BA-64018

Assignment 2

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1.

(a) Decision variables

Back Savers wants to maximize the production of Collegiate and Mini backpacks per week. Therefore, Collegiate and Mini backpacks are the decision variables.

x = number of Collegiate backpacks produced per week

y = number of Mini backpacks produced per week

(b) Objective function

The objective is to maximize the total profit. Each Collegiate backpack generates $32, and each Mini backpack generates $24. Combine them to generate max profit.

In this case, the objective function is: Maximize Z = 32x+24y

(c) Constraints

It requires raw materials such as Nylon fabric and labors to produce backpacks. In addition, the sales forecasts indicate that 1000 Collegiates and 1200 Minis can be sold per week. Therefore, Nylon fabric, labors and forecasts are the constraints.

Nylon fabric constraint:

supplier constraint (5000 square-foot) each week. It requires 3 square feet for each Collegiate and 2 square feet for Mini.

3x + 2x <= 5000

Labor constraints:

It requires 45 minutes of labor to produce one Collegiate backpack and 40minutes of labor for Mini backpack and there are 35 labors work 40 hours per week.

35 * 40 = 1400 total hours of labor per week

40 hours * 60 minutes = 84,000 minutes per week

Each Collegiate requires 45 minutes of labor and 40 minutes of labor for Mini, so the labor constraint is

45x + 40y <= 84,000

Sales forecast constraint:

Collegiate sales forecast is x <= 1,000

Mini sales forecast is y <= 1,200

Non-negativity constraint:

X >=0, y>=0

(d) Full mathematical formulation

Nylon fabric	3x + 2x <= 5000
Labors	45x + 40y <= 84,000
Collegiate sales	x <= 1,000
Mini sales	y <= 1,200
Non-negativity	x >=0, y>=0

2.

(a)

Table 1. Product Data

Sizes	Profit per Unit	Pallet slots per Unit (sq ft)	Sales forecast (units/day)
Large	$420	20	900
Medium	$360	15	1200
Small	$300	12	750

Table 2. Plant Data

Plant	Excess Assembly Capacity	Storage Space (sq ft)
1	750	13,000
2	900	12,000
3	450	5,000

Define the decision variables:

Weigelt Corporation plans to maximize the profits with three plants to produce three different sizes of products: large, medium and small. The corporation wants to know how much the plants can produce their products daily. In this case, the three plants and the three product sizes are the decision variables. Each plant is able to produce all three sizes of products. Therefore, there are total of 9 decision variables.

Plant	Large	Medium	Small
1	x1	x4	x7
2	x2	x5	x5
3	x3	x6	x9

- x1 = Large at plant 1; x2 = Large at plant 2; x3 = Large at plant 3
- x4, x5, x6 = Medium at plants 1-3
- x7, x8, x9 = Small at plants 1-3

(b)

Objective function

Maximize total daily profits with three plants:

Z = 420 (x1+x2+x3) + 360 (x4+x5+x6) + 300 (x7+x8+x9)

Constraints:

1) Assembly capacity at each plant

Plant 1	x1 + x4 + x7 <= 750
Plant 2	x2 + x6 + x8 <= 900
Plant 3	x3 + x6 + x9 <= 450

2) Storage space constraint

Plant 1	15x4 + 12x7 <= 13,000
Plant 2	15x4 + 12x8 <= 12,000
Plant 3	20x3 + 15x6 <= 5,000

3) Sales forecast constraint

Large	x1 + x2 + x3 <= 900
Medium	x4 + x5 + x6 <= 1,200
Small	x7 + x8 + x9 <= 750

4) Equal percentage excess capacity used

(x1 + x4 + x7)/750 = (x2 + x6 + x8)/900 = (x3 + x6 + x9)/450

5) Non-negativity

x1, ….. ,x9 >= 0