18.06 Professor Edelman Quiz 3 December 3, 2012

Your PRINTED name is: _____

Grading	
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Please circle your recitation:

1	T 9	2-132	Andrey Grinshpun	2-349	3-7578	`agrinshp`
2	T 10	2-132	Rosalie Belanger-Rioux	2-331	3-5029	`robr`
3	T 10	2-146	Andrey Grinshpun	2-349	3-7578	`agrinshp`
4	T 11	2-132	Rosalie Belanger-Rioux	2-331	3-5029	`robr`
5	T 12	2-132	Geoffroy Horel	2-490	3-4094	`ghorel`
6	T 1	2-132	Tiankai Liu	2-491	3-4091	`tiankai`
7	T 2	2-132	Tiankai Liu	2-491	3-4091	`tiankai`

1 (16 pts.)

a) (4 pts.) Suppose C is $n \times n$ and positive definite. If A is $n \times m$ and $M = A^T C A$ is not positive definite, find the smallest eigenvalue of M. (Explain briefly.)

b) (12 pts.) If A is symmetric, which of these four matrices are necessarily positive definite? A^3, $(A^2 + I)^{-1}$, $A + I$, e^A. (Explain briefly.)

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2 (30 pts.)

Let $A = \begin{pmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$.

a) (6 pts.) What are the eigenvalues of A ? (Explain briefly.)

b) (6 pts.) What is the rank of A?

c) (6 pts.) What are the singular values of A?

d) (6 pts.) What is the Jordan form of A? (Explain briefly.)

e) (6 pts.) Compute in simplest form e^{tA}.

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3 (28 pts.)

We are told that A is 2×2, symmetric, and Markov and one of the real eigenvalues is y with $-1 < y < 1$.

a) (7 pts.) What is this matrix A in terms of y?

b) (7 pts.) Compute the eigenvectors of A.

c) (7 pts.) What is A^{2012} in simplest form?

d) (7 pts.) What is $\lim_{n\to\infty} A^n$ in simplest form? (Explain Briefly.)

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4 (26 pts.)

a) (5 pts.) P is a three by three permutation matrix. List all the possible values of a singular value. (Explain briefly.)

b) (9 pts.) P is a three by three permutation matrix. List all the possible values of an eigenvalue. (Explain briefly.)

c) (12 pts.) There are six 3×3 permutation matrices. Which are similar to each other? (Explain briefly.)

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