LINEAR PROGRAMMING PROBLEM
B.Com IVth SEM Q.T

INTRODUCTION:

Decision making is the key operation in organizational performance, progress and prosperity every entity makes its best efforts in either maximizing profit or minimizing its cost of its operation in production marketing and other allied functional cost.

The concept of operation research arise during the world war II by military planners. The Russian mathematician **L.V.KANTORORCH** was the first who applied mathematical models to solve the business problems, now every field of is used for development of mankind.

" The linear function to be optimized (maximized or minimized), Is called the objective function".

"The condition expression the relationship between the variables are called constraints", usually theses constraints are in the form of in equations.

"The variables that appear in the objective function are called decision variables".

Theoretical problems converted into mathematical models is called linear programming problems .

DEFINATION: The objective function subject to the constraints and nom negative restrictions is called **Linear Programming Problem.**

In Mathematical Model:

- The Objective function

  optimum $z = C_1 X_1 + C_2 X_2$ 1

Subjective to constraints
$$\left.\begin{array}{l} a_1 x_1 + a_2 x_2 \leq = \geq b_1 \\ a_2 x_1 + a_2 x_2 \leq = \geq b_2 \end{array}\right\} \quad \text{——} \quad 2$$

Where $x_1\ x_2 \ldots\ldots \geq 0$ (non negative restrictions) —— 3

Formulation of LPP:

The theoretical problem are converted into mathematical models .The framing of such mathematical model to suit a situation is called formulation.

Example A: A firm is engaged in producing two products M_1 & M_2 each unit of product M_1 requires 8 units of raw materials and 16 laborers hours for processing , were as each unit of product M_2 requires 20kg of raw materials and 12 labor hours of the same type. Every week the firm has the availability of 200kg raw materials and 240 labor hours one unit of product M_1 sold earn profit of rupees 80 and one unit of product M_2 sold gives rupees 120 as a profit. Formulate this problem to mathematical model.

Solution: Let X_1 : Number of units of product M_1 to be produced

X_2 : Number of units of product M_2 to be produced

Then from the given data, we have

Particulars	Products		Requirements
	M_1	M_2	
Number of items	X_1	X_2	
Profit	$80\ X_1$	$120\ X_2$	Maximize
Raw materials	$8\ X_1$	$20\ X_2$	≤ 200kgs
Labour hours	$16\ X_1$	$12\ X_2$	≤ 240kgs

The LPP is ,

Maximize $Z = 80\ X_1 + 120\ X_2$

Subject to constraints (s.t.c)

$$80\ X_1 + 120\ X_2 \leq 200$$

$$16\ X_1 + 12\ X_2 \leq 240$$

and $X_1 \geq 0$, $X_2 \geq 0$

Example B: A farmer has 1000 acres of land on which he can grow corn, wheat and soybeans. Each acre of corn costs Rs. 100 for preparation requires 7 man-days of work and yields profit of Rs. 30. An acre of wheat costs Rs. 120 to prepare, required 10 man days of work and yields a profit of Rs = 40. An acre of soya beans costs Rs. 70 to prepare requires 8 man days of work and yield a profit of Rs. 20. if the farmer has Rs. 1,00,000 for preparation and can count on 80,000 man-days work. Formulate the mathematical model.

Solution:

Crop	**Preparation costs**	**Man-days requires**	**Profit in per acre**
corn	100	7	30
wheat	120	10	40
Soyabeans	70	8	20
Availability	1,00,000	80,000	

Let $\mathbf{X_1}$ acres be allotted to grow corn
Let $\mathbf{X_2}$ acres be allotted to grow wheat
Let $\mathbf{X_3}$ acres be allotted to grow soyabeans
Then the total profit is $\mathbf{30X_1 + 40X_2 + 20X_3}$

The constraints are
The availability of land $X_1 + X_2 + X_3 \le 1000$
For preparation of land cost $100X_1 + 120X_2 + 70X_3 \le 1,00,000$
For man-days required : $7X_1 + 10X_2 + 8X_3 \le 80,000$
Non-negativity $X_1\ X_2\ X_3 \ge 0$