Mathematics 2310: Linear Algebra with Applications

Spring 2012

Preliminary Exam 1: February 22
This exam is closed book: no notes, calculators or other aids allowed.

1. Set $A$, $B$ and $C$ to be the matrices

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}, \quad B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{pmatrix}, \quad C = \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix}$$

Compute the matrices $AB$, $BA$, $AC$, $CA$ if they are defined. If they are not defined, explain why.

2. Set $A$ to be the matrix

$$A = \begin{pmatrix} 1 & -1 & 1 \\ -1 & 3 & 1 \\ 2 & 2 & 6 \end{pmatrix}$$

(a) Factor $A = LU$ where $L$ is lower triangular and $U$ is upper triangular.
(b) Find the row reduced echelon form $R$ of $A$.
(c) Find a non-zero vector in the null space of $A$ or explain why none exists.

3. Find a system of equations whose solutions consist of the line through the origin and the vector $(1, 1, 1)^T$ in $\mathbb{R}^3$.

4. Set

$$A = \begin{pmatrix} 1 & -1 & 1 \\ -1 & 3 & 1 \\ 2 & 2 & 6 \end{pmatrix}, \quad b = \begin{pmatrix} 0 \\ 2 \\ 4 \end{pmatrix}$$

(a) Find a solution of the equation $Ax = b$.
(b) Is the set of solutions of $Ax = b$ a subspace? Why or why not?