

## Assignment - 1

HANISH BHOGADI

811190202

1) Given

$$\text{Total Nylon} = 5000$$

Collegiate requires 3 ft.

Mini requires 2 ft.

Collegiate sold = 1000 / week

Mini sold = 1200 / week

Collegiate = 45/60 per unit ; Profit = \$ 32

Mini = 40/60 per unit ; profit = \$ 24

Total labours = 35

Time = 40 / week

(a) Decision Variables

Collegiate =  $X$

Mini =  $Y$

(b) Obj. function

Let  $Z$  be the profit

$$Z = 32X + 24Y$$

© Constraints:

$$5000 \geq 3X + 2Y \rightarrow \text{Material Constraint}$$

$$\begin{aligned} \text{Total no. of hours on time} &= 35 \times 40 \\ &= 1400 \end{aligned}$$

Can produce  $X$  number of Collegiate in  $\frac{3}{4}$  hrs  
 $Y$  number of Mini in  $\frac{2}{3}$  hrs

$$1400 \geq \frac{3}{4}X + \frac{2}{3}Y \rightarrow \text{Time Constraint}$$

$$X \leq 1000 \quad \& \quad Y \leq 1200$$

$$\begin{aligned} X &\geq 0 \\ Y &\geq 0 \end{aligned} \quad \left. \vphantom{\begin{aligned} X &\geq 0 \\ Y &\geq 0 \end{aligned}} \right\} \text{Non-negative constraints}$$

④ Mathematical Formulation

$$\text{Obj fn. Max profit } Z = 32X + 24Y$$

Constraints are

$$5000 \geq 3X + 2Y$$

$$1400 \geq \frac{3}{4}X + \frac{2}{3}Y$$

$$X \leq 1000 \quad \& \quad Y \leq 1200$$

$$X \geq 0 \quad \& \quad Y \geq 0$$



2) Given :

Net Unit profit

$$\text{Large} = \$420$$

$$\text{Medium} = \$360$$

$$\text{Small} = \$300$$

Production of units/day

$$\text{Plant 1} = 750$$

$$\text{Plant 2} = 900$$

$$\text{Plant 3} = 450$$

Capacities of plants

$$\text{Plant 1} = 13,000 \text{ sq. ft.}$$

$$\text{Plant 2} = 12,000 \text{ sq. ft.}$$

$$\text{Plant 3} = 5000 \text{ sq. ft.}$$

Large size requires - ~~20~~ 20 sq. ft.

Medium requires - ~~15~~ 15 sq. ft.

Small requires - 12 sq. ft.

And plants should use same percentage of their capacity

Solution:

Let Sizes of

$$\text{Large} = X$$

$$\text{Medium} = Y$$

$$\text{Small} = Z$$

$$\text{Plant 1} = 1$$

$$\text{Plant 2} = 2$$

$$\text{Plant 3} = 3$$

(a) Decision Variable

$$X_1 \quad Y_1 \quad Z_1$$

$$X_2 \quad Y_2 \quad Z_2$$

$$X_3 \quad Y_3 \quad Z_3$$

(b) Linear Programming Model

Obj fn,  $Z$  be profit

$$Z = 420(X_1 + X_2 + X_3) + 360(Y_1 + Y_2 + Y_3) + 300(Z_1 + Z_2 + Z_3)$$

Capacity constraint

$$X_1 + Y_1 + Z_1 \leq 750$$

$$X_2 + Y_2 + Z_2 \leq 900$$

$$X_3 + Y_3 + Z_3 \leq 450$$



Space Constraint

$$20X_1 + 15Y_1 + 12Z_1 \leq 13,000$$

$$20X_2 + 15Y_2 + 12Z_2 \leq 12,000$$

$$20X_3 + 15Y_3 + 12Z_3 \leq 5000$$

Plants should use some percentage of their capacity

$$900(X_1 + Y_1 + Z_1) = 750(X_2 + Y_2 + Z_2)$$

$$450(X_1 + Y_1 + Z_1) = 750(X_3 + Y_3 + Z_3)$$

And Non-negative constraints

$$X_1 \geq 0 \quad X_2 \geq 0 \quad X_3 \geq 0$$

$$Y_1 \geq 0 \quad Y_2 \geq 0 \quad Y_3 \geq 0$$

$$Z_1 \geq 0 \quad Z_2 \geq 0 \quad Z_3 \geq 0$$