18.06 Professor Edelman Quiz 2 October 22, 2008

Your PRINTED name is: _____

Please circle your recitation:

Grading	
1	
2	
3	
4	
5	
	_____

1)	T 10	2-131	J.Yu	2-348	4-2597	`jyu`
2)	T 10	2-132	J. Aristoff	2-492	3-4093	`jeffa`
3)	T 10	2-255	Su Ho Oh	2-333	3-7826	`suho`
4)	T 11	2-131	J. Yu	2-348	4-2597	`jyu`
5)	T 11	2-132	J. Pascaleff	2-492	3-4093	`jpascale`
6)	T 12	2-132	J. Pascaleff	2-492	3-4093	`jpascale`
7)	T 12	2-131	K. Jung	2-331	3-5029	`kmjung`
8)	T 1	2-131	K. Jung	2-331	3-5029	`kmjung`
9)	T 1	2-136	V. Sohinger	2-310	4-1231	`vedran`
10)	T 1	2-147	M Frankland	2-090	3-6293	`franklan`
11)	T 2	2-131	J. French	2-489	3-4086	`jfrench`
12)	T 2	2-147	M. Frankland	2-090	3-6293	`franklan`
13)	T 2	4-159	C. Dodd	2-492	3-4093	`cdodd`
14)	T 3	2-131	J. French	2-489	3-4086	`jfrench`
15)	T 3	4-159	C. Dodd	2-492	3-4093	`cdodd`

1 (10 pts.) The determinant of the 1000 by 1000 matrix A is 12. What is the determinant of $(-A)^T$? (Careful: No credit for the wrong sign.)

This page intentionally blank.

2 (30 pts.)

(a) P is the projection matrix onto the column space of A which has independent columns. Q is a square orthogonal matrix with the same number of rows as A. In simplest form, in terms of P and Q, what is the projection matrix onto the column space of QA?

(b) The vectors a, b, and c are independent. The matrix P is the projection matrix onto the span of a and b. Suppose we apply Gram-Schmidt onto the vectors a,b, and c producing orthonormal vectors q_1, q_2, and q_3. Write the unit vector q_3 in simplest form in terms of P and c only.

(c) The vector a, b and c are independent. The matrix $A = [a\ b\ c]$ has these three vectors as its columns. The QR decomposition writes $A = QR$ where Q is orthogonal and R is 3×3 upper triangular. Write $||c||$ in terms of only the elements of R in simplest form.

This page intentionally blank.

3 (15 pts.) The vector u is a "unit vector" meaning $||u|| = 1$. What are all the possible values of t which guarantee that the matrix $A = I + tuu^T$ is orthogonal?

This page intentionally blank.

4 (15 pts.) Suppose we have obtained from measurements n data points (t_i, b_i), and you are asked to find a best least squares fit function of the form $y = C + Dt + E(1 - t)$. Are C,D, and E uniquely determined? Write down a solvable system of equations that gives a solution to the least squares problem.

This page intentionally blank.

5 (30 pts.) (a) If A is invertible, must the column space of A^{-1} be the same as the column space of A?

(b) If A is square, must the column space of A^2 be the same as the column space of A?

This page intentionally blank.

This page intentionally blank.