QUANTITATIVE MANAGEMENT MODELING

Assignment -1

Name: Ashvitha Mothakani

KSU ID: 811190016

Question 1:

A. Clearly define the decision variables

Here the decision variables are the numbers of collegiate(A) and Mini bage pack(B) that are generated every week.

TP= Total profit

A = Number of collegiate back packs.

B = Number of mini back packs.

B. What is the objective function?

The objective function is to maximizing profit.so, A make a profit of $32 and B generate profit of $24.

Maximize (MP) = 32 A + 24 B

C. What are the constraints?

Material Constraints: Bank savers receives a nylon fabric of 5,000 Sq. Ft shipment

3Sq.Ft Nylon fabric needed for A and 2Sq.Ft needed for B

3A+2B<=5000

Time constraint: 35 Employees works 40 hours a week.

A requires 45 minutes of labour to generate profit of $32 and B needs 40 minutes to earn profit of $25.

45A+40B<=35 employees*40hours*60 minutes

Non-Negativity:

0<=A<=1000

0<=B<=1200

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

A= Number of collegiate backpacks per week

B=Number of Mini backpacks per week

Maximize (Z) = 32A+24B

Subject to

A<= 1000 collegiates sold per week

B<=1200 minis sold per week

45A+40B<=84000 minutes per week (35 employees*40 hours*60 minutes)

3A+2B<=5000sq.ft of material required per week.

Question 2:

A. Define the decision variables

The number of units of the new product, regardless of size, that should be produced on each plant to maximize the profit of the Weigelt corporation.

Note:

X_i = number of unites produced on each plant,

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

L, M and S = Product's Size

Where L = large, M = medium, S = small.

Decision Variables:

X_iL = No. of Large sized items produced on plant i

X_iM = No. of Medium sized items produced on plant i

X_iS = No. of Small sized items produced on plant i,

B. Formulate a Linear Programming for this Problem:

X_iL = Number of Large sized items produced on plant i

X_iM = Number of Medium sized items produced on plant i

X_iS = Number of Small sized items produced on plant i,

Where i = 1 (Plant 1), 2 (Plant 2), 3 (Plant 3).

Maximize Profit

Z = 420 ($X_1L + X_2L + X_3L$) + 360 ($X_1M + X_2M + X_3M$) +300 ($X_1S + X_2S + X_3S$)

Constraints:

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

$L = X_1L + X_2L + X_3L$

$M = X_1M + X_2M + X_3M$

$S = X_1S + X_2S + X_3S$

Production Capacity per unit by plant each day

i.e.,

Plant 1 = $X_1L + X_1M + X_1S \leq 750$

Plant 2 = $X_2L + X_2M + X_2S \leq 900$

Plant 3 = $X_3L + X_3M + X_3S \leq 450$

Storage capacity per unit by plant each day:

Plant 1 = $20X_1L + 15X_1M + 12X_1S \leq 13000$

Plant 2 = $20X_2L + 15X_2M + 12X_2S \leq 12000$

Plant 3 = $20X_3L + 15X_3M + 12X_3S \leq 5000$

Sales forecast per day:

$L = X_1L + X_2L + X_3L \leq 900$

$M = X_1M + X_2M + X_3M \leq 1200$

$S = X_1S + X_2S + X_3S \leq 750$

The Plants always utilize the same % of their excess capacity to produce the new product.

$$\frac{X_1L + X_1M + X_1S}{750} = \frac{X_2L + X_2M + X_2S}{900} = \frac{X_3L + X_3M + X_3S}{450}$$

It can be denoted as:

a) $900 (X_1L + X_1M + X_1S) – 750 (X_2L + X_2M + X_2S) = 0$

b) $450 (X_2L + X_2M + X_2S) – 900 (X_3L + X_3M + X_3S) = 0$

c) $450 (X_1L + X_1M + X_1S) – 750 (X_3L + X_3M + X_3S) = 0$

All Values must be greater or equal to zero

L, M and S ≥ 0

X_iL, X_iM and $X_iS \geq 0$