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TUTORIAL -6

a). x_1 = proportion of time devoted to iPod cover Production

x_2 = " " " iPhone

x_3 = " " " iPad.

If whole day iPhones covers are produced, then No. = 5000

" " iPod " " = 6000

" " iPad " " = 3000

for any Propation x_1, x_2, x_3

$$\begin{bmatrix} \text{iPhone cover in a day} \\ \text{iPod} \quad \text{"} \\ \text{iPad} \quad \text{"} \end{bmatrix} = \begin{bmatrix} 5000x_1 \\ 6000x_1 \\ 3000x_3 \end{bmatrix}$$

Item that are produced in each week (x5 to each of the day) $= \begin{bmatrix} 30,000x_1 \\ 25,000x_2 \\ 15000x_3 \end{bmatrix}$

net Profit on each item $\begin{bmatrix} 4 \text{ USD} \\ 6 \text{ USD} \\ 10 \text{ USD} \end{bmatrix}$ iPod cover, iPhone ", iPad "

Total net Profit in a Week $= 120000x_1 + 150000x_2 + 150000x_3$

Objective is To Maximise this profit

$$\max \quad 120000x_1 + 150000x_2 + 150000x_3 \text{ USD}$$

S.t Contraints.

(1)

(4) +ve constraint $\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \geq \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ (3)

Constraint Set:

① Total storage capacity $\leq$ 6000.

1 iPhone cover takes = 45/1000 feet^3.

1 iPod cover takes = 40/1000 feet^3

1 iPad cover takes = $\frac{210}{1000}$ feet^3.

We, multiply each of the spaces with respective total produced items. to get total space

$$1200x_1 + 1125x_2 + 3150x_3 \leq 6000$$

② minimum Production According to Agreement.

iPod covers $\geq$ 5,000

iPad covers. $\geq$ 4,000

$$30000x_1 \geq 5000.$$
$$15000x_3 \geq 4000$$

③ Constraints Put by demand,

$$30000x_1 \leq 10{,}000$$
$$25000x_2 \leq 15{,}000$$
$$15000x_3 \leq 8000$$

④ Positivity Constraints

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \geq \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

(b). The variable for this problem is

y_1 = no. of iPod covers produced in 1 week

y_2 = " iPhone "

y_3 = " iPad "

net Profit = $4y_1 + 6y_2 + 10y_3$

objective is to maximise the profit hence.

max $4y_1 + 6y_2 + 10y_3$ USD.

st.

Production Constraint.

In one week we can Produce max iPhone cover = 30,000

" iPod cover = 25000

" iPad cover = 15,000.

1 iPhone cover is produced = $\frac{1}{30,000}$

1 iPod " = $\frac{1}{25,000}$

1 iPad " = $\frac{1}{15,000}$

(1) Production Constraint per week ⇒

$$\frac{1}{30000y_1} + \frac{1}{25000y_2} + \frac{1}{15000y_3} \leq 1.$$

(2) Min Prod Agreement constraint.

$y_1 \geq 5000$, $y_2 \geq 4000$

(3) Max Demand constraint.

$y_1 \leq 10000$, $y_2 \leq 15000$, $y_3 \leq 8000$

(4) +ve constraint $\begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix} \geq \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$ (3)

c). z_1 = number of hours. to the production of iPod covers. in a Week

z_2 = " " iPhone " "

z_3 = " " iPad " "

Total number of iPod cover produced in 1 hr = 750

" " iPhone " " = 625

" " iPad " " = 375.

total Shours Produce 6000 iPod Covers.

1 hour Produce = 750 iPod Covers.

1 hour Produes = 625 iPhone covers.

1 hour Produe = 375 iPad covers.

in one week = $\begin{bmatrix} 750 z_1 \\ 625 z_2 \\ 375 z_3 \end{bmatrix}$ iPod Cover. / IPhone Covers / iPad covers.

Net Profit = $3z_1 + 3.75z_2 + 3.75z_3$ Thousand USD

objective = max $3z_1 + 3.75z_2 + 3.75z_3$ (Thousand USD)

St.

Constraints

(1) · Production Constraints → $\begin{pmatrix} z_1 \\ z_2 \\ z_3 \end{pmatrix} (1 \quad 1 \quad 1) \leq 40$

$z_1 + z_2 + z_3 \leq 40$.

(4). (Total hrs in Prod 8×5)

② Storage constraints:

$$750 \times \frac{40}{1000} z_1 + 625 \times \frac{45}{1000} \times z_2 + 375 \times \frac{210}{1000} z_3 \leq 6000$$

③ Min Production Agreement Constraint:

$$750 z_1 \geq 5000$$

$$375 z_3 \geq 4000$$

④ Max demand Constraints:

$$750 z_1 \leq 10000$$

$$625 z_2 \leq 15000$$

$$375 z_3 \leq 8000$$

⑤ +ve constraints $\begin{pmatrix} z_1 \\ z_2 \\ z_3 \end{pmatrix} \geq \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$.

⑥ Relationship between x_1 x_2 x_3 and z_1 z_2 z_3.

$x \longrightarrow$ proportion of time in a day for an item.

Total there can be 40 hours of a week,

$$z_1 = 40x_1$$

$$z_2 = 40x_2$$

$$z_3 = 40x_3$$