Assignment -1

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1.Define the decision variables.

The decision variables are Number of collegiate(N_c) and mini backpacks (N_m) generated per week

$$The\ \ number\ \ of\ \ collegiate\ \ back\ \ packs = N_c$$
$$The\ \ number\ \ of\ \ mini\ \ backpacks = N_m$$

$$The\ \ total\ \ profit = T_P$$

2.What is objective function?

Maximizing profit is the objective function. Therefore A make a profit of $32 and B generate profit of $24

$$Max\ \ Z = 32N_c + 24N_m$$

3.what are the constraints? Material Constraints: Bank savers receives a nylon fabric of 5,000sq. Ft shipment 3sq.Ft nylon fabric needed for A and 2sq.Ft needed for B

$$3N_c + 2N_m \leq 5000$$

Time constraints: 35 Employees works 40 hours a week. 45 minutes of labor are needed to produce a profit of $32 and B needs 40 minutes to earn profit of $25

$$45N_c + 40N_m \leq 35employees * 40hours * 60minutes$$

Non- Negativity:

$$0 \leq N_c \leq 1000$$
$$0 \leq N_m \leq 1200$$

4.Mathematical formula for this problem?

$$N_c = Number\ \ of\ \ collegiate\ \ backpacks\ \ per\ \ week$$

$$N_m = NumberofMinibackpacksperweek$$
$$Maximize(Z) = 32N_c + 24N_m$$

Subject to

$$N_c \leq 1000\ \ collegiates\ \ sold\ \ per\ \ week$$
$$N_m \leq 1200\ \ minis\ \ sold\ \ per\ \ week$$
$$45N_c + 40N_m \leq 84000\ \ minutes\ \ per\ \ week\ \ (35employees * 40hours * 60minutes)$$

$$3N_c + 2N_m \leq 5000 \ \ sq.ft \ \ of \ \ material \ \ required \ \ per \ \ week$$

A.Define the decision variables? The number of units of the new product, irrespective of size, that should be generate on each plant to maximize the profit of the eight corporation.

Note:

$$U_e = number \ \ of \ \ units \ \ produced \ \ on \ \ each \ \ plant$$

i.e., e =1 (plant 1), 2 (plant 2), 3(Plant 3).

$$L, M \ \ and \ \ S = Product's \ \ Size$$

Where A= large, B= medium, C=small.

Decision variables:

$$U_eA = No.of \ \ Large \ \ sized \ \ items \ \ produced \ \ on \ \ plant \ \ e$$

$$U_eB = No.of \ \ Medium \ \ sized \ \ items \ \ produced \ \ on \ \ plant \ \ e$$

$$U_eC = No.of \ \ small \ \ sized \ \ items \ \ produced \ \ on \ \ plant \ \ e$$

B. Formulation of LP for this Question:

$$U_eA = Number \ \ of \ \ Large \ \ items \ \ produced \ \ on \ \ plant \ \ on \ \ plant \ \ e$$

$$U_eB = Number \ \ of \ \ Medium \ \ sized \ \ items \ \ produced \ \ on \ \ plant \ \ e$$

$$U_eC = Number \ \ of \ \ Small \ \ sized \ \ items \ \ produced \ \ on \ \ plant \ \ e$$

Where e = 1(Plant1), 2 (Plant 2), 3(Plant 3).

Maximize Profit

$$Max \ \ Z = 420(U_1A + U_2A + U_3B) + 360(U_1B + U_2B + U_3C) + 300(U_1C + U_2C + U_3c)$$

Constraints:

Total number of size's units produced regardless the plant:

$$L = U_1A + U_2A + U_3A$$

$$M = U_1B + U_2B + U_3B$$

$$S = U_1C + X_2S + U_3C$$

Production Capacity per unit by plant each day i.e.,

$$Plant1 = U_A + U_B + U_C \leq 750$$

$$Plant2 = U_A + U_B + U_2C \leq 900$$

$$Plant3 = U_3A + U_3B + U_3C \leq 450$$

Storage capacity per unit by plant each day:

$$Plant1 = 20U_1A + 15U_1B + 12U_1C \leq 13000$$

$$Plant2 = 20X_2L + 15X_2M + 12X_2S \leq 12000$$

$$Plant3 = 20X_3L + 15X_3M + 12X_3s \leq 5000$$

Sales forecast per day:

$$A = U_1A + U_2A + U_3A \leq 900$$
$$B = U_1B + U_2B + U_3B \leq 1200$$
$$C = U_1C + U_2C + U_3C \leq 750$$

The amount of extra capacity that the plants use to create the new product is stable.

$$\frac{U_1A + U_1B + U_1C}{750} = \frac{U_2A + U_2B + U_2C}{900} = \frac{U_3A + U_3B + U_3C}{450}$$

it can be represented as :

$$900(U_1A + U_1B + U_1C) - 750(U_2A + U_2B + U_2C) = 0$$
$$450(U_2A + U_2B + U_2C) - 900(U_3A + U_3B + U_3C) = 0$$
$$450(U_1A + U_1B + U_1C) - 750(U_3A + U_3B + U_3C) = 0$$

All Variables must be greater than or equal to zero

$$A, B, C \geq 0$$
$$U_1A, U_1B, U_1c \geq 0$$