

CSE 494/598, Fall 2007 Quiz 1
Wednesday, September 19

1. True or False. (**5 points**)

- (i) If A and B are both nonsingular, then $A + B$ is also nonsingular.
- (ii) Let $A \in \mathbb{R}^{n \times n}$ be a symmetric matrix and let λ be its largest eigenvalue. Then λ^2 is the largest eigenvalue of the matrix AA .
- (iii) For any matrix $A \in \mathbb{R}^{m \times n}$, AA^T and $A^T A$ are both positive semi-definite.
- (iv) Let v be any vector in \mathbb{R}^n with $n \geq 2$. Then $\|v\|_1 \|v\|_\infty \leq \frac{1+\sqrt{n}}{2} \|v\|_2$.
- (v) If matrix $A \in \mathbb{R}^{n \times n}$ is orthogonal and upper triangular, then A is diagonal.

2. Let $x = (12, 3, 4)^T$, $y = (13, 0, 0)^T$, and $z = (0, 13, 0)^T$. (**5 points**)

- (i) Are x , y , and z linearly independent?
- (ii) Find a vector $a \in \mathbb{R}^3$ that is orthogonal to x .
- (iii) Let A be the matrix consisting of x , y , and z . That is, $A = [x, y, z] \in \mathbb{R}^{3 \times 3}$. Compute $\|A\|_1$ and $\|A\|_\infty$.
- (iv) Compute the Householder matrix P so that $Px = y$.
- (v) Compute two Givens (rotation) matrices G_1 and G_2 so that $G_2 G_1 x = y$.