Solution of Simultaneous Linear Equations Ex 8.1 Q14

Let X, Y and Z be the cash awards for
Honesty, Regularity and Hard work respectively.
As per the data in the question, we get

$X + Y + Z = 6000$

$X + 3Z = 11000$

$X - 2Y + Z = 0$

The above three simulataneous equations
can be written in the matrix form as

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 3 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 6000 \\ 11000 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 3 \\ 1 & -2 & 1 \end{bmatrix}^{-1}\begin{bmatrix} 6000 \\ 11000 \\ 0 \end{bmatrix} \ldots(1)$$

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 3 \\ 1 & -2 & 1 \end{bmatrix}$$

$$|A| = 1(6) - 1(-2) + 1(-2) = 6$$

$$cofA = \begin{bmatrix} 6 & 2 & -2 \\ -3 & 0 & 3 \\ 3 & -2 & -1 \end{bmatrix}$$

Solution of Simultaneous Linear Equations Ex 8.1 Q15

Let x, y and z be teh prize amount per person for
Resourcefulness, Competence and Determination respectively.
As per the data in the question, we get
$4x + 3y + 2z = 37000$
$5x + 3y + 4z = 47000$
$x + y + z = 12000$
The above three simulataneous equations
can be written in matrix form as

$$\begin{bmatrix} 4 & 3 & 2 \\ 5 & 3 & 4 \\ 1 & 1 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 37000 \\ 47000 \\ 12000 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 4 & 3 & 2 \\ 5 & 3 & 4 \\ 1 & 1 & 1 \end{bmatrix}^{-1}\begin{bmatrix} 37000 \\ 47000 \\ 12000 \end{bmatrix} \ldots(1)$$

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

$$|A| = 4(-1) - 3(1) + 2(2) = -3$$

$$cofA = \begin{bmatrix} -1 & -1 & 2 \\ -1 & 2 & -1 \\ 6 & -6 & -3 \end{bmatrix}$$

$$adjA = (cofA)^T = \begin{bmatrix} -1 & -1 & 6 \\ -1 & 2 & -6 \\ 2 & -1 & -3 \end{bmatrix}$$

$$A^{-1} = \frac{adjA}{|A|} = \frac{1}{-3}\begin{bmatrix} -1 & -1 & 6 \\ -1 & 2 & -6 \\ 2 & -1 & -3 \end{bmatrix}$$

From (1)

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \frac{1}{-3}\begin{bmatrix} -1 & -1 & 6 \\ -1 & 2 & -6 \\ 2 & -1 & -3 \end{bmatrix}\begin{bmatrix} 37000 \\ 47000 \\ 12000 \end{bmatrix}$$

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \frac{1}{-3}\begin{bmatrix} -12000 \\ -15000 \\ -9000 \end{bmatrix} = \begin{bmatrix} 4000 \\ 5000 \\ 3000 \end{bmatrix}$$

The values x, y and z describe the amount of prizes
per person for resourcefulness, competence and determination.

Solution of Simultaneous Linear Equations Ex 8.1 Q16

Let x, y and z be the prize amount per person for adaptibility, carefulness and calmness respectively.
As per the given data, we get

$2x + 4y + 3z = 29000$

$5x + 2y + 3z = 30500$

$x + y + z = 9500$

The above three simulataneous equations can be written in the matrix form as

$$\begin{bmatrix} 2 & 4 & 3 \\ 5 & 2 & 3 \\ 1 & 1 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 29000 \\ 30500 \\ 9500 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 2 & 4 & 3 \\ 5 & 2 & 3 \\ 1 & 1 & 1 \end{bmatrix}^{-1}\begin{bmatrix} 29000 \\ 30500 \\ 9500 \end{bmatrix} \ldots(1)$$

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

$$|A| = 2(-1) - 4(2) + 3(3) = -1$$

$$cofA = \begin{bmatrix} -1 & -2 & 3 \\ -1 & -1 & 2 \\ 6 & 9 & -16 \end{bmatrix}$$

$$adjA = (cofA)^T = \begin{bmatrix} -1 & -1 & 6 \\ -2 & -1 & 9 \\ 3 & 2 & -16 \end{bmatrix}$$

$$A^{-1} = \frac{adjA}{|A|} = \frac{\begin{bmatrix} -1 & -1 & 6 \\ -2 & -1 & 9 \\ 3 & 2 & -16 \end{bmatrix}}{-1} = \begin{bmatrix} 1 & 1 & -6 \\ 2 & 1 & -9 \\ -3 & -2 & 16 \end{bmatrix}$$

From (1)

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 1 & 1 & -6 \\ 2 & 1 & -9 \\ -3 & -2 & 16 \end{bmatrix}\begin{bmatrix} 29000 \\ 30500 \\ 9500 \end{bmatrix} \ldots(1)$$

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 2500 \\ 3000 \\ 4000 \end{bmatrix}$$

*********** END **********