

Final Exam

Linear Algebra, Dave Bayer, May 8, 2001

Name: _____

ID: _____ School: _____

[1] (5 pts)	[2] (5 pts)	[3] (6 pts)	[4] (6 pts)	[5] (6 pts)	[6] (6 pts)	[7] (6 pts)	TOTAL

Please work only one problem per page, starting with the pages provided, and number all continuations clearly. Please do not use calculators or decimal notation.

[1] Compute the determinant of the following 4×4 matrix:

$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 2 & 0 & 2 & 2 \\ 3 & 3 & 0 & 3 \\ 4 & 4 & 4 & 0 \end{bmatrix}$$

What can you say about the determinant of the $n \times n$ matrix with the same pattern?

[2] Let V be the vector space of all polynomials $f(x)$ of degree ≤ 3 . Let $W \subset V$ be the set of all polynomials f in V which satisfy $f(0) = f(1) = 0$. Show that W is a subspace of V . Find a basis for W . Extend this basis to a basis for V .

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[4] By least squares, find the equation of the form $y = ax + b$ which best fits the data $(x_1, y_1) = (0, -1)$, $(x_2, y_2) = (1, 1)$, $(x_2, y_2) = (2, 1)$, $(x_3, y_3) = (3, -1)$.

[5] Find (s, t) so $\begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} s \\ t \end{bmatrix}$ is as close as possible to $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$.

[6] Find an orthogonal basis for the subspace $w + x + y + z = 0$ of \mathbb{R}^4 .

[7] Let A be the matrix

$$A = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}.$$

Find a basis of eigenvectors and eigenvalues for A . Find the matrix exponential e^A .

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