18.06 Professor Edelman Quiz 3 November 21, 2008

Grading

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Your PRINTED name is: ____________________

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Please circle your recitation:

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 (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.

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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.)

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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?

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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}?

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