1.

a. Clearly define the decision variables

Decision Variables:

the decision variables are as follows:

'x' represents the number of collegiate backpacks that are produced per week.
'y' represents the number of mini backpackes that are produced per week.

b. What is the objective function?

The main objective of Bank Savers is to maximize their profits that are generated every week. The profit is calculated as the difference between the income that is generated from sales and the total cost.
The objective function can be expressed as follows:

$$Z= 32x + 24y$$

In the above equation 'Z' represents the total profits that are generated in the week in dollars. 32 is the profit generated per collegiate backpack produced. 24 is the profit generated per mini backpack produced.

c. What are the Constraints?

Material Constraint: The total amount of nylon used to make the backpacks must not exceed the weekly available supply of 5000 square feet.

$$3x+2y<=5000$$

Demand constraint: The production of the backpacks should not be more than the expected demand.

$$x<=1000 \quad y<=1200$$

labor constraint: The labor hours that are used for the production of backpacks shouldn't be more than the available labor capacity, we know that there are 35 laborers with 40 hours of work per week.

$$45x+40y<=35\times40$$

Non-negativity constraint: The production of the backpacks cannot be negative. The decision variables 'x' and 'y' should be greater than zero.

$$x>=0$$
$$y>=0$$

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

The full mathematical formulation for this LP problem is:

$$Z= 32x + 24y$$

2.

a. Define the decision variables.

The decision variables are as follows:

XL1, XL2, XL3: These are the variables for large sized units produced at plants 1, 2 and 3.
XM1, XM2, XM3: These are the variables for medium sized units produced at the plants 1, 2 and 3.
XS1, XS2, XS3: These are the variables for small sized units produced at the plants 1, 2 and 3.

b. LP Model:

The main objective of this is to maximize the profit, that can be calculated by adding the profits incurred from producing each size at each plant.

Mathematical formula can be expressed as:
$Z = 420(XL1+XL2+XL3) + 360(XM1+XM2+XM3) + 300(XS1+XS2+XS3)$

Constraints:

Production capacity constraints:

Plant 1 : $XL1+XM1+XS1 <= 750$
Plant 2 : $XL2+XM2+XS2 <= 900$
Plant 3 : $XL3+XM3+XM3 <= 450$

In-process storage constraits:

Plant 1 : $20XL1+15XM1+12XS1 <= 13000$
Plant 2 : $20XL2+15XM2+12XS2 <= 12000$
Plant 3 : $20XL3+15XM3+12XM3 <= 5000$

Demand constraints:

Large size demand : $XL1+XL2+XL3 <= 900$
Medium size demand : $XM1+XM2+XM3 <= 1000$
Small size demand : $XS1+XS2+XS3 <= 750$

Non-negativity constraints :

$(XL1,XL2,XL3,XM1,XM2,XM3,XS1,XS2,XS3) >= 0$

It is also mentioned that the excess capacity at each plant should be used to produce the new product.