

Application of Matrices

Ex: A company is considering which of the three methods of production it should use in producing three goods A, B & C. The amount of each good produced by each method is shown in the following matrix.

	A	B	C
Method 1	4	8	2
Method 2	5	7	1
Method 3	5	3	9

The column matrix $\begin{bmatrix} 10 & 4 & 6 \end{bmatrix}$ represents the profit per unit for A, B & C in that order.

Using matrix multiplication find which method maximizes the total profit.

Solⁿ

$$\begin{array}{l} \text{Method 1} \\ \text{Method 2} \\ \text{Method 3} \end{array} \begin{bmatrix} \text{A} & \text{B} & \text{C} \\ 4 & 8 & 2 \\ 5 & 7 & 1 \\ 5 & 3 & 9 \end{bmatrix} \begin{bmatrix} 10 \\ 4 \\ 6 \end{bmatrix}$$
$$= \begin{bmatrix} 4 \times 10 + 8 \times 4 + 2 \times 6 \\ 5 \times 10 + 7 \times 4 + 1 \times 6 \\ 5 \times 10 + 3 \times 4 + 9 \times 6 \end{bmatrix} = \begin{bmatrix} 40 + 32 + 12 \\ 50 + 28 + 6 \\ 50 + 12 + 54 \end{bmatrix}$$
$$= \begin{bmatrix} 84 \\ 84 \\ 116 \end{bmatrix}$$

\therefore Method 3 maximizes the total profit
& the total profit = 116 units.

Ex: A manufacturer produces three products A, B & C & sells in two markets. Annual sales of these products in the two markets are given below:

	Products		
	A	B	C
Market I	10,000	2,000	8,000
Market II	6,000	20,000	4,000

- (i) If the unit sales price of A, B & C are Rs 25, Rs 12 & Rs 15 respectively, find the total revenue in each market.
- (ii) If the unit cost of products A, B & C are Rs 18, Rs 10 & Rs 8 respectively, find the gross profit in each market.

Sol: Total revenue earned in Market I & Market II can be obtained as follows:

$$\begin{aligned}
 & \begin{bmatrix} 10,000 & 2,000 & 8,000 \\ 6,000 & 20,000 & 4,000 \end{bmatrix} \begin{bmatrix} 25 \\ 12 \\ 15 \end{bmatrix} \\
 &= \begin{bmatrix} 10,000 \times 25 + 2,000 \times 12 + 8,000 \times 15 \\ 6,000 \times 25 + 20,000 \times 12 + 4,000 \times 15 \end{bmatrix} \\
 &= \begin{bmatrix} 3,94,000 \\ 4,50,000 \end{bmatrix}
 \end{aligned}$$

Thus total revenue in Market I = Rs 3,94,000

& total revenue in Market II = Rs 4,50,000

Again, total cost of products sold in Market I & Market II can be obtained as follows:

$$\begin{bmatrix} 10,000 & 2,000 & 8,000 \\ 6,000 & 20,000 & 4,000 \end{bmatrix} \begin{bmatrix} 18 \\ 10 \\ 8 \end{bmatrix}$$

$$= \begin{bmatrix} 10,000 \times 18 + 2,000 \times 10 + 8,000 \times 8 \\ 6,000 \times 18 + 20,000 \times 10 + 4,000 \times 8 \end{bmatrix}$$

$$= \begin{bmatrix} 2,64,000 \\ 3,40,000 \end{bmatrix}$$

\therefore Total cost of products sold in Market I
= Rs 2,64,000

& Total cost of products sold in Market II
= Rs 3,40,000

Now, Gross profit in Market I = Rs 3,94,000 - 2,64,000
= Rs 1,30,000

& Gross profit in Market II = Rs 4,50,000 - 3,40,000
= Rs 1,10,000 .

Ex: A manufacturer produces 3 products A, B & C & sells in two markets. Annual sales of these products in two markets are given below:

	A	B	C
Market I	5,000	7500	15000
Market II	9,000	12000	8700

If the sales prices of products A, B & C per unit be Rs 2, Rs 3 & Rs 4 respectively, calculate the total revenue in each centre by using matrices.