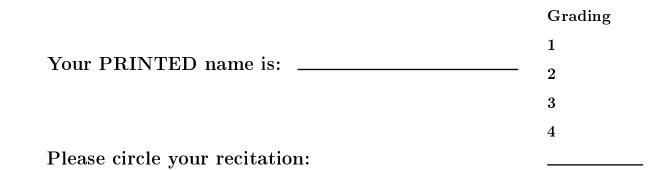
18.06 Professor Edelman Quiz 3 November 21, 2008



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)	Τ1	2-131	K. Jung	2-331	3-5029	kmjung
9)	Τ1	2-136	V. Sohinger	2-310	4-1231	vedran
10)	Τ1	2-147	M Frankland	2-090	3-6293	franklan
11)	Τ2	2-131	J. French	2-489	3-4086	jfrench
12)	T 2	2-147	M. Frankland	2-090	3-6293	franklan
13)	Τ2	4-159	C. Dodd	2-492	3-4093	cdodd
14)	Т3	2-131	J. French	2-489	3-4086	jfrench
15)	Т3	4-159	C. Dodd	2-492	3-4093	cdodd

1 (30 pts.) The complex matrix

$$A = \begin{bmatrix} a & c+di \\ c-di & b \end{bmatrix},$$

where a, b, c, and $d \neq 0$ are real numbers.

In (a) and (b) below circle the one **best** answer to the questions:

- (a) This matrix is necessarily: symmetric? Hermitian? unitary? Markov?
- (b) The two eigenvalues are necessarily: real? positive? zero? complex conjugates?
- (c) The sum of the two eigenvalues is _____.
- (d) The product of the two eigenvalues in terms of a, b, c, and d but not i is ______.
- (e) In terms of an eigenvalue λ (whose value you need not derive), write down an eigenvector of A.

2 (32 pts.) The real matrix

$$A = \begin{bmatrix} x & 3/5 \\ y & z \end{bmatrix}.$$

The answers to the questions below involve alternative equations or inequalities involving x,y, and z that characterize all matrices of a certain type. Write down the relations. For (a) through (c), credit is only given for the complete description in reasonably clear and simple form.

- (a) When is A positive definite? (Write two inequalities.)
- (b) When is A Markov? (Perhaps write two or more inequalities, and two equalities.)
- (c) When is A singular? (Write one equality)
- (d) Write down one such A that is orthogonal. (There are four possible A and you are asked to write down one.)

3 (13 pts.) The 4x4 Fourier matrix F has eigenvalues -2, 2, 2i, -2i. Preferably without any explicit computation (or even knowledge of the matrix itself) what is the matrix F^4 ? How do you know it has that particular Jordan form?

4 (25 pts.) In terms of x (0 < x < 1) complete

$$A = \begin{bmatrix} x \\ & \end{bmatrix},$$

so that A is a 2x2 matrix that is both Markov and singular.

What is A^{2008} ?