Name: Sri Hari Vadhry

Student ID: 811297316

Subject: Quantitative Management Modelling

Problem1:

A). Decision Variables:

Let,

   X= Number of Collegiate produced per week

   Y= Number of Mini produced per week

B) Objective Function:

The main objective is to check what quantity of each product to be produced to get the maximum profit

Z= 32X + 24Y

Where,

   Z= Maximizing profit

   Profit per unit of X = 32

   Profit per unit of Y = 24

C) Constraints:

- Material Constraint: It is given that total nylon receives only 5000 square foot of shipment per week and Each Collegiate requires 3 Square feet whereas each Mini requires 2 Square feet.
  3X + 2Y <= 5000

- Production Constraint: The quantity of Collegiate bags produced should be less than 1000 per week and the quantity of Mini bags produced should be less than 1200 per week
  X <= 1000
  Y <= 1200

- Labor Constraint: There are 35 laborers working 40 hours per week and the time required for X is 45 mins and for Y is 40 mins (35*40= 1400 hours, convert it into minutes, 1400*60 = 84000)
  45X + 40Y <= 84000

- Non-Negative Constraint: The number of bags produced per week cannot be negative
  X >= 0
  Y >= 0

D) Mathematical Formulation:

Z= 32X + 42Y

Subjected to,

X <= 1000, Y <= 1200

3X + 2Y <= 5000

45X + 40Y <= 84000

X >= 0, Y >= 0

Problem 2:

A) Decision Variables:

Let,

X_1, X_2, X_3 be the quantity of the products produced by Plant1, Plant2 and Plant3 respectively

Y_1, Y_2, Y_3 be the quantity of the products produced by Plant1, Plant2 and Plant3 respectively

Z_1, Z_1, Z_3 be the quantity of the products produced by Plant1, Plant2 and Plant3 respectively

B) Formulation of Linear Programming Model:

Objective Function:

How many products to be produced by each plant to maximize the profit and to check on avoiding layoff by using same percentage of excess production capacity

$Z = 420 (X_1 + X_2 + X_3) + 360 (Y_1 + Y_2 + Y_3) + 300 (Z_1 + Z_2 + Z_3)$

Subject to constraint,

Excess Production Capacity Constraints:

Plant1- $X_1 + Y_1 + Z_1 \leq 750$

Plant2- $X_2 + Y_2 + Z_2 \leq 900$

Plant3- $X_3 + Y_3 + Z_3 \leq 450$

Storage Capacity Constraints:

Plant1- $20X_1 + 15Y_1 + 12Z_1 \leq 13000$

Plant2- $20X_2 + 15Y_2 + 12Z_2 \leq 12000$

Plant3- $20X_3 + 15Y_3 + 12Z_3 \leq 5000$

Sales Constraint:

Large Size- $X_1 + X_2 + X_3 \leq 900$

Medium Size- $Y_1 + Y_2 + Y_3 \leq 1200$

Small Size- $Z_1 + Z_2 + Z_3 \leq 750$

Percentage of Excess Capacity to avoid layoffs:

The management has decided that the plants use same percentage of excess capacity to produce the new product

$$(X1 + Y1 + Z1)/750 = (X2 + Y2 + Z2)/900 = (X3 + Y3 + Z3)/450$$

Non-Negative Constraints:

$X1 >= 0, X2 >= 0, X3 >= 0,$

$Y1 >= 0, Y2 >= 0, Y3 >= 0,$

$Z1 >= 0, Z2 >= 0, Z3 >= 0.$