INTRODUCTION AND FORMULATION OF LPP

Many problems can be formulated as maximizing or minimizing an objective ,given limited resources and competing constraints . If we can specify the objective as a linear function of certain variables and if we can specify the constraints on resources as equalities or inequalities on those variables, then we have a *linear programming problem*.

- Real life problems can be seen as LPP problem.The problem is actually related to best utilise the resources
- available . Linear programming techniques gives various methods to solve these problems.
- Our job is to now identify such problems and then convert it to the LPP model,which is:

Determine $x_1, x_2, \cdots, x_n$
which optimizes a linear function

$$z = c_1 x_1 + \cdots + c_n x_n.$$

- • subject to the conditions

$$\mathsf{a}_{11}x_1 + \cdots + a_{1j}x_j + \cdots + a_{1n}x_n(\leq, =, \geq)b_1.$$

$$\mathsf{a}_{21}x_1 + \cdots + a_{2j}x_j + \cdots + a_{2n}x_n(\leq, =, \geq)b_2.$$

$$\vdots$$

$$a_{i1}x_1 + \cdots + a_{ij}x_j + \cdots + a_{in}x_n(\leq, =, \geq)b_i.$$

$$a_{m1}x_1 + \cdots + a_{mj}x_j + \cdots + a_{mn}x_n(\leq, =, \geq)b_m.$$

- and non-negativity restrictions $x_j \geq 0, j = 1, 2, \cdots, n$ where all $c_j's, b_i's$ are constants and $x_j's$ are decision variables.

Steps to formulate the LPP

- STEP 1
  To identify the unknown decision variables to be determined and assign symbols to them . [Decision Variables represent the amounts of each units to be produced respectively]
- STEP 2
- To identify all the restrictions or constraints in the problem and express them as linear equations or inequalities of decision variables. [constraints= the limitations under which the amounts are to be produced , like the number of labor available.]
- STEP 3
- To identify the objective or aim of the problem and represent it also as a linear function of decision variables.

- EXAMPLE SHOWING FORMULATION OF A REAL LIFE PROBLEM
- A resourceful home decorator manufactures two types of lamps , say A and B. Both the lamps go through two technicians , first a cutter , second a finisher. Lamp A requires 2 hours of the cutter's time and 1 hour of the finishers time. Lamp B requires 1hour of cutter's and 2 hours of finisher's time. The cutter has 104 hours , and finisher 76hours of available time each month. Profit on one lamp A is rs 6.00 and on one lamp B is rs 11.00 . Assuming that he can sale all that , he produces , how many of each type lamps should be manufactured to obtain the best return?
- SOLUTION
- To identify the decision variables $\rightarrow$ Suppose he manufactures'x' A type lamps and 'y'B type lamps . Then he wants to maximize the total profit,i.e.,

$$z = 6x + 11y$$

- To identify the constraints $\rightarrow$ Now the total cutters time used in preparing'x' type lamps and 'y' B type lamps is 2x+y, which should be less than or equal to 104 This gives the constraint.

$$2x + y \leq 104$$

- Similarly , the finishers time implies the constra n

$$x + 2y \leq 76$$

- To identify the objective function—
  The decorators problem i

$$z = 6x + 11y$$

Subject to

$$2x + y \leq 104$$

$$x + 2y \leq 76$$

- and non-negativity restrictions $x, y \geq 0$ (since the quantity manufactured by the decorator cannot be negative)