

TEST THREE, MA 305, DR. JING'S SECTION
OCTOBER 22, 2009. 8:30–9:30

Print Your Name:

Signature

1. (25 pts) Let $A = \begin{bmatrix} 1 & 3 & 1 \\ 2 & 4 & 4 \end{bmatrix}$.

(a) Find some bases for $N(A)$ and $C(A^T)$.

(b) Split the vector $x = \begin{bmatrix} 1 \\ 4 \\ 5 \end{bmatrix}$ into the sum $x_r + x_n$, where x_r is the row space component and x_n is the nullspace component.

(c) Is it possible to find a non-zero vector in the intersection $N(A) \cap C(A^T)$?

2. (25 pts) Let S be the subspace of \mathbb{R}^4 spanned by $(1, 0, -2, 1)$ and $(0, 1, 3, -2)$. Find a basis for the orthogonal complement S^\perp ?

3. (25 pts) (a) Find the projection of the vector $(1, 4)$ onto $(1, 3)$

(b) Let Q be the point on the line $y = \frac{1}{3}x$ that is closest to the point $(1, 4)$. Determine the coordinates of Q .

4. (25%) (a) Find the projection of $b = (1, 2, 3)^T$ onto the column space of

$$A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \\ 0 & 2 \end{bmatrix}.$$

(b) Find the projection of b onto the first column vector of A , and the projection onto the second column of A . What is their sum?