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

④ Decision Variables:-

Let 'P' be the profit

'C' be the no of collegiate manufactured

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

Ⓑ objective function :-

$$\boxed{\text{Max } P = 32C + 24M}$$ where $0 \le C \le 1000$

$0 \le M \le 1200$

Ⓒ constraints :-

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

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

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

ⓓ Mathematical formulation :-

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

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

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

where $0 \le C \le 1000$

$0 \le M \le 1200$

(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

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

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

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

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, $S_3P_3 \geq 0$

Space constraints :-

$$20lP_1 + 15mP_1 + 12sP_1 \leq 13,000$$
$$20lP_2 + 15mP_2 + 12sP_3 \leq 12,000$$
$$20lP_3 + 15mP_3 + 12sP_3 \leq 5,000$$

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

Sales per forecast constraint :-

$$lP_1 + lP_2 + lP_3 \leq 900$$
$$mP_1 + mP_2 + mP_3 \leq 1200$$
$$sP_1 + sP_2 + sP_3 \leq 750$$

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

Percentage of excess capacity to avoid layoff :-

$$\text{For plant 1} = \frac{P_1l + P_1m + P_1s}{750} \times 100$$

$$\text{For Plant 2} = \frac{P_2l + P_2m + P_2s}{900} \times 100$$

$$\text{For plant 3} = \frac{P_3l + P_3m + P_3s}{450} \times 100$$