1. **Objective function** is the mathematical representation of overall goal stated as a function of decision variables , examples are profit levels, total revenue, total cost, pollution levels, market share etc.
2. The **Constraints**, also stated in terms of x, are conditions that must be satisfied when determining levels for the decision variables. They can be represented by equations or by inequalities (≤ and/or ≥ types).

Q1 Truckco manufactures two types of trucks: 1 and 2. Each truck must go through the painting shop and assembly shop. If the painting shop were completely devoted to painting Type 1 trucks, then 800 per day could be painted; if the painting shop were completely devoted to painting Type 2 trucks, then 700 per day could be painted. If the assembly shop were completely devoted to assembling truck 1 engines, then 1,500 per day could be assembled; if the assembly shop were completely devoted to assembling truck 2 engines, then 1,200 per day could be assembled. Each Type 1 truck contributes \$300 to profit; each Type 2 truck contributes \$500. Formulate an LP that will maximize Truckco's profit.

Q 2

1 A firm manufacture two types of Products, A and B (3) and sells them at a profit of Rs 2 on type A and Rs. 3 on type B. Each Product is Processed on two machines G and H. Type A requires one ~~mite~~ minute of Processing time on G and two minutes on H; Type B requires one minute on G and one minute on H. The machine G is ~~able~~ available for not more than 6 hours 40 minutes while machine H is available for 10 hours during any working day. Formulate the Problem as a LPP.

Q3

Diet Mix Model

A dietician is planning the menu for the evening meal at a university dining hall. Three main items will be served, all having different nutritional content. The dietician is interested in providing at least the minimum daily requirement of each of three vitamins in this one meal. Following table summarizes the vitamin contents per ounce of each type of food, the cost per ounce of each food, and minimum daily requirements (MDR) for the three vitamins. Any combination of the three foods may be selected as long as the total serving size is at least 9 ounces.

	Vitamins			
Food	1	2	3	Cost per Oz, $
1	50mg	20mg	10mg	0.10
2	30mg	10mg	50mg	0.15
3	20mg	30mg	20mg	0.12
Minimum daily requirement (MDR)	290mg	200mg	210mg	

The problem is to determine the number of ounces of each food to be included in the meal. The objective is to minimize the cost of each meal subject to satisfying minimum daily requirements of the three vitamins as well as the restriction on minimum serving size.

Q4

P-17

Q A Person wants to decide the constituents of a diet which will fulfil his daily requirements of Proteins, Fat, carbohydrates at the minimum cost. The choice is to be made from four diferent types of foods. The yield per unit of these foods are given in table.

Food type	Yield / unit Proteins	Fats	Carbohydrates	Cost / units Rs
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirement	800	200	700	

Formulate the linear Programming model for the Problem

Q5

Q1 Farmer Jones must determine how many acres of corn and wheat to plant this year. An acre of wheat yields 25 bushels of wheat and requires 10 hours of labor per week. An acre of corn yields 10 bushels of corn and requires 4 hours of labor per week. All wheat can be sold at $4 a bushel, and all corn can be sold at $3 a bushel. Seven acres of land and 40 hours per week of labor are available. Government regulations require that at least 30 bushels of corn be produced during the current year. Let x1 number of acres of corn planted, and x2 number of acres of wheat planted. Using these decision variables, formulate an LP whose solution will tell Farmer Jones how to maximize the total revenue from wheat and corn.

Formulating a problem – Let's manufacture some chocolates

Example: Consider a chocolate manufacturing company that produces only two types of chocolate – A and B. Both the chocolates require Milk and Choco only. To manufacture each unit of A and B, the following quantities are required:

- Each unit of A requires 1 unit of Milk and 3 units of Choco
- Each unit of B requires 1 unit of Milk and 2 units of Choco

The company kitchen has a total of 5 units of Milk and 12 units of Choco. On each sale, the company makes a profit of

- Rs 6 per unit A sold
- Rs 5 per unit B sold.

Now, the company wishes to maximize its profit. How many units of A and B should it produce respectively?

Solution: The first thing I'm gonna do is represent the problem in a tabular form for better understanding.

	Milk	Choco	Profit per unit
A	1	3	Rs 6
B	1	2	Rs 5
Total	5	12	

Let the total number of units produced by A be = X

Let the total number of units produced by B be = Y

Now, the total profit is represented by Z

The total profit the company makes is given by the total number of units of A and B produced multiplied by its per-unit profit of Rs 6 and Rs 5 respectively.

Profit: Max $Z = 6X+5Y$

which means we have to maximize Z.

The company will try to produce as many units of A and B to maximize the profit. But the resources Milk and Choco are available in a limited amount.

As per the above table, each unit of A and B requires 1 unit of Milk. The total amount of Milk available is 5 units. To represent this mathematically,

$$X+Y \leq 5$$

Also, each unit of A and B requires 3 units & 2 units of Choco respectively. The total amount of Choco available is 12 units. To represent this mathematically,

$$3X+2Y \leq 12$$

Also, the values for units of A can only be integers.

So we have two more constraints, $X \geq 0$ & $Y \geq 0$

For the company to make maximum profit, the above inequalities have to be satisfied.

This is called formulating a real-world problem into a mathematical model.