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Quiz # 02 semester 4th

Sol:-

40	
P	E
A	E

S_1

50	
P	P
A	E

S_2

P	P
A	A

S_3

1 : 2 : 1 , 2 : 1 : 1 2 : 0 : 2

So,

Let x, y, z be the costing in pak, Egypt and American.

According to given condition;

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

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

In matrices;

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

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

We know $AX = B$

$$X = A^{-1}B$$

and $A^{-1} = \dfrac{\text{adj}(A)}{|A|}$

$\Rightarrow A_1 = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix}$, $A_2 = \begin{bmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{bmatrix}$

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

Now $|A| = \begin{vmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix}$.

expand by R_1

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

$= 1(1) - 2(2-1) + 1(2-1)$

$\Rightarrow -1 + 2 + 1$

$|A| = 2$

Now $A_1 = \begin{vmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{vmatrix}$ Expand with R_1

$\cancel{= 160\begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} - 200\begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix}}$

$= 160\begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} - 2\begin{vmatrix} 200 & 1 \\ 120 & 1 \end{vmatrix} + 1\begin{vmatrix} 200 & 1 \\ 120 & 0 \end{vmatrix}$

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

$|A| = -120$

Same process for A_2 and A_3.

$|A_2| = \begin{vmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{vmatrix}$ expand with R_1

$= 1\begin{vmatrix} 200 & 1 \\ 120 & 1 \end{vmatrix} - 160\begin{vmatrix} 2 & 1 \\ 1 & 1 \end{vmatrix} + 1\begin{vmatrix} 2 & 200 \\ 1 & 120 \end{vmatrix}$

$= 1(200-120) - 160(2-1) + 1(240-200)$.

$A_2 = -40$

$|A_3| = \begin{vmatrix} 1 & 20 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{vmatrix}$ expand

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

$= -1120$

According to Cramer's Rule.

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

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

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

$\rightarrow$

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

pak; 60

egyptian; 20

American; 60

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