Assignment - I

Linear programming

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Quantitative Management modelling

1) Solution: No.of labours = 35
No.of hours labour work = 40 hrs
Total Amount of Nylon = 5000 sq.ft

Total number of labour hours = 35 x 40 = 1400hrs

Collegiate requires 3sq ft and Mini requires 2sq ft of Nylon i.e

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

Time taken for each collegiate = 45min

$$= \frac{45}{60} = \frac{3}{4}$$

Time taken for each Minis = 40 min

$$= \frac{40}{60} = \frac{2}{3}$$

Total time taken for both

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

a) Decision variables :-

P(C,M) : Total profit

C : No.of collegiate

M : No.of Minis

b) objective function :-

maximize profit

$$P(C,M) = 32C + 24M$$

C) Constraints:

$3C + 2M \leq 5000$

$3C + 2M \leq 5000$

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

Non-negativity

$P \geq 0$

$C \geq 0$

$M \geq 0$

$0 \leq C \leq 1000$

$0 \leq M \leq 1200$

D) Full mathematical formulation:

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

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

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

$0 \leq C \leq 1000$

$0 \leq M \leq 1200$

Non-Negativity

$P(C,M) \geq 0$

$C \geq 0$

$M \geq 0$

2. Solution:-

a) Decision Variables:

Let U_{ij} be no. of units of size

U : No. of units

i : No. of plants

j : The size of plants ex: small, medium, large

P : (Maximized Profit

(b) Constraints:

For plant 1 Capacity

$$U_{1L} + U_{1M} + U_{1S} \leq 750$$

For plant 2 capacity

$$U_{2L} + U_{2M} + U_{2S} \leq 900$$

For plant 3 Capacity

$$U_{3L} + U_{3M} + U_{3S} \leq 450$$

Storage limits

$$20\,U_{1L} + 15\,U_{1M} + 12\,U_{1S} \leq 13000$$

$$20\,U_{2L} + 15\,U_{2M} + 12\,U_{2S} \leq 12000$$

$$20\,U_{3L} + 15\,U_{3M} + 15\,U_{3S} \leq 5000$$

Sales forcast:

$$U_{1L} + U_{1M} + U_{1S} \leq 900$$

$$U_{2L} + U_{2M} + U_{2S} \leq 1200$$

$$U_{3L} + U_{3M} + U_{3S} \leq 750$$

Percentage for avoiding layoff

$$= \frac{U_{1L} + U_{1M} + U_{1S}}{750} \times 100$$

$$= \frac{U_{2L} + U_{2M} + U_{2S}}{900} \times 100$$

$$= \frac{U_{3L} + U_{3M} + U_{35}}{450} \times 100$$

Objective function:

$$P = 420 (U_{1L} + U_{2L} + U_{3L}) + 360 (U_{1M} + U_{2M} + U_{3M}) + 300 (U_{1S} + U_{2S} + U_{3S})$$

Constraints:-

Non-Negativity

$$U_{ij} \geq 0$$

$$P \geq 0$$