Assignment 1

(1) Given,

Total shipment of material each week = 5000 sq.ft

Material required by collegiate = 3 sq.ft

Material required by Mini = 2 sq.ft

Total hours of work done per week = 35 labor's × 40

= 1400 hours

(A) Decision Variables :-

Let 'P' be the profit

'C' be the no of collegiate manufactured

'M' be the no of ~~collegiate~~ Mini manufactured

(B) objective function :-

$$\text{Max } P = 32C + 24M$$

where $0 \leq C \leq 1000$

$0 \leq M \leq 1200$

(C) constraints :-

$$3C + 2M \leq 5000$$

$$\frac{3}{4}C + \frac{2}{3}M \leq 1400$$

$\frac{45}{60} = \frac{3}{4}$; $\frac{40}{60} = \frac{2}{3}$

(D) Mathematical formulation :-

$$\text{Max } P = 32C + 24M$$

Subject to $3C + 2M \leq 5000$

$$\frac{3}{4}C + \frac{2}{3}M \leq 1400$$

where $0 \leq C \leq 1000$

$0 \leq M \leq 1200$

(2)

(A) Decision Variables:-

let P_1 = Plant 1 ; P_2 = Plant 2 ; P_3 = Plant 3

l = large ; m = medium ; s = small

L_1P_1 = No'of large product produced in plant P_1

L_2P_2 = No'of large product produced in plant P_2

L_3P_3 = No'of large sized product produced in plant P_3

Similarly,

M_1P_1 = No'of medium sized produtes produced in plant P_1;

M_2P_2 = No'of medium sized product produced in plant P_2

M_3P_3 = No'of medium sized product produced in plant P_3

S_1P_1 = No'of small sized product produced in plant P_1

S_2P_2 = No'of small sized product produced in plant P_2

S_3P_3 = No'of small sized product produced in plant P_3

(B) objective function:-

$$\text{Max } P = 420(L_1P_1 + L_2P_2 + L_3P_3) + 360(M_1P_1 + M_2P_2 + M_3P_3) + 300(S_1P_1 + S_2P_2 + S_3P_3)$$

(C) Constraints :-

Excess capacity constraints

$$L_1P_1 + M_1P_1 + S_1P_1 \leq 750$$

$$L_2P_2 + M_2P_2 + S_2P_2 \leq 900$$

$$L_3P_3 + M_3P_3 + S_3P_3 \leq 450$$

Space constraints :-

$$20lP_1 + 15mP_1 + 12sP_1 \leq 13,000$$

$$20lP_2 + 15mP_2 + 12sP_2 \leq 12,000$$

$$20lP_3 + 15mP_3 + 12sP_3 \leq 5,000$$

Sales per forecast :-

$$P_1l + P_1m + P_1s \leq 900$$

$$P_2l + P_2m + P_2s \leq 1200$$

$$P_3l + P_3m + P_3s \leq 750$$

where, L_1P_1 ; M_1P_1 ; S_1P_1 ; L_2P_2 , M_2P_2 , S_2P_2 ; L_3P_3 , M_3P_3 , $S_3P_3 \geq 0$

lP_1 ; mP_1 ; sP_1 ; lP_2 ; mP_2 ; sP_2 ; lP_3 , mP_3, $sP_3 \geq 0$

P_1l ; P_1m ; P_1s ; P_2l ; P_2m ; P_2s ; P_3l ; P_3m ; $P_3s \geq 0$

Percentage of excess capacity to avoid layoff's :-

$$\text{for plant } P_1 \leq \frac{P_1l + P_1m + P_1s}{750} \times 100$$

$$\text{for plant } P_2 = \frac{P_2l + P_2m + P_2s}{900} \times 100$$

$$\text{for plant } P_3 = \frac{P_3l + P_3m + P_3s}{450} \times 100$$