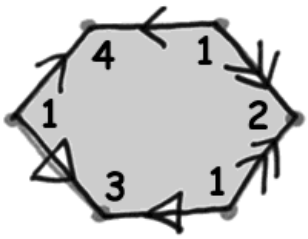
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



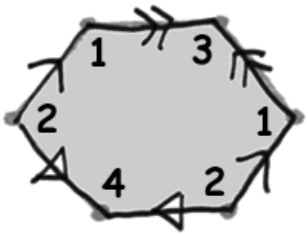


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

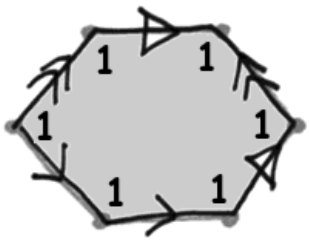
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



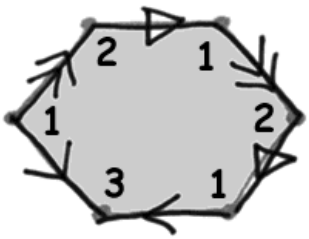
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



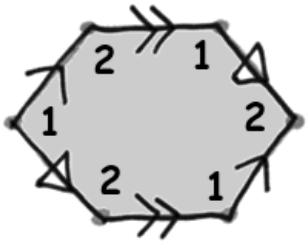
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



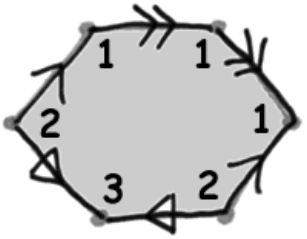
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



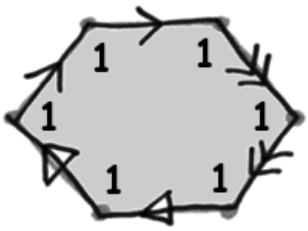
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



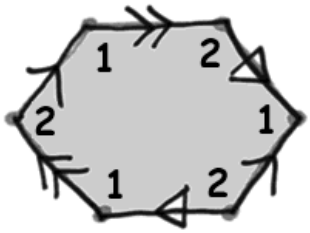
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

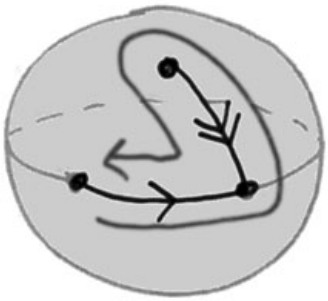
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

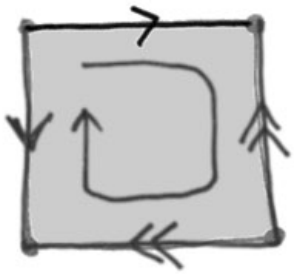
First Exam MB

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

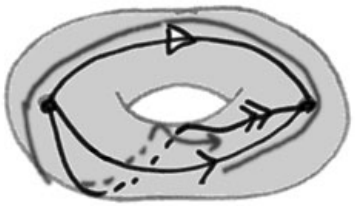
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

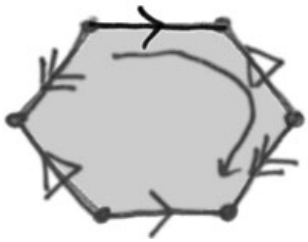




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

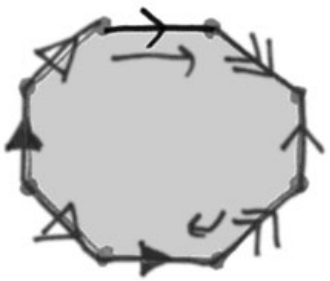
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





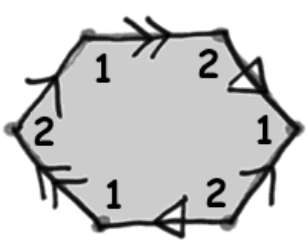
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

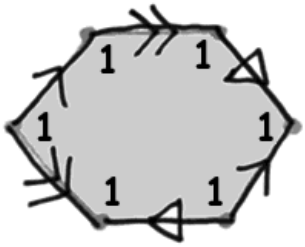


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

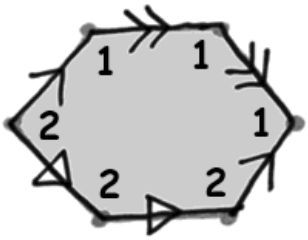
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



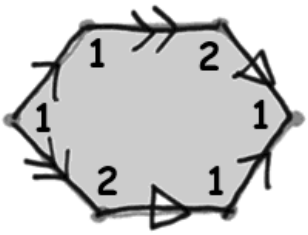
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



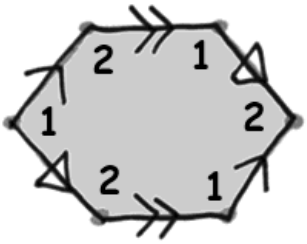
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



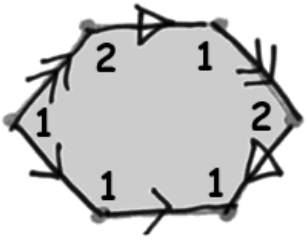
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



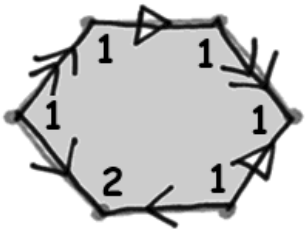
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



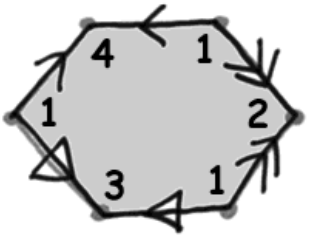
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

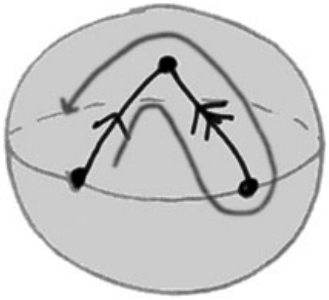
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

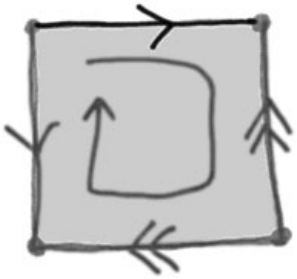
First Exam MC

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

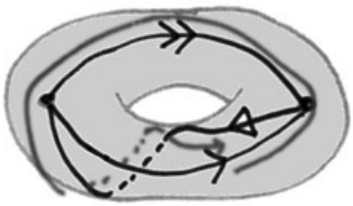
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

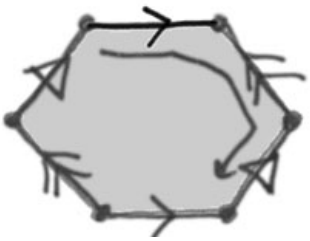




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

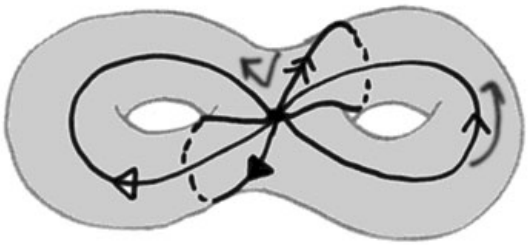
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

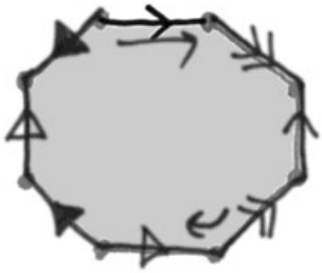




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

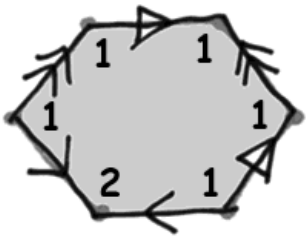
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



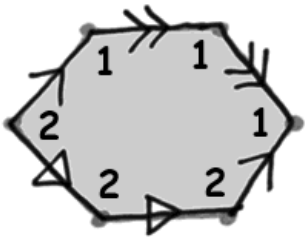


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

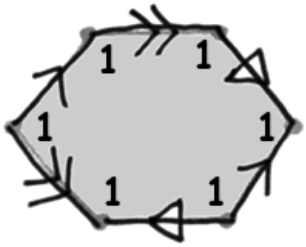
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



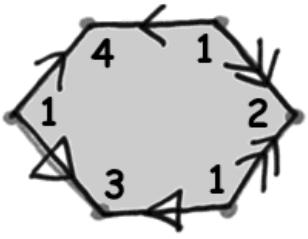
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



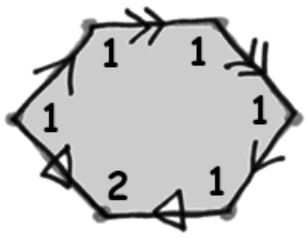
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



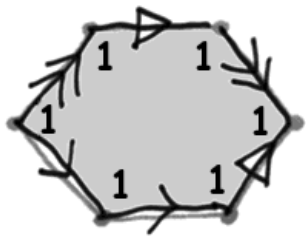
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



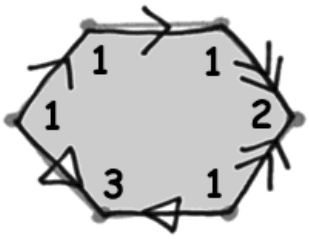
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



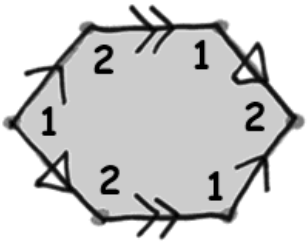
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

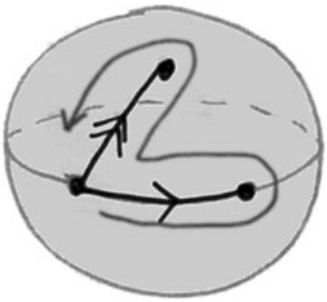
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

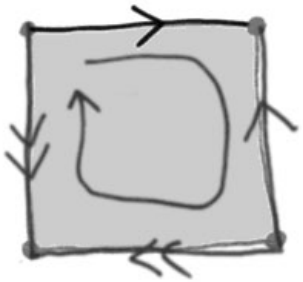
First Exam MD

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

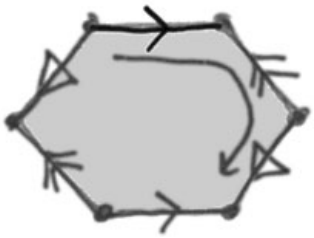
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





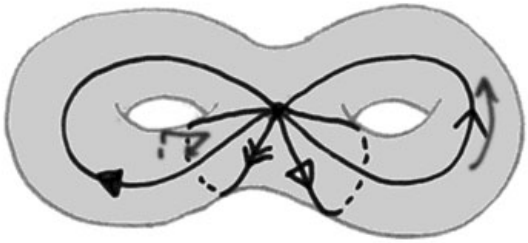
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

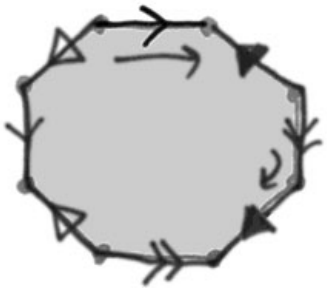
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

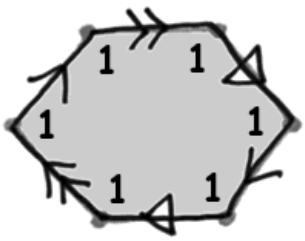
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



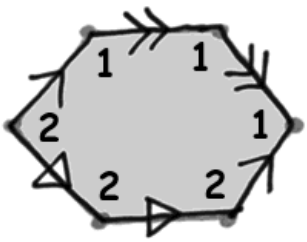


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

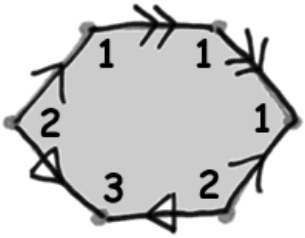
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



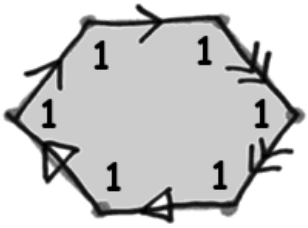
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



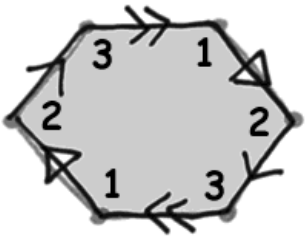
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



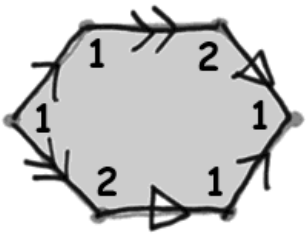
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



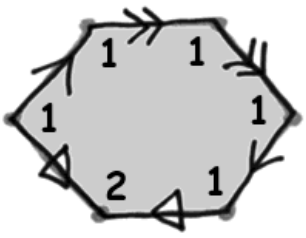
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



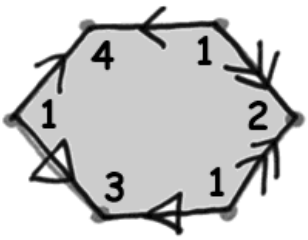
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable

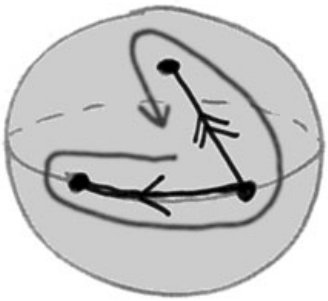
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

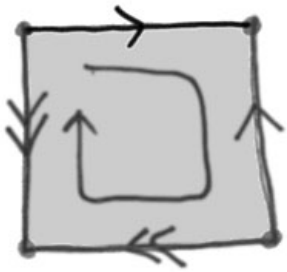
First Exam ME

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

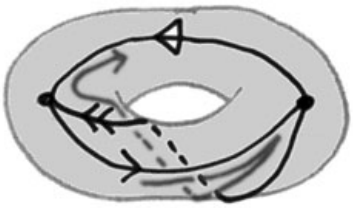
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

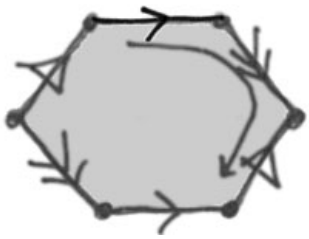




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

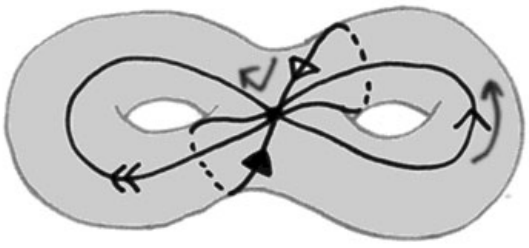
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

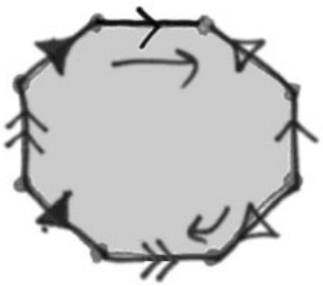




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

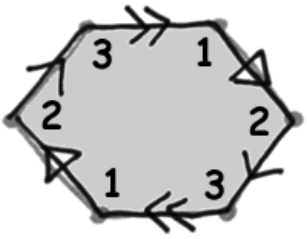
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



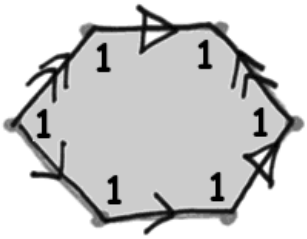


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

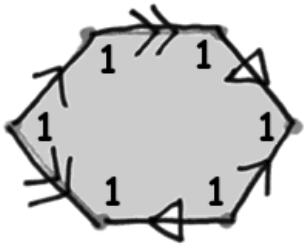
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



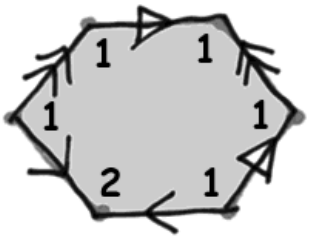
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



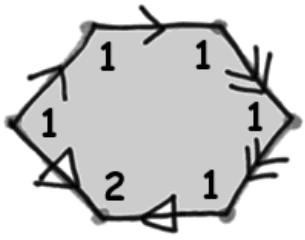
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



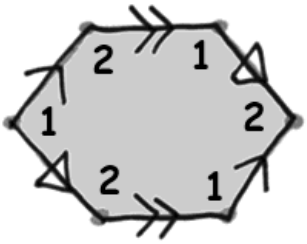
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



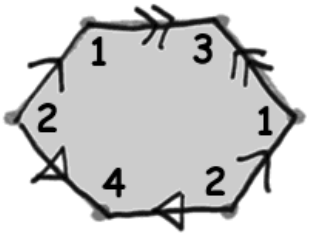
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



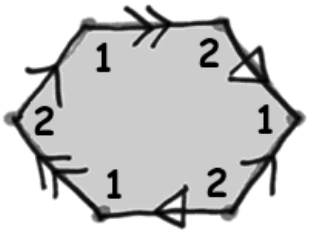
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

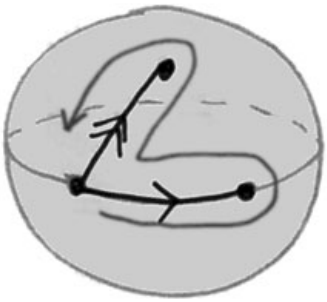
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

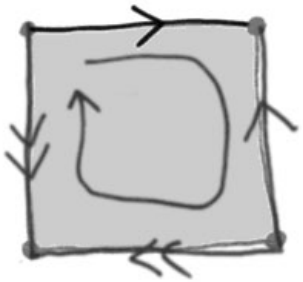
First Exam MF

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

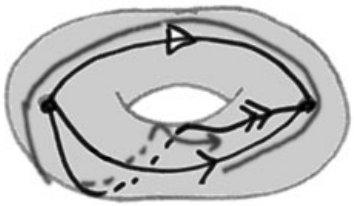
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

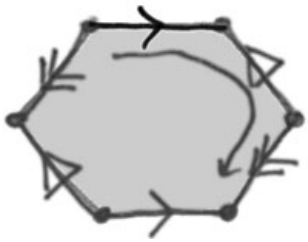




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

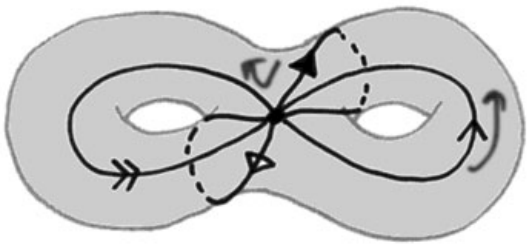
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

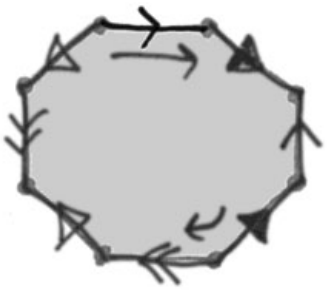




$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

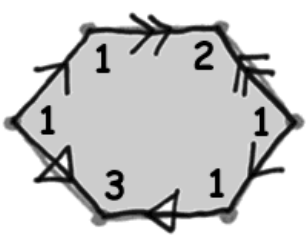
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



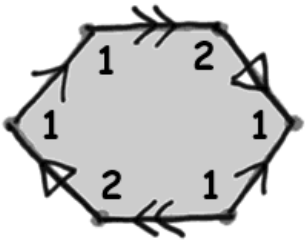


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

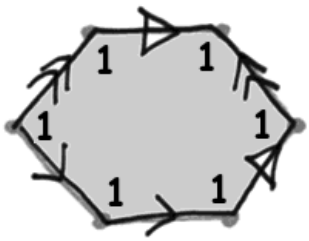
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



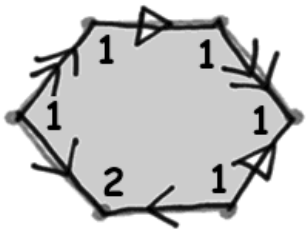
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



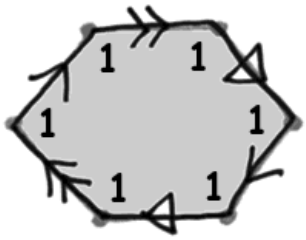
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



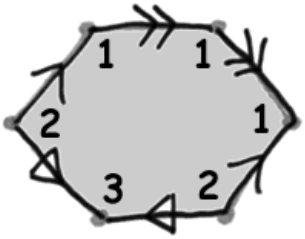
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



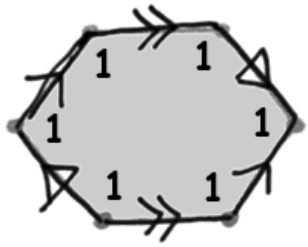
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



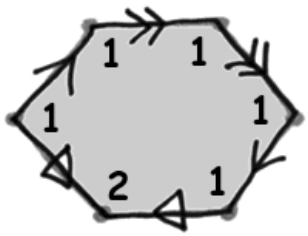
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

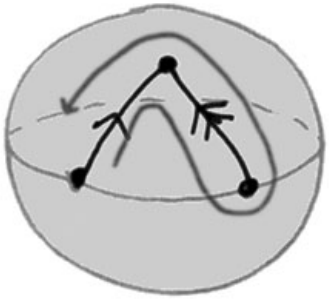
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

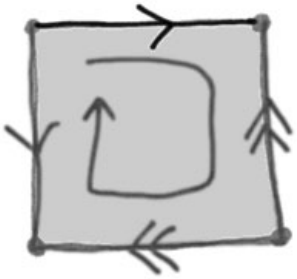
First Exam MG

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

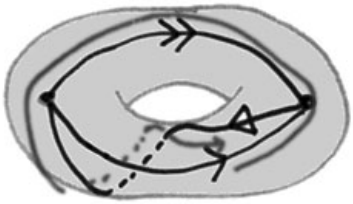
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

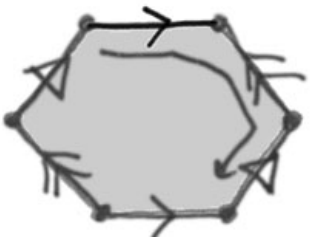




$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

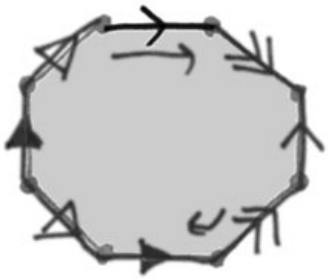
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





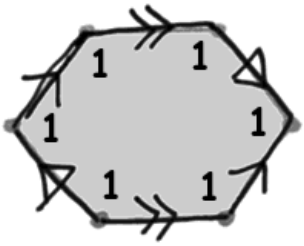
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

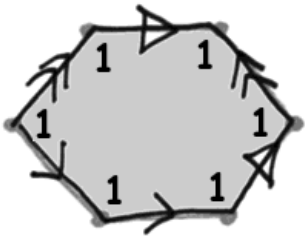


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

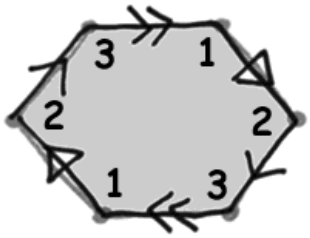
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



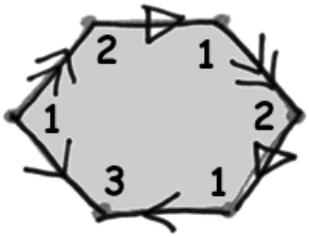
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



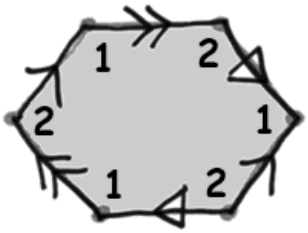
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



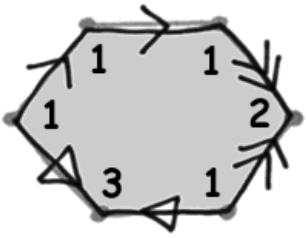
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



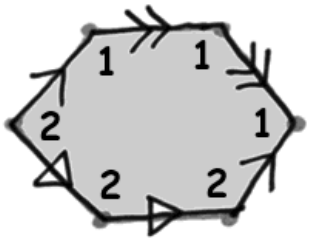
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



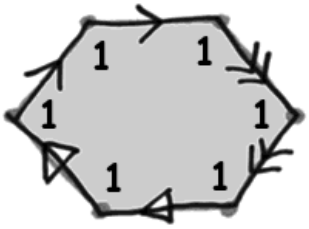
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

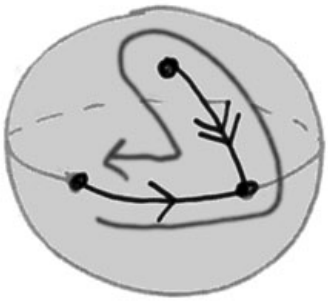
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

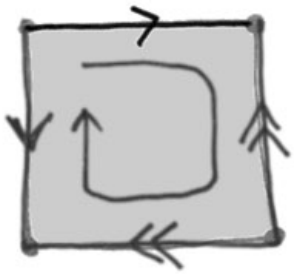
First Exam MH

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

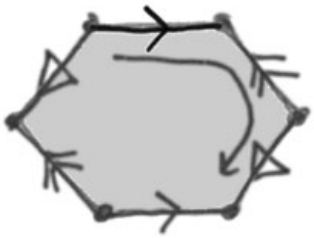
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





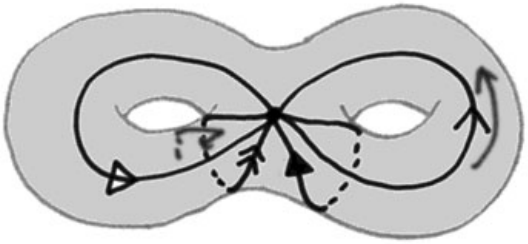
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

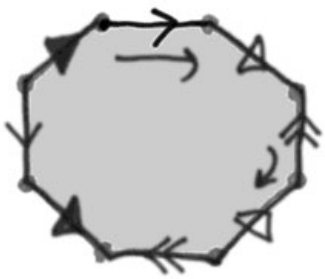
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

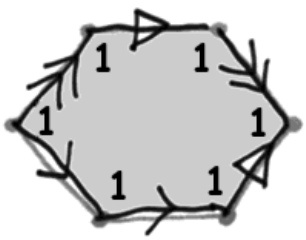
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



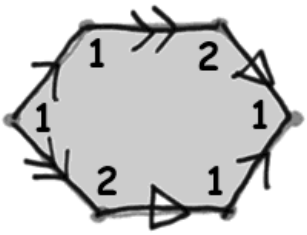


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

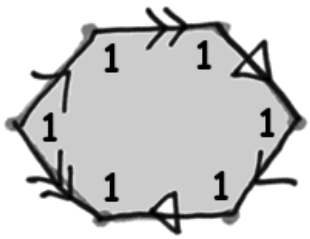
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



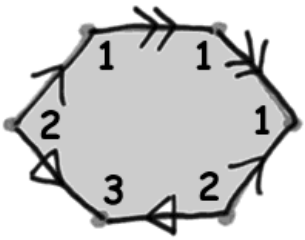
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



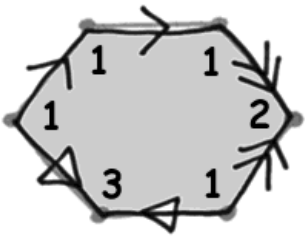
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



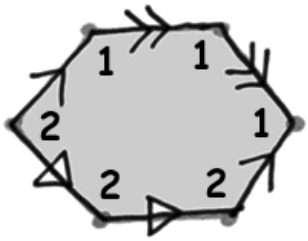
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



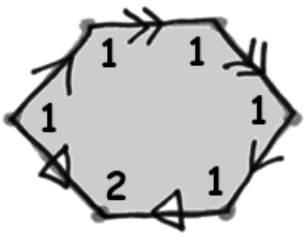
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



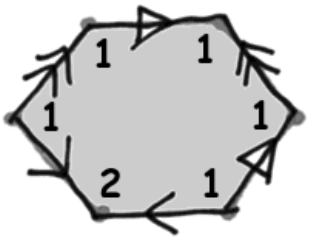
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

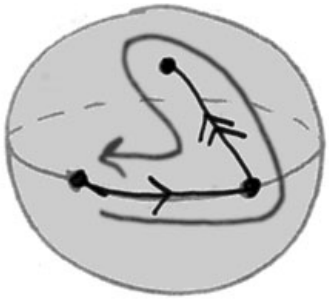
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

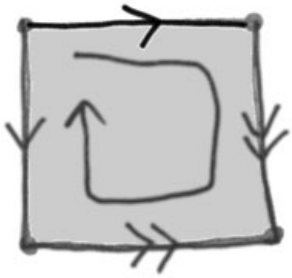
First Exam MI

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

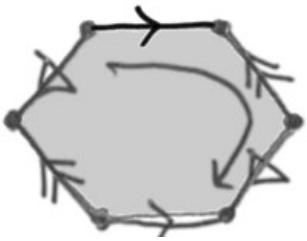
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





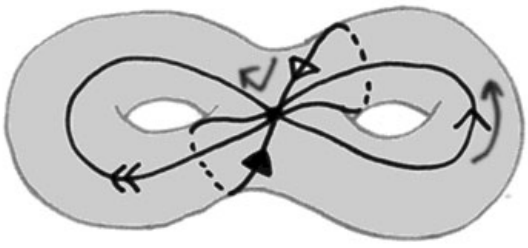
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

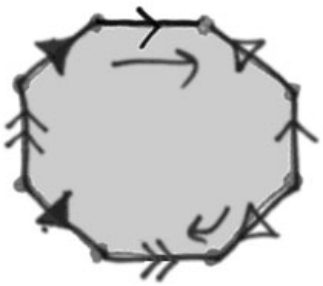
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

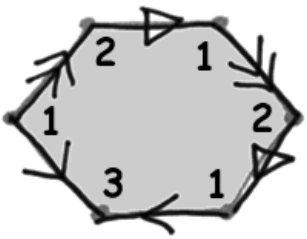
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



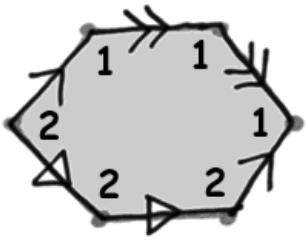


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

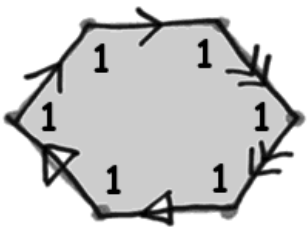
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



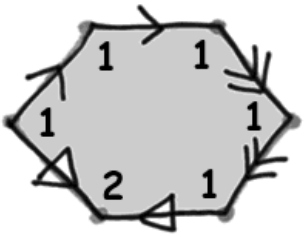
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



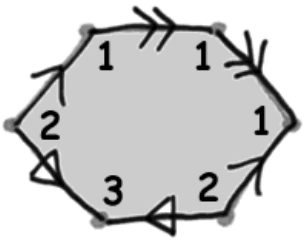
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



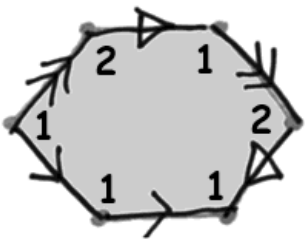
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



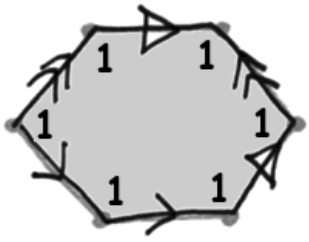
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



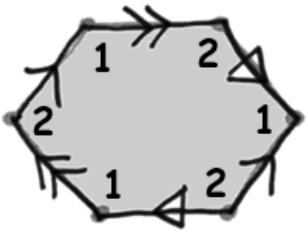
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

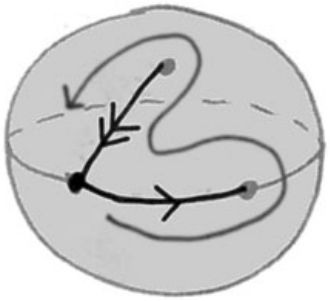
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

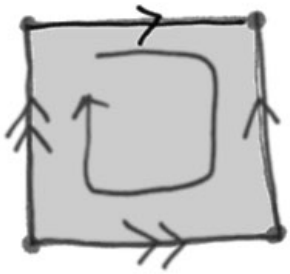
First Exam MJ

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

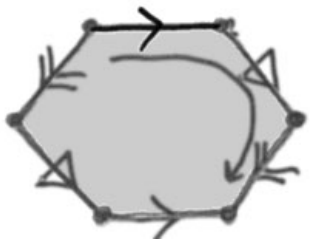
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





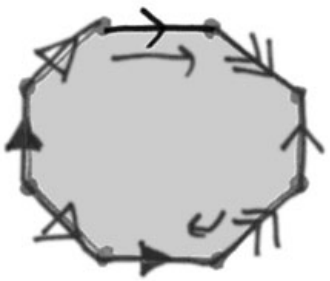
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



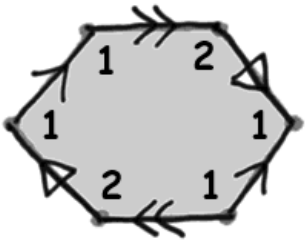
$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.

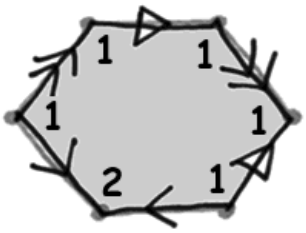


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

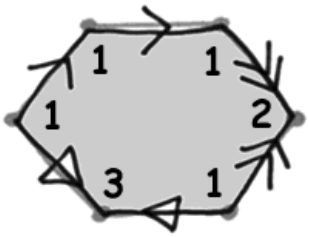
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



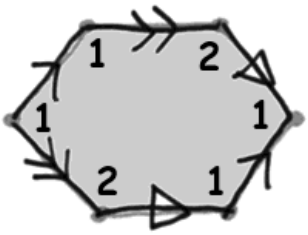
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



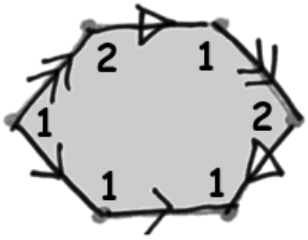
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



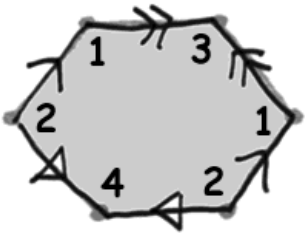
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



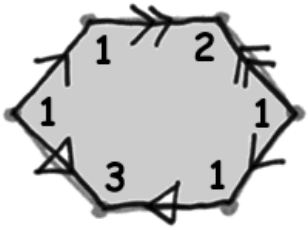
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



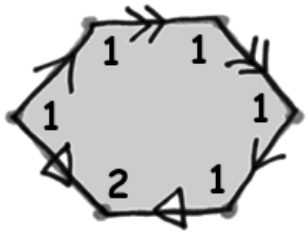
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable

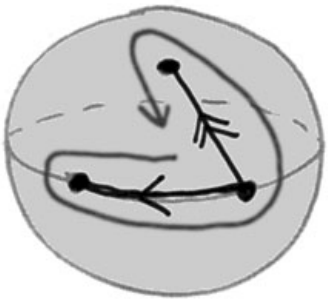
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

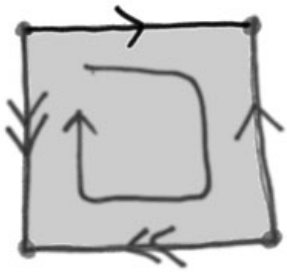
First Exam MK

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

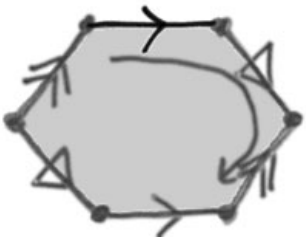
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





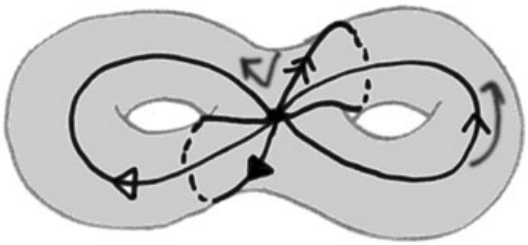
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

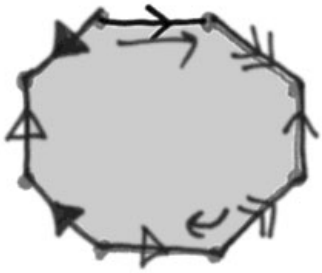
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

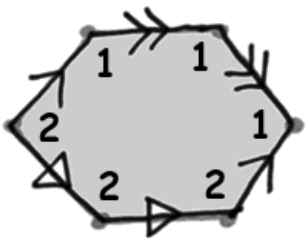
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



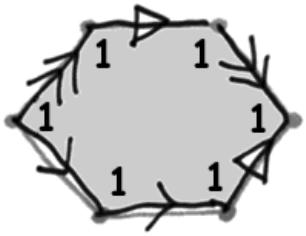


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

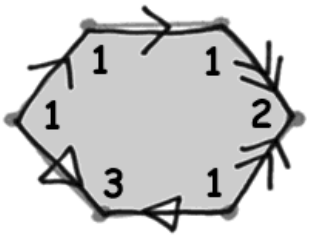
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



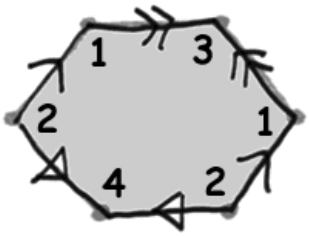
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



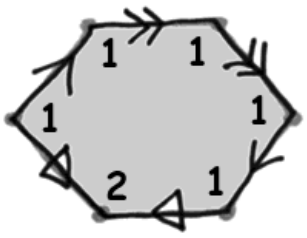
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



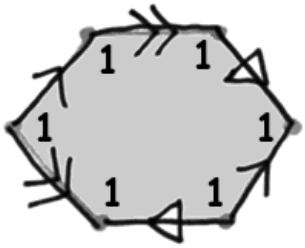
$+ v = 3$
$- e = 3$
$+ f = 1$
$\chi = 1$
nonorientable



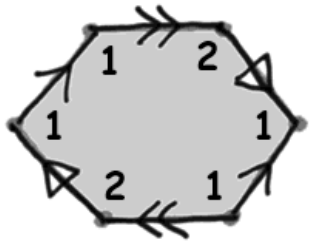
$+ v = 4$
$- e = 3$
$+ f = 1$
$\chi = 2$
orientable



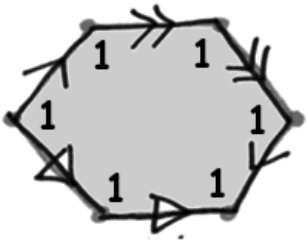
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable

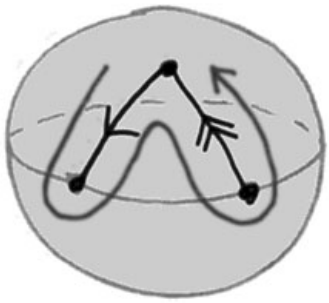
[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.

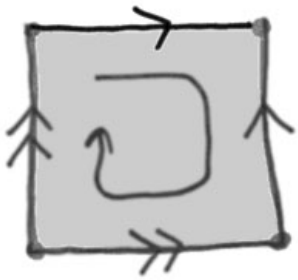
First Exam ML

Surfaces and Knots, Dave Bayer, February 21, 2002

Answer Key

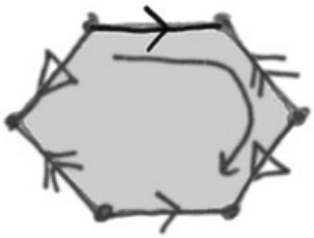
[1] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.





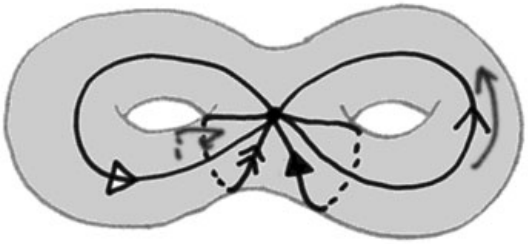
$$\begin{aligned} +\ v &= 3 \\ -\ e &= 2 \\ +\ f &= 1 \\ \hline \chi &= 2 \end{aligned}$$

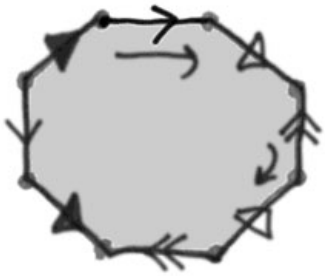
[2] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



$$\begin{aligned} +\ v &= 2 \\ -\ e &= 3 \\ +\ f &= 1 \\ \hline \chi &= 0 \end{aligned}$$

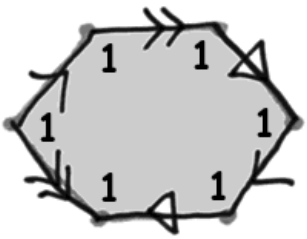
[3] Finish labeling the gluing diagram on the right, so it glues together to form the surface on the left. Compute the Euler characteristic of this surface.



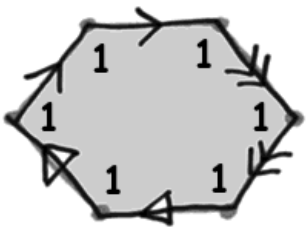


$$\begin{aligned} +\ v &= 1 \\ -\ e &= 4 \\ +\ f &= 1 \\ \hline \chi &= -2 \end{aligned}$$

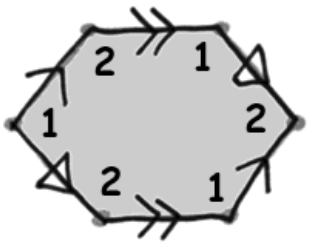
[4] Determine what surface each of the following gluing diagrams represents, by computing its Euler characteristic, and determining whether it is orientable or not.



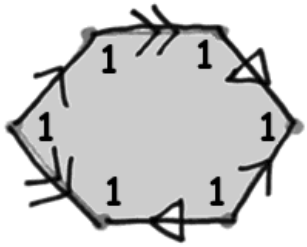
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



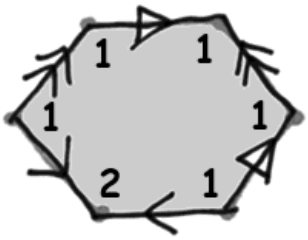
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



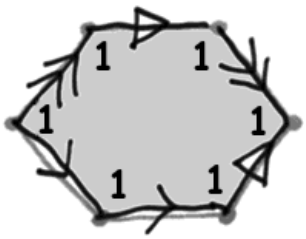
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



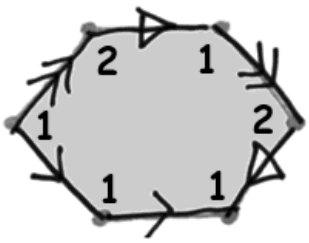
$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



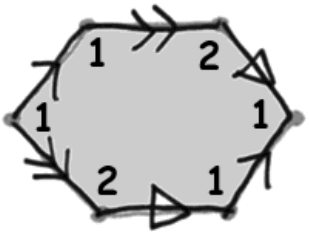
$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable



$+ v = 1$
$- e = 3$
$+ f = 1$
$\chi = -1$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
nonorientable



$+ v = 2$
$- e = 3$
$+ f = 1$
$\chi = 0$
orientable

[5] Find a pair of gluing diagrams, above, which represent the same surface. In any set of eight hexagonal gluing diagrams, why must there always be such a pair? Demonstrate that your pair represents the same surface, by modifying the diagrams until they agree.