1.

a. Clearly define the decision variables

The decision variables are the units of Collegiate backpacks and the units of Mini backpacks to produce

b. What is the objective function?

The objective function is to maximize the profit of selling backpacks

c. What are the constraints?

The constraints are square foot of materials each week, sales unit numbers of each type of the bags and labor hours.

d. Write down the full mathematical formulation for this LP problem

Set c for the units of Collegiate backpacks to make and m for the units of Mini backpacks to make

Max profit=32c+24m

Constraints:

3c+2m<=5000 (square foot of materials constraint)

c<=1000 (Sale unit numbers of collegiate bags constraint)

m<=1200 (Sale unit numbers of mini backpacks bags constraint)

45c+40m<=84000 (labor hours constraint)

c, m >=0

2.

a. Define the decision variables

Let Xpj be the number of units of size j produced at plant p per day, where:

p=1,2,3 (plants 1, 2, 3)

j=L,M,S (large, medium, small)

So, the decision variables are:

- X1L: units of large size produced at plant 1
- X1M: units of medium size produced at plant 1
- X1S: units of small size produced at plant 1
- X2L: units of large size produced at plant 2
- X2M: units of medium size produced at plant 2
- X2S: units of small size produced at plant 2
- X3L: units of large size produced at plant 3
- X3M: units of medium size produced at plant 3
- X3S: units of small size produced at plant 3

Objective Function: To maximize the profit of the new production

Maximize Profit = 420(X1L+X2L+X3L)+360(X1M+X2M+X3M)+300(X1S+X2S+X3S)

Constraints :

Plant Capacity Constraint:

Plant1: X1S+X1M+X1L<=750

Plant2: X2S+X2M+X2L<=900

Plant3: X3S+X3M+X3L<=450

Storage Constraint:

Plant1: 20X1L+15X1M+12X1S<=13000

Plant2: 20X2L+15X2M+12X2S<=12000

Plant3: 20X3Ll+15X3M+12X3S<=5000

Sales Unit Constraint

Large ones: X1L+X2L+X3L<=900

Medium ones: XIM+X2M+X3M<=1200

Small ones: X1S+X2M+X3S<=750

Equal Capacity Ratio

(X1L+X1M+X1S)/750=(X2L+X2M+X2S)/900=(X3L+X3M+X3S)/450

Xpj >=0