Economics 1B
Suggested Solutions - Seminar 4

Max Schroder

February 28, 2020

Abstract

This guide is supposed to be complementary to the official solutions supplied by the lecturer. All errors are my own.

Question 2

$$A = \begin{bmatrix} 2 & 3 & 1 & 9 \\ 1 & 0 & 5 & 0 \\ 6 & 7 & 8 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 7 & 9 & 6 \\ 2 & 1 & 0 & 5 \\ 6 & 4 & 5 & 3 \end{bmatrix}$$

a)

$$2A = \begin{bmatrix} 4 & 6 & 2 & 18 \\ 2 & 0 & 10 & 0 \\ 12 & 14 & 16 & 8 \end{bmatrix}$$

b)

$$2B = \begin{bmatrix} 2 & 14 & 18 & 12 \\ 4 & 2 & 0 & 10 \\ 12 & 8 & 10 & 6 \end{bmatrix}$$

c)

$$2A + 2B = \begin{bmatrix} 4 & 6 & 2 & 18 \\ 2 & 0 & 10 & 0 \\ 12 & 14 & 16 & 8 \end{bmatrix} + \begin{bmatrix} 2 & 14 & 18 & 12 \\ 4 & 2 & 0 & 10 \\ 12 & 8 & 10 & 6 \end{bmatrix} = \begin{bmatrix} 6 & 20 & 20 & 30 \\ 6 & 2 & 10 & 10 \\ 24 & 22 & 26 & 14 \end{bmatrix}$$

d)

The distributive law applies for matrices as well.

Question 3

$4B$ is possible - you can always multiply a matrix by a scalar - order 2×3.

$A + B$ is not possible - the matrices don't have the same order.

$3B^T + C$ is not possible - B^T has order 3×2.

AB is not possible since the inner sizes don't match.

$B^T A$ same.

C has order 4×2 and B has order 2×3, so CB has order 4×3 and $(CB)^T$ has order 3×4.

CB has order 4×3 and A has oder 3×3 so CBA has order 4×3.

Question 4

a)

$$AB = \begin{bmatrix} 5900 \\ 1100 \end{bmatrix}$$

Total revenue generated from each customer.

b)

$$AC = \begin{bmatrix} 13 & 7 & 23 & 22 \\ 3 & 1 & 4 & 5 \end{bmatrix}$$

number of tonns of each raw material needed for the production of each customers order.

c)

$$CD = \begin{bmatrix} 35 \\ 75 \\ 30 \end{bmatrix}$$

raw material cost for the production of one unit of each type of item.

d)

$$ACD = \begin{bmatrix} 1005 \\ 205 \end{bmatrix}$$

total raw material cost to fulfill each customers order.

e)

$$EAB = 7000$$

total revenue.

f)

$$EACD = 1210$$

total cost of raw materials.

g)

$$EAB - EACD = 5790$$

revenue minus raw material costs.

Question 5

1)

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}, B = \begin{bmatrix} 1 & -1 \\ 2 & 1 \\ -3 & 4 \end{bmatrix}$$

a)

$$A^T = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{bmatrix}$$

b)

$$B^T = \begin{bmatrix} 1 & 2 & -3 \\ -1 & 1 & 4 \end{bmatrix}$$

c)

$$A + B = \begin{bmatrix} 2 & 1 \\ 5 & 5 \\ 2 & 10 \end{bmatrix}$$

d)

$$(A + B)^T = \begin{bmatrix} 2 & 5 & 2 \\ 1 & 5 & 10 \end{bmatrix}$$

e)

$$A^T + B^T = (A + B)^T$$

2)

$$C = \begin{bmatrix} 1 & 4 \\ 5 & 9 \end{bmatrix}, D = \begin{bmatrix} 2 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$$

a)

$$C^T = \begin{bmatrix} 1 & 5 \\ 4 & 9 \end{bmatrix}$$

b)

$$D^T = \begin{bmatrix} 2 & -1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$

c)

$$CD = \begin{bmatrix} -2 & 1 & 4 \\ 1 & 5 & 9 \end{bmatrix}$$

d)

$$(CD)^T = \begin{bmatrix} -2 & 1 \\ 1 & 5 \\ 4 & 9 \end{bmatrix}$$

e)

$$(CD)^T = D^T C^T$$

Question 7

$$A = \begin{bmatrix} 1 & 2 & -4 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 7 \\ 3 \\ 2 \end{bmatrix}$$

$$
\begin{aligned}
AB &= (1*1 + 2*7 + -4*3 + 3*2) = 9 \\
BA &= \begin{bmatrix} 1 & 2 & -4 & 3 \\ 7 & 14 & -28 & 21 \\ 3 & 6 & -12 & 9 \\ 2 & 4 & -8 & 6 \end{bmatrix}
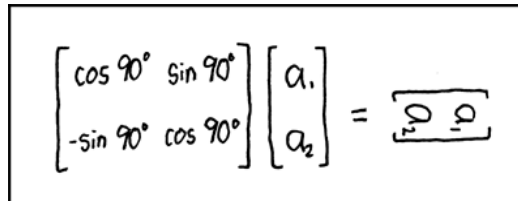\end{aligned}
$$

Question 8

a)

$$
\begin{aligned}
A &= \begin{bmatrix} 7 & 5 \\ 1 & 3 \end{bmatrix}, \mathbf{x} = \begin{bmatrix} x \\ y \end{bmatrix} \\
A\mathbf{x} &= \begin{bmatrix} 7x + 5y \\ x + 3y \end{bmatrix}
\end{aligned}
$$

b)

$$
\mathbf{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, A = \begin{bmatrix} 2 & 3 & -2 \\ 1 & -1 & 2 \\ 4 & 2 & 5 \end{bmatrix}, b = \begin{bmatrix} 6 \\ 3 \\ 1 \end{bmatrix}
$$

Figure 1: Source:https://xkcd.com/