18.06 Professor Strang Quiz 1 October 2, 2000

Your name is: ______________________________

Please circle your recitation:

1)	M2	2-131	Holm	2-181	3-3665	`tsh@math`
2)	M2	2-132	Dumitriu	2-333	3-7826	`dumitriu@math`
3)	M3	2-131	Holm	2-181	3-3665	`tsh@math`
4)	T10	2-132	Ardila	2-333	3-7826	`fardila@math`
5)	T10	2-131	Czyz	2-342	3-7578	`czyz@math`
6)	T11	2-131	Bauer	2-229	3-1589	`bauer@math`
7)	T11	2-132	Ardila	2-333	3-7826	`fardila@math`
8)	T12	2-132	Czyz	2-342	3-7578	`czyz@math`
9)	T12	2-131	Bauer	2-229	3-1589	`bauer@math`
10)	T1	2-132	Ingerman	2-372	3-4344	`ingerman@math`
11)	T1	2-131	Nave	2-251	3-4097	`nave@math`
12)	T2	2-132	Ingerman	2-372	3-4344	`ingerman@math`
13)	T2	1-150	Nave	2-251	3-4097	`nave@math`

1 (30 pts.) Suppose the matrix A has reduced row echelon form R:

$$A = \begin{bmatrix} 1 & 2 & 1 & b \\ 2 & a & 1 & 8 \\ & \text{(row} & 3) & \end{bmatrix}, \quad R = \begin{bmatrix} 1 & 2 & 0 & 3 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(a) What can you say immediately about row 3 of A?

(b) What are the numbers a and b?

(c) Describe *all solutions* of $Rx = 0$. Circle the spaces that are the same for A as for R: (row space)(column space)(null space).

2 (30 pts.) (a) Find the number c that makes this matrix singular (not invertible):

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 5 & 6 \\ 2 & 6 & c \end{bmatrix}$$

(b) If $c = 20$ what are the column space $C(A)$ and the nullspace $N(A)$? Describe them in this specific case (not just repeat their definitions). Also describe $C(A^{-1})$ and $N(A^{-1})$ for the inverse matrix!

(c) With $c = 20$ factor the matrix into $A = LU$ (lower triangular L and upper triangular U).

3 (40 pts.) Suppose A is an m by n matrix of rank r.

(a) If $Ax = b$ has a solution for every right side b, what is the column space of A?

(b) In part (a), what are all equations or inequalities that must hold between the numbers m, n, and r.

(c) Give a specific example of a 3 by 2 matrix A of rank 1 with first row [2 5]. Describe the column space $C(A)$ and the nullspace $N(A)$ completely.

(d) Suppose the right side b is the same as the first column in your example (part c). Find the complete solution to $Ax = b$.