

Math 251 X02 Assignment Four

Name: \_\_\_\_\_

**Due: In class on Friday September 9**

Assignments must be completed on this paper. Marks may be deducted for not showing all your work.

1. [6 marks] a) Find an orthonormal basis for  $\text{span} \left( \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 5 \\ 6 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} \right)$ .

b) Use part a) to find the  $QR$  factorization of  $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 5 & 1 \\ 0 & 6 & 2 \\ 0 & 0 & 3 \end{bmatrix}$ .

2. [9 marks] Find the matrix  $Q$  that orthogonally diagonalizes  $A = \begin{bmatrix} 4 & -1 & -1 \\ -1 & 4 & -1 \\ -1 & -1 & 4 \end{bmatrix}$ .

The characteristic polynomial of  $A$  is  $(\lambda - 2)(\lambda - 5)^2$ .  
(Attach an extra page if necessary).

3. [4 marks] Express  $z = \frac{x+yi}{13+5i}$  in the form  $a + bi$ .

4. [6 marks] Find all the cube roots of  $-8i$ . Express each root in the form  $a + bi$ .