Quiz #1 (CSE 4190.313)
Thursday, March 21, 2019

Name: _____   ID No: _____

1. (10 points)

   (a) (3 points) Explain why the inner product $\mathbf{x}^T\mathbf{y}$ of $\mathbf{x}$ and $\mathbf{y}$ equals the inner product of $P\mathbf{x}$ and $P\mathbf{y}$, where P is a permutation matrix.

   (b) (7 points) With $\mathbf{x}^T = (1, 2, 3)$ and $\mathbf{y}^T = (1, 4, 2)$, choose a 3×3 permutation matrix P to show that $(P\mathbf{x})^T\mathbf{y}$ is not always equal to $\mathbf{x}^T(P\mathbf{y})$.

2. (10 points)

(a) (3 points) Suppose you solve $A\mathbf{x} = \mathbf{b}$ for three special right-hand sides $\mathbf{b}$:

$$A\mathbf{x}_1 = \mathbf{e}_1, \quad A\mathbf{x}_2 = \mathbf{e}_2, \quad A\mathbf{x}_3 = \mathbf{e}_3.$$

If the solutions $\mathbf{x}_1$, $\mathbf{x}_2$, $\mathbf{x}_3$ are the columns of a matrix X, what is AX?

(b) (7 points) Find the inverses of

$$A_1 = \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 3 & 0 & 0 \\ 4 & 0 & 0 & 0 \end{bmatrix}, \quad A_2 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 0 & 3 & 1 & 0 \\ 0 & 0 & 4 & 1 \end{bmatrix}, \quad A_3 = \begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \\ 0 & 0 & 5 & 6 \\ 0 & 0 & 7 & 8 \end{bmatrix}.$$