KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

EE 662 **ELECTRICAL ENGINEERING DEPARTMENT** Mar 18, 2010

HW #3

Due Date: Mar. 28, 2010

Q1 (Matrix manipulations of a scalar quantity) Consider the expression

$$z(\mathbf{x}) = \sigma + \mathbf{b}^*\mathbf{x} + \mathbf{x}^*\mathbf{c} + \mathbf{x}^*\mathbf{A}\mathbf{x}$$

where $\sigma, \mathbf{b}, \mathbf{c}, \mathbf{A}$, and $\mathbf{x}$ are in general complex valued

1. Write $z(\mathbf{x})$ in the form $\mathbf{a}^*\mathbf{Q}\mathbf{a}$ for some $\mathbf{a}$ and $\mathbf{Q}$ that you should specify.
2. What are the conditions on $\sigma, \mathbf{b}, \mathbf{c}$, and $\mathbf{A}$ for z to be real.

Q2 (Positive definiteness) Let $\mathbf{A}$ and $\mathbf{B}$ be two Hermitian positive definite matrices. Define the matrix

$$\mathbf{Z} = \begin{bmatrix} \mathbf{A} & \mathbf{O} \\ \mathbf{O} & \mathbf{B} \end{bmatrix}$$

Prove that $\mathbf{Z}$ is positive definite if and only if both $\mathbf{A}$ and $\mathbf{B}$ are positive definite.

Q3 Solve problem 8 in Chapter 2 of the text book.

Q4 Solve problem 26 in Chapter 2 of the text book.

Q5 Solve problem 21 in Chapter 2 of the text book.