

Name: AHMED Musa

ID # 7944

SECTION "B"

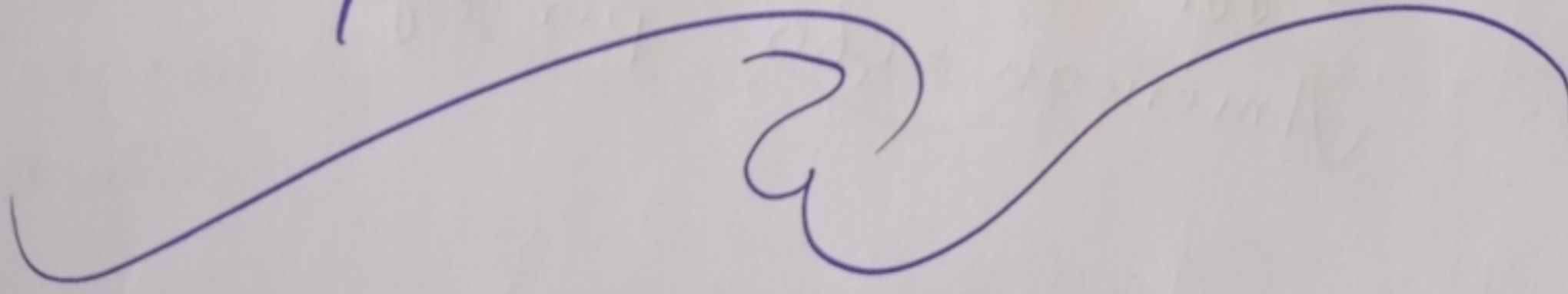
Sub: DE

Instructor; Mam SHOMIALA MAZHAR

Department of Civil Engineering

IQRA NATIONAL UNIVERSITY

PESHAWER

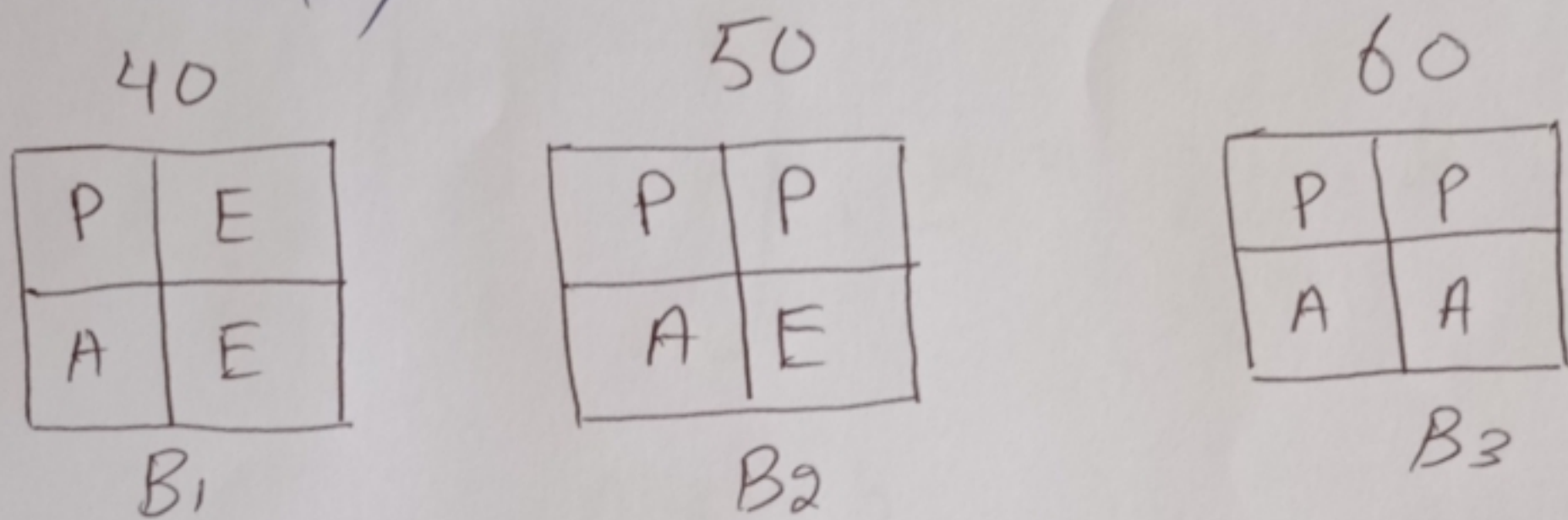


①

Question No #01

A yarn merchant sells brands A, B, C of yarn each of which is a blend of Pakistani, Egyptian, and American cotton in the ratio 1:2:1, 2:1:1, 2:0:2 respectively. If one kilogram of A, B, C costs 40, 50 and 60 Rupees respectively. Find the cost of a kilogram of cotton of each country.

Solution: →



Let x, y, z be the cost of cost/kg of Pakistani, Egyptian and American cotton respectively. Then according to the given conditions.

$$\left. \begin{aligned} \frac{1}{4}x + \frac{2}{4}y + \frac{1}{4}z &= 40 \\ \frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z &= 50 \\ \frac{2}{4}x + \frac{2}{4}z &= 60 \end{aligned} \right\} \text{----- (S')}$$

$$\begin{cases} 1x + 2y + 1z = 160 \\ 2x + 1y + 1z = 200 \\ 1x + 1z = 120 \end{cases} \text{----- (S)}$$

In Matrix form, we can written as;

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}, \quad \underline{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad \underline{b} = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

$$A \underline{x} = \underline{b}$$

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

$$A_1 = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix},$$

$$A_2 = \begin{bmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{bmatrix}$$

$$A_3 = \begin{bmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{bmatrix}$$

(3)

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}, \quad \underline{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad \underline{b} = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 1(1 \times 1 - 0 \times 1) - 2(2 \times 1 - 1 \times 1) + 1(2 \times 1 - 1 \times 1)$$

$$|A| = -2,$$

$$|A_1| = \begin{vmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{vmatrix} = 160(1 \times 1 - 0 \times 1) - 2(200 \times 1 - 120 \times 1) + 1(200 \times 1 - 120 \times 1)$$

$$|A_1| = -120,$$

$$|A_2| = \begin{vmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{vmatrix} = 1(200 \times 1 - 120 \times 1) - 160(2 \times 1 - 1 \times 1) + 1(2 \times 1 - 1 \times 200)$$

$$|A_2| = -40$$

$$|A_3| = \begin{vmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{vmatrix} = 1(1 \times 120 - 0 \times 200) - 2(2 \times 120 - 1 \times 200) + 160(2 \times 120 - 1 \times 1)$$

$$|A_3| = -120,$$

Hence

(4)

$$|A| = -2$$

$$|A_1| = -120$$

$$|A_2| = -40$$

$$|A_3| = -120$$

According to Cramers Rule

$$x = \frac{|A_1|}{|A|} = \frac{-120}{-2} = 60$$

$$y = \frac{|A_2|}{|A|} = \frac{-40}{-2} = 20$$

$$z = \frac{|A_3|}{|A|} = \frac{-120}{-2} = 60$$

$$(x, y, z) = (60, 20, 60)$$

So Pakistani = Rs. 60 per kg

Egyptian = Rs. 20 per kg

American = Rs. 60 per kg

PTO

⑤

To check The ans-

such as $(x, y, z) = (60, 20, 60)$

So this value put in 3 equations.

$$\frac{1}{4}x + \frac{2}{4}y + \frac{1}{4}z = 40 \text{ ————— (1)}$$

Put $x=60, y=20, z=60$ in eq (1)

$$\frac{1}{4}(60) + \frac{2}{4}(20) + \frac{1}{4}(60) = 40$$

$$\boxed{40 = 40}$$

$$\frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z = 50 \text{ ————— (2)}$$

Put $x=60, y=20, z=60$ in eq (2)

$$\frac{2}{4}(60) + \frac{1}{4}(20) + \frac{1}{4}(60) = 50$$

$$\boxed{50 = 50}$$

$$\frac{2}{4}x + \frac{2}{4}z = 60 \text{ ————— (3)}$$

put $x=60, y=20, z=60$ in eq (3)

$$\frac{2}{4}(60) + \frac{2}{4}(60) = 60$$

$$\boxed{60 = 60}$$

left hand side is equal to the Right hand side of Three equations So Solution is correct.