OKLAHOMA STATE UNIVERSITY

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECEN 5713 Linear System
Fall 1998
Midterm Exam #2

Name : ______________________________

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<u>Problem 1</u>:

Let $F=\{0,1,2,3,4\}$. Define the rules of addition and multiplication such that F is a field.

<u>Problem 2</u>:

Find the "<u>relationship</u>" between the two bases $\{v^1, v^2, v^3\}$ and $\{\bar{v}^1, \bar{v}^2, \bar{v}^3\}$, where $v^1 = [2 \quad 1 \quad 0]^T$, $v^2 = [1 \quad 0 \quad -1]^T$, $v^3 = [1 \quad 0 \quad 0]^T$, $\bar{v}^1 = [1 \quad 0 \quad 0]^T$, $\bar{v}^2 = [0 \quad 1 \quad -1]^T$, and $\bar{v}^3 = [0 \quad 1 \quad 1]^T$. Determine the "<u>representations</u>" of the vector $e_2 = [0 \quad 1 \quad 0]^T$ with respect to both of the above bases.

<u>Problem 3</u>:

Determine the matrix X in $\begin{bmatrix} A & B \\ 0 & D \end{bmatrix}^{-1} = \begin{bmatrix} A^{-1} & X \\ 0 & D^{-1} \end{bmatrix}$, where it is assumed that A and D are nonsingular.

Problem 4:

Determine the bases for the range and null spaces of the matrix

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

Problem 5:

Let

$$S = \left\{ x \in \Re^3 | x = \alpha \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}, \alpha \in \Re \right\},$$

find the orthogonal complement space of S, $S^{\perp} (\subset \Re^3)$, and determine an orthonormal basis and dimension for $S^{\perp}$. For $x = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}^T (\in \Re^3)$, find its direct sum representation (i.e., x_1 and x_2) of $x = x_1 \oplus x_2$, such that $x_1 \in S, x_2 \in S^{\perp}$.