18.06 Professor Strang Quiz 1 October 4, 2006

Grading

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Your PRINTED name is: ____________________

Please circle your recitation:

1)	T 10	2-131	K. Meszaros	2-333	3-7826	karola
2)	T 10	2-132	A. Barakat	2-172	3-4470	barakat
3)	T 11	2-132	A. Barakat	2-172	3-4470	barakat
4)	T 11	2-131	A. Osorno	2-229	3-1589	aosorno
5)	T 12	2-132	A. Edelman	2-343	3-7770	edelman
6)	T 12	2-131	K. Meszaros	2-333	3-7826	karola
7)	T 1	2-132	A. Edelman	2-343	3-7770	edelman
8)	T 2	2-132	J. Burns	2-333	3-7826	burns
9)	T 3	2-132	A. Osorno	2-229	3-1589	aosorno

1 (24 pts.) This question is about an m by n matrix A for which

$$Ax = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \text{ has } \textbf{no solutions} \quad \text{and} \quad Ax = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{ has } \textbf{exactly one solution}.$$

(a) Give all possible information about m and n and the rank r of A.

(b) Find all solutions to $Ax = 0$ and **explain your answer**.

(c) Write down an example of a matrix A that fits the description in part (a).

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2 (24 pts.) The 3 by 3 matrix A reduces to the identity matrix I by the following three row operations (in order):

E_{21} : Subtract 4 (row 1) from row 2.

E_{31} : Subtract 3 (row 1) from row 3.

E_{23} : Subtract row 3 from row 2.

(a) Write the inverse matrix A^{-1} in terms of the E's. **Then compute $\boldsymbol{A^{-1}}$.**

(b) What is the original matrix A?

(c) What is the lower triangular factor L in $A = LU$?

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3 (28 pts.) This 3 by 4 matrix depends on c:

$$A = \begin{bmatrix} 1 & 1 & 2 & 4 \\ 3 & c & 2 & 8 \\ 0 & 0 & 2 & 2 \end{bmatrix}$$

(a) *For each* c find a basis for the column space of A.

(b) *For each* c find a basis for the nullspace of A.

(c) *For each* c find the complete solution x to $Ax = \begin{bmatrix} 1 \\ c \\ 0 \end{bmatrix}$.

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4 (24 pts.) (a) If A is a 3 by 5 matrix, what information do you have about the nullspace of A?

(b) Suppose row operations on A lead to this matrix $R = \texttt{rref}(A)$:

$$R = \begin{bmatrix} 1 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Write all known information about the columns of A.

(c) In the vector space M of all 3 by 3 matrices (you could call this a matrix space), what subspace S is spanned by all possible row reduced echelon forms R?

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