# Quiz #3 (CSE 4190.313)

## Monday, May 11, 2015

**Name:** _____     **ID No:** _____

1. (10 points) If $A$ is a Markov matrix, show that the sum of the components of $A\mathbf{x}$ equals the sum of the components of $\mathbf{x}$. Deduce that if $A\mathbf{x} = \lambda\mathbf{x}$ with $\lambda \neq 1$, the components of the eigenvector add to zero.

2. (10 points) Generally $e^A e^B$ is different from $e^B e^A$. They are both different from $e^{A+B}$. Check this using the following example:

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}, \quad B = \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix}, \quad A + B = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}.$$

3. (8 points) The identity transformation takes every vector to itself: $T\mathbf{x} = \mathbf{x}$. Find the corresponding matix, if the first basis is $\mathbf{v}_1 = (1,0)$, $\mathbf{v}_2 = (0,1)$, and the second basis is $\mathbf{w}_1 = (1,2)$, $\mathbf{w}_2 = (3,4)$.

4. (12 points) True or false, with a good reason or a counterexample.

   (a) (3 points) An invertible matrix cannot be similar to a singular matrix.

   (b) (3 points) A symmetric matrix cannot be similar to a nonsymmetric matrix.

   (c) (3 points) $A$ cannot be similar to $-A$ unless $A = 0$.

   (d) (3 points) $A - I$ cannot be similar to $A + I$.