1)

a) Decision variable:-

P = Total Profit

C = Collegiate Material

M = Mini Material

b) Objective function:-

Maximize Profit(P) = $32 \times C + 24 \times M$

Unit Profit of Collegiate material = 32\$

Unit Profit of Mini material = 24\$

$$P = 32 \times C + 24 \times M$$

c) Constraints:-

Material constraints:- Nylon = 5000 sqtfeet.

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

Time constraints:-

Collegiate required = 45 min → $\frac{45}{60} = \frac{3}{4}$ hrs

Mini required = 40min → $\frac{40}{60} = \frac{2}{3}$ hrs

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

35 labour × 40 hours = 1400 hou

Constraints for forecasts of Sale:-

$$0 \leq C \leq 1000$$

$$0 \leq M \leq 1200$$

d) Mathematic formulation for Linear Programming Problem :-

$$\text{Maximize}(P) = 32 \times C + 24 \times M$$

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

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

so,

$$0 \leq C \leq 1000$$

$$0 \leq M \leq 1200$$

2) a) Decision Variable:-

Maximize Profit = Z

Objective function

$$Z = 420(P_1L + P_2L + P_3L) + 360(P_1M + P_2M + P_3M) + 300(P_1S + P_2S + P_3S)$$

P_1 = Units produced for plant 1

P_2 = Units produce for plant 2

P_3 = Units produce for plant 3

L = large size Units

M = Medium size units

S = small size Units

SO, $P_1L, P_2L, P_3L, P_1M, P_2M, P_3M, P_1S, P_2S, P_3S \geq 0$

b) Formulate a linear programming

→

Constraints:-

$$\left.\begin{aligned} P_1L + P_1M + P_1S &\leq 750 \\ P_2L + P_2M + P_3M &\leq 900 \\ P_3L + P_3M + P_3S &\leq 450 \end{aligned}\right\} \text{capacity Excess limits}$$

$$\left.\begin{aligned} 20P_1L + 15P_1M + 12P_1S &\leq 13000 \\ 20P_2L + 15P_2M + 12P_2S &\leq 12000 \\ 20P_3L + 15P_3M + 12P_3S &\leq 5000 \end{aligned}\right\} \text{constraints on the materials.}$$

$$\left.\begin{aligned} P_1L + P_2L + P_3L &\le 900 \\ P_1M + P_2M + P_3M &\le 1200 \\ P_1S + P_2S + P_3S &\le 750 \end{aligned}\right\}$$ Constraints on sale by forecast

The Percentage required to avoid layoff

$$\frac{P_1L + P_1M + P_1S}{750} \times 100\%$$

$$\frac{P_2L + P_2M + P_2S}{900} \times 100\%.$$

$$\frac{P_3L + P_3M + P_3S}{450} \times 100\%$$