Fin 500J Homework 1

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Problem 1. For

$$A = \begin{pmatrix} 3 & 6 \\ 2 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 3 & 2 \\ 0 & -1 & -1 & 1 \end{pmatrix}, \quad C = \begin{pmatrix} 2 & 4 & 5 \\ 0 & 3 & 0 \\ 1 & 0 & 1 \end{pmatrix}$$

compute

$$(1)(A + A^T)B \quad (2)\ Determinant\ of\ C$$

and verify your answers using Matlab.

Problem 2. Invert the coefficient matrix to solve the following systems of equations and verify your answers using Matlab:
(1)

$$2x_1 + x_2 = 5, \quad x_1 + x_2 = 3$$

(2)

$$2x_1 + x_2 = 4, \quad 6x_1 + 2x_2 + 6x_3 = 20, \quad -4x_1 - 3x_2 + 9x_3 = 3.$$

Problem 3. Determine the definiteness of the following symmetric matrices:

$$A_1 = \begin{pmatrix} 5 & 2 & 1 \\ 2 & 4 & -1 \\ 1 & -1 & 2 \end{pmatrix}, \quad A_2 = \begin{pmatrix} 1 & 2 & 0 \\ 2 & 4 & 5 \\ 0 & 5 & 6 \end{pmatrix}$$

Problem 4. Let

$$x = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix}, \quad C = \begin{pmatrix} c_{11} & c_{12} & \cdots & c_{1n} \\ c_{21} & c_{22} & \cdots & c_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ c_{n1} & c_{n2} & \cdots & c_{nn} \end{pmatrix},$$

show

$$(1)\frac{\partial x^T C}{\partial x} = C, \qquad (2)\frac{\partial x^T x}{\partial x} = 2x.$$