Tutorial - 6

AI20BTECH11006

let demand = $\begin{bmatrix} 5000 \\ 0 \\ 4000 \end{bmatrix}$

max demand ~~max dmd~~ = $\begin{bmatrix} 10000 \\ 15000 \\ 8000 \end{bmatrix}$

Profit = $\begin{bmatrix} 4 \\ 6 \\ 10 \end{bmatrix}$

Space = $\begin{bmatrix} 0.04 \\ 0.045 \\ 0.21 \end{bmatrix}$

Production = $\begin{bmatrix} 6000 \\ 5000 \\ 3000 \end{bmatrix}$

a) Assumption

We can assume the production is equitable over the week i.e; the proportion is same on each day of the week. There can be multiple optimal solutions with same profit but for ease we can assume same proportions.

Let $X = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$ where x_i represents the proportion of time devoted to making that article

we have

(1) $\mathbf{1}^T X = \underline{1}$

(2) $5 * (\text{Production}^T X) \geq \text{demand}$

(3) $5 * (\text{Productio}$

Constraints

① $\mathbb{1}^T X = 1$

② $5 * (\text{Production} \circ X) \geq \text{demand}$

↑ hadamard product

③ $5 * (\text{Production} \circ X) \leq \text{max\_demand}$

④ $5 * (\text{space}^T (\text{Production} \circ X)) \leq \text{space}$

Optimization

$$\max \quad 5 * (\text{Profit}^T (\text{Production} \circ X))$$

subject to constraints.

b)

y_1 = number of ipad covers produced over ...

y_2 = " iphone "

y_3 = " ipad "

Let $Y = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix}$

Constraints

① $\text{space}^T Y \leq 6000$

② $Y \leq \text{max\_demand}$

③ $Y \geqslant \text{demand}$

④ $I^T \left(Y \circ \begin{pmatrix} \frac{1}{6000} \\ \frac{1}{5000} \\ \frac{1}{3000} \end{pmatrix} \right) = 5$

represents the number of days spent on each article.

Optimization

max $\text{Profit}^T Y$

Subject to constraints.

c)

z_1 = number of hours devoted to the production of ipod ...

z_2 = " iphone

z_3 = " ipad

constraints.

(1) $1^T z = 40$

(2) $\frac{1}{8}(z \circ \text{Production}) \geq \text{demand}$

(3) $\frac{1}{8}(z \circ \text{Production}) \leq \text{max-demand}$

(4) $\frac{1}{8}(\text{space}^T(z \circ \text{Production})) \leq \text{space}$

Optimization

~~$\frac{1}{8}$ max $\frac{1}{8}$ (Profit^T(~~

max $\frac{1}{8}(\text{Profit}^T(z \circ \text{Production}))$

Subject to constraints

d) $Z = 40X$

$\Rightarrow \quad z_i = 40X_i$

it is obvious because

$\sum z_i = 40$

so, if we divide Z by 40, we will get proportions. We already assumed proportions for X_1, X_2, X_3 will remain same over the entire week.