

## **Assignment: Module 2 - The LP Model**

1. a. The decision variables are **number of units of bags** produced per week– the Collegiate( $X_1$ ) and the Mini( $X_2$ ).

- b. Objective function is to maximize the profit by the sale of the two types of bag.

$$Z = 32 * X_1 + 24 * X_2$$

- c. Constraints are

limit of bag production based on the total sq-ft. nylon received from the supplier

$$3 * X_1 + 2 * X_2 \leq 5000$$

Bag manufacturing count should be less than maximum bags can be sold per week.

$$X_1 \leq 1000, X_2 \leq 1200$$

Another constraint is based on the number of hours labors can work per week.

$$45 * X_1 + 40 * X_2 \leq 40 * 60 * 35$$

$$X_1, X_2 \geq 0$$

- d. Mathematical formula for the linear problem.

$$\text{Maximize profit } Z = 32 * X_1 + 24 * X_2$$

$$3 * X_1 + 2 * X_2 \leq 5000$$

$$X_1 \leq 1000, X_2 \leq 1200$$

$$45 * X_1 + 40 * X_2 \leq 40 * 60 * 35$$

$$X_1, X_2 \geq 0$$

2. a. Decision variables:

Let's assume that below are the **per day** production rate/volume

$X_{11}$  = number of Large Products made at Plant 1

$X_{12}$  = number of Medium Products made at Plant 1

$X_{13}$  = number of Small Products made at Plant 1

$X_{21}$  = number of Large Products made at Plant 2

$X_{22}$  = number of Medium Products made at Plant 2

$X_{23}$  = number of Small Products made at Plant 2

$X_{31}$  = number of Large Products made at Plant 3

$X_{32}$  = number of Medium Products made at Plant 3

$X_{33}$  = number of Small Products made at Plant 3

- b. LP model:

Constraints:

Production unit limit per day

$$X_{11} + X_{12} + X_{13} \leq 750$$

$$X_{21} + X_{22} + X_{23} \leq 900$$

$$X_{31} + X_{32} + X_{33} \leq 450$$

In process storage space for day's production

$$20 \cdot X_{11} + 15 \cdot X_{12} + X_{13} \leq 13000$$

$$20 \cdot X_{21} + 15 \cdot X_{22} + X_{23} \leq 12000$$

$$20 \cdot X_{31} + 15 \cdot X_{32} + X_{33} \leq 5000$$

Sales forecast of quantities sale per day

$$X_{11} + X_{21} + X_{31} \leq 900$$

$$X_{12} + X_{22} + X_{32} \leq 1200$$

$$X_{13} + X_{23} + X_{33} \leq 750$$

$$X_{11}, X_{12}, X_{13}, X_{21}, X_{22}, X_{23}, X_{31}, X_{32}, X_{33} \geq 0$$

Objective Function:

$$\text{Maximize the profit } C = (X_{11} + X_{21} + X_{31}) \cdot 420 + (X_{12} + X_{22} + X_{32}) \cdot 360 + (X_{13} + X_{23} + X_{33}) \cdot 300$$