



B.E. International Program

Faculty of Economics, Thammasat University



EE 320 Introductory Mathematical Economics (Section 046402)

Semester 1/2013

Quiz 2 (a)

Given the following system of equations

$$Q_D = 16 - P$$

$$Q_S = 4 + 3P$$

$$Q_D = Q_S$$

a) (1 point) Rewrite the above system in matrix form (i.e., $AX = d$).

$$Q_D + P = 16$$

$$Q_S - 3P = 4$$

$$Q_D - Q_S = 0$$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -3 \\ 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} Q_D \\ Q_S \\ P \end{bmatrix} = \begin{bmatrix} 16 \\ 4 \\ 0 \end{bmatrix}$$

b) (4 points) Find $|A|$ by using cofactor-expansion method on the 1st row of A.

$$|A| = (1)(-1)^{1+1} \begin{vmatrix} 1 & -3 \\ -1 & 0 \end{vmatrix} + (1)(-1)^{1+3} \begin{vmatrix} 0 & 1 \\ 1 & -1 \end{vmatrix}$$

$$= (1)(0-3) + (1)(0-1)$$

$$= -4$$

c) (5 points) Find A^{-1} and solve for the three unknowns by using matrix inversion method.

$$A^{-1} = \frac{1}{|A|} \text{Adj}(A) = \frac{1}{|A|} [C]^T$$

$$[C] = \begin{bmatrix} \begin{vmatrix} 1 & -3 \\ -1 & 0 \end{vmatrix} & -\begin{vmatrix} 0 & -3 \\ 1 & 0 \end{vmatrix} & \begin{vmatrix} 0 & 1 \\ 1 & -1 \end{vmatrix} \\ -\begin{vmatrix} 0 & 1 \\ -1 & 0 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 0 \end{vmatrix} & -\begin{vmatrix} 1 & 0 \\ 1 & -1 \end{vmatrix} \\ \begin{vmatrix} 0 & 1 \\ 1 & -3 \end{vmatrix} & -\begin{vmatrix} 1 & 1 \\ 0 & -3 \end{vmatrix} & \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \end{bmatrix} = \begin{bmatrix} -3 & -3 & -1 \\ -1 & -1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$$

$$\Rightarrow A^{-1} = -\frac{1}{4} \begin{bmatrix} -3 & -1 & -1 \\ -3 & -1 & 3 \\ -1 & 1 & 1 \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 3 & 1 & 1 \\ 3 & 1 & -3 \\ 1 & -1 & -1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} Q_D^* \\ Q_S^* \\ P^* \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 3 & 1 & 1 \\ 3 & 1 & -3 \\ 1 & -1 & -1 \end{bmatrix} \begin{bmatrix} 16 \\ 4 \\ 0 \end{bmatrix} = \begin{bmatrix} 13 \\ 13 \\ 3 \end{bmatrix}$$

