Assignment 2 - LP Model

Problem Statement 1:

Given

Total Nylon available: 5000sqft.

Each Collegiate requires 3 ft.

Each Mini requires 2ft.

1000 Collegiate and 1200 Mini are sold per week

Collegiate requires 45 mins = 45/60 hrs per unit, Profit =$32

Mini requires 40 mins = 40/60 hrs per unit, profit=$24

Total Labours = 35, Total Time = 40 hours per week

Solution

Let X be the number of units generated for Collegiate

Y be the number of units generated for Mini

a: Decision Variables

X, Y are the number of units generated by Collegiate and Mini respectively so the Decision Variables are X, Y

b: Objective Function

Here the Objective Function is to maximize the profit for the values X and Y

Therefore, Considering Z be the profit

$Z = 32X + 24Y$

c: Constraints

1. Since 5000sqft is the total nylon available and Collegiate requires 3sqft and Mini requires 2sqft per

   $5000 >= 3X + 2Y$ ➔ Material Constraint

2. Total number of labours on Total time(35x40=1400) can produce X number of Collegiate in 3/4 hrs and Y number of Mini in 2/3 hrs

   $1400 >= 3/4\ X + 2/3\ Y$ ➔Time Constraint

3. 1000 Collegiate and 1200 Mini are sold per week

   $X <= 1000$ and $Y <= 1200$

4. Non-negative constraints

   $X >= 0$ and $Y >= 0$

d: Mathematical Formulation

Objective Function: Max Profit Z = 32X + 24 Y

Constraints are:

Material constraint: 5000>= 3X + 2Y

Time constraint: 1400>=3/4X + 2/3Y

Quantity Constraint: X<=1000 and Y<=1200

Non-negativity Constraint: X>= 0 and Y>=0

Problem Statement 2:

Given:

Large unit profit = $420

Medium unit profit = $360

Small unit Profit = $300

Plant 1 produces = 750 Units

Plant 2 produces = 900 Units

Plant 3 produces = 450 Units

Plant 1 Capacity = 13,000sqft

Plant 2 Capacity = 12,000sqft

Plant 3 Capacity = 5000sqft

Large size requires 20sqft

Medium size requires 15sqft

Small size requires 12sqft

And plants should use the same percentage of their capacity

Solution:

Let X, Y, Z be the number of sizes for Large, Medium, and Small respectively

1, 2, 3 Indicates Project 1, Project 2 and Project 3 respectively

a: Decision Variables

There are six decision variables

- X1, Y1, Z1, X2, Y2, Z2, X3, Y3, Z3 are the decision variables

b: Linear Programming Model

Objective Function:

Objective Function for the Weigelt corporation is to Maximize their profit

Let Z be the Profit

As net profit for the large, medium, small sizes are \$420, \$360, \$300. Each plant has large, medium, small sizes.

For X, Y, Z number of sizes for large, medium, and small

$Z = 420 (X1 + X2 + X3) + 360(Y1 + Y2 + Y3) + 300(Z1 + Z2 + Z3)$

Subject to

Constraints

Each plant produces units for different sizes

Capacity Constraint

$X1 + Y1 + Z1 <= 750$

$X2 + Y2 + Z2 <= 900$

$X3 + Y3 + Z3 <= 450$

Space Constraint

$20 X1 + 15 Y1 + 12 Z1 <= 13,000$

$20 X2 + 15 Y2 + 12 Z1 <= 12,000$

$20 X3 + 15 Y2 + 12 Z1 <= 5000$

Plants should use the same percentage of their capacity

$900 (X1 + Y1 + Z1) = 750 (X2 + Y2 + Z2)$

$450 (X1 + Y1 + Z1) = 750 (X3 + Y3 + Z3)$

And Non-negative constraints

$X1>=0, Y1>=0, Z1>=0, X2>=0, Y2>=0, Z2>=0, X3>=0, Y3>=0, Z3>=0$