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QUIZ TOPIC: MATRICES

$$x = A, \quad y = B, \quad z = C$$

Let x, y and z be the cost/kg of Pakistani, Egyptian and American cotton respectively

According to the condition

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

Sum of Ratio = 4

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

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

Multiplying '4' both sides on equation (1), (2) and (3), we get

$$(1) \Rightarrow x + 2y + z = 160$$

$$(2) \Rightarrow 2x + y + z = 200$$

$$(3) \Rightarrow 2x + 0y + z = 120$$

Now, we use these equations in matrix form

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

So,

$$A_1 = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix}, \quad x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad B_1 = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

$$\Rightarrow A_1 x = B_1$$

Now, using Cramer's Rule

$$A_{1,x} = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix} \quad \text{we just replace } B_1 \text{ in 1st column of } A_1$$

$$|A_{1,x}| = 160 \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} - 2 \begin{vmatrix} 200 & 1 \\ 120 & 1 \end{vmatrix}$$

$$+ \begin{vmatrix} 200 & 1 \\ 120 & 0 \end{vmatrix}$$

$$= 160(1-0) - 2(200-120) + 1(0-120)$$

$$= 160 - 2(80) - 120 = 160 - 160 - 120$$

$$|A_{1,x}| = -120$$

Now,

$$x = \frac{|A_{1,x}|}{|A_1|} \rightarrow \textcircled{4}$$

Now find $|A_1|$

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

$$= 1 - 2 - 1 = -2$$

Now,

$$(4) \Rightarrow x = \frac{|A_{1x}|}{|A_{11}|} = \frac{-120}{-2} = 60$$

$$x = A = 60$$

also,

$$y = \frac{|A_{1y}|}{|A_{11}|} \rightarrow (5)$$

$$A_{1y} = \begin{bmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{bmatrix} \quad \text{just replace } B_1 \text{ in 2nd column of } A_1$$

$$|A_{1y}| = 1(200 - 120) - 160(2 - 1) + 1(240 - 200)$$

$$= 80 - 160 + 40$$

$$|A_{1y}| = -40$$

$$(5) \Rightarrow y = \frac{|A_{1y}|}{|A_{11}|} = \frac{-40}{-2} = 20$$

$$y = B = 20$$

again

$$z = \frac{|A_{1z}|}{|A_{11}|} \rightarrow (6)$$

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

$$|A_1 Z| = 1(120 - 0) - 2(240 - 200) + 160(0 - 1)$$

$$= 120 - 80 - 160$$

$$= -120$$

$$(b) \Rightarrow Z = \frac{|A_1 Z|}{|A_1|} = \frac{-120}{-2} = 60$$

$$Z = c = 60$$

Hence

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

or

$$(A, B, C) = (60, 20, 60)$$

it means that

Pakistani blend cost / kg of cotton = 60
 Egyptian blend cost / kg of cotton = 20
 American blend cost / kg of cotton = 60.