

Quiz # 01

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Sec # B

Dept # BE (C)

Topic # Matrices.

(1)

Q.1) 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?

Sol:-

(2)

40

P	E
A	E

A

50

P	P
A	E

B

60

P	P
A	A

C

Now,

$$\left. \begin{aligned} \frac{1}{4}x + \frac{2}{4}y + \frac{1}{4}z &= 40, \\ \frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z &= 50, \\ \frac{2}{4}x + \frac{2}{4}z &= 60, \end{aligned} \right\} \textcircled{1}$$

$$\left. \begin{aligned} 1x + 2y + 1z &= 160 \\ 2x + 1y + 1z &= 200 \\ 1x + 1z &= 120. \end{aligned} \right\} \textcircled{2}$$

In matrix form, we write as,

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

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

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

$$Ax = b$$

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

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

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

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

(4)

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

$$|A| = -2$$

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

$$|A_1| = -120$$

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

$$|A_2| = -40$$

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

$$|A_3| = -120$$

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$$|A| = -2, |A_1| = -120, |A_2| = -40, \\ |A_3| = -120.$$

According to Cramer's
Rule,

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

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

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

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

Ans.