# MA 232 - Linear Algebra

Homework 5 (due November 13)

**Problem 1** [20pts] Find the eigenvalues and eigenvectors of the following matrices $A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$ and $A^2$. Compare their eigenvalues.

**Problem 2** [20pts] Show that $A$ and its transpose $A^T$ have the same eigenvalues. Find an example that shows that they don't have the same eigenvectors.

**Problem 3** [20pts] Diagonalize the following matrices in the form $S\Lambda S^{-1}$.

$$A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 1 \\ 3 & 3 \end{bmatrix}$$

**Problem 4** [20pts] Find the eigenvalues and the unit eigenvectors of

$$A = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 0 & 0 \\ 2 & 0 & 0 \end{bmatrix}$$

**Problem 5** [20pts] Test to see if $R^T R$ is positive definite in each case.

$$R = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}, R = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 2 & 1 \end{bmatrix}, R = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$$

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