18.06 Quiz 1 Professor Strang February 28, 2011

Your PRINTED name is ____________________ **1.**

Your Recitation Instructor (and time) is ____________________ **2.**

Instructors: (Pires)(Hezari)(Sheridan)(Yoo) **3.**

1. (a) By elimination find the **rank** of A and the pivot columns of A (in its column space):

$$A = \begin{bmatrix} 1 & 2 & 1 & 4 \\ 3 & 6 & 3 & 9 \\ 2 & 4 & 2 & 9 \end{bmatrix}.$$

(b) Find the special solutions to $Ax = 0$ and then find **all solutions** to $Ax = 0$.

(c) For which number b_3 does $Ax = \begin{bmatrix} 3 \\ 9 \\ b_3 \end{bmatrix}$ have a solution?

Write the **complete solution** x (the general solution) with that value of b_3.

2. Suppose A is a 3 by 5 matrix and the equation $Ax = b$ has a solution for every b. What are $(a)(b)(c)(d)$? (If you don't have enough information to answer, tell as much about the answer as you can.)

   (a) Column space of A

   (b) Nullspace of A

   (c) Rank of A

   (d) Rank of the 6 by 5 matrix $B = \begin{bmatrix} A \\ A \end{bmatrix}$.

3. (a) When an odd permutation matrix P_1 multiplies an even permutation matrix P_2, the product $P_1 P_2$ is ________________ (EXPLAIN WHY).

(b) If the columns of B are vectors in the nullspace of A, then AB is ________________ (EXPLAIN WHY).

(c) If $c = 0$, factor this matrix into $A = LU$ (lower triangular times upper triangular):

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 9 \\ 1 & 8 & c \end{bmatrix}.$$

(d) That matrix A is invertible unless $c =$ ________________ .