F17 8:40 Exam 2 Problem 1
Linear Algebra, Dave Bayer

test1a2p1

[Reserved for Score]

Test 1

Name ______________________________ Uni ______________

[1] By least squares, find the equation of the form $y = ax + b$ that best fits the data

$$\begin{bmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \\ x_4 & y_4 \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ 0 & 0 \\ 1 & 0 \\ 3 & 0 \end{bmatrix}$$

$$\boxed{y = \square\, x + \square}$$

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Test 1

[2] Find the inverse of the matrix

$$A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

$$A^{-1} = \frac{1}{\boxed{}} \begin{bmatrix} \boxed{} & \boxed{} & \boxed{} \\ \boxed{} & \boxed{} & \boxed{} \\ \boxed{} & \boxed{} & \boxed{} \end{bmatrix}$$

(Do not write a negative denominator.)

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Test 1

[3] Consider $\mathbb{R}^3$ equipped with the inner product

$$\langle (a,b,c),(d,e,f)\rangle \;=\; \begin{bmatrix} a & b & c \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} d \\ e \\ f \end{bmatrix}$$

Using this inner product, find the orthogonal projection of the vector $(2,2,2)$ onto the plane spanned by $(1,0,1)$ and $(0,1,1)$.

$$\boxed{\begin{bmatrix} \square & \square & \square \end{bmatrix}}$$

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Test 1

[4] Let $f(n)$ be the determinant of the $n \times n$ matrix in the sequence

$$\begin{bmatrix} 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & -1 \\ 3 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & -1 & 0 \\ 3 & 1 & -1 \\ 0 & 3 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & -1 & 0 & 0 \\ 3 & 1 & -1 & 0 \\ 0 & 3 & 1 & -1 \\ 0 & 0 & 3 & 1 \end{bmatrix}$$

Find $f(1)$ and $f(2)$. Find a recurrence relation for $f(n)$. Find $f(6)$.

$$f(1) = \boxed{} \qquad f(2) = \boxed{}$$
$$f(n) = \left(\boxed{}\right) f(n-1) + \left(\boxed{}\right) f(n-2)$$
$$f(6) = \boxed{}$$

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test1a2p5

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Test 1

[5] Find a system of eigenvalues and eigenvectors for the matrix A, where

$$A = \begin{bmatrix} 5 & -2 \\ 1 & 2 \end{bmatrix}$$

$$\lambda_1,\ \lambda_2 = \boxed{},\ \boxed{}$$

$$v_1,\ v_2 = \begin{bmatrix} \boxed{} \\ \boxed{} \end{bmatrix},\ \begin{bmatrix} \boxed{} \\ \boxed{} \end{bmatrix}$$