**Linear Programming Problem**:

**Mathematical Formulation of a LPP:**

The mathematical formulation of a lpp consists of the following steps:

(i)Identify the objective of the problem

(ii) Write down the decision variables of the problem

(iii)Formulate the objective function which is to be optimized

(iv)Formulate the constraints of the problem

(v)Add the non-negative constraints

The objective function, the set of constraints and the non-negative constraints together form a linear programming problem.

**Example 1:** A manufacturer makes two types of furniture, say, chairs and tables. The processing of these products is done on two machines A and B. One chair requires 2 hours work on machine A and 6 hours work on machine B. One table requires 5 hours work on machine A and 3 hours work on machine B. There are 16 hours of time available on machine A and 20 hours work available on machine B. Profit gained by the manufacturer from a chair and a table are 5 dollars and 8 dollars respectively. Formulate this as a lpp in order to maximize the profit for the manufacturer.

**Solution:**

Step (i): Identifying the objective – Maximizing the profit coming out of selling

Chairs and Tables.

Step (ii): The decision variables of the problem – The number of chairs x1 ,

The number of tables x2.

Step (iii): Objective function – Maximize z = 5x1 + 8x2  -------- (1)

Step (iv): Constraints (limitations) of the problem

2 x1 + 5 x2 ≤ 16 (Machine A availability) -------- (2)

6 x1 + 3 x2 ≤ 20 (Machine B availability) -------- (3)

Step (v): Non-negative constraints

x1 , x2 ≥ 0 --------- (4)

Equations (1) – (4) represent the lp formulation of the given problem.

**Example 2: S Bank has to formulate the loan policy for the financial year 2021 – 22. the total loan amount available is 100bn rupees. The bank grants loan to different type of clientele to maximize the return. The following table provides the interest rate charged by the bank for various types of loans and the probability of bad debts as estimated from the past records. Bad debts are assumed to be unrecoverable and also do not produce any revenue**.

Type of loan Interest rate Likely proportion of bad debts

Car loan 8% 0.1

Housing loan 7% 0.04

Industry loan 6% 0.09

Agricultural loan 4% 0.4

As per the Bank guidelines, at least 15% of funds must be loaned to agricultural sector. Industry and agricultural sector loan should be more than 50%. Housing loan should not exceed 30% of the available amount. The overall bad debt on all loans should not exceed 0.05% of the total fund available. Formulate the above bank loan policy into a lpp to maximize the total interest earned.