Lecture-2
SLa

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Important models in operation research

1. Linear programming model

This model is used for resource allocation when the resources are limited and there are a number of competitors for the use of these resources. The model maybe used to do the following:

- Maximize the return.
- Minimize the cost.
- Transportation model.
- Assignment model.

2. Sequencing model

When a manufacturing firm has some job orders which can be processed in two or three machines and the processing time of each job on each machine is known then the problem of processing in a sequence to minimize the cost or time is called the sequencing model.

3. Queueing model

A model used for solving a problem where certain service facilities have to provide service to its customers avoiding long queues so that customers are satisfied from effective service minimizing idle time of service facilities is called a queueing model. Ex - Bank

4. Inventory model

Any manufacturing firm has to maintain stock of materials for use in an inventory. A company has to maintain an inventory at an optimal cost. Different types of inventory problems depending on demand and availability pattern are solved by an inventory model.

Formulation of LPP

Phases of solving an LPP

- Formulation of problem

It is a statement that includes the following

- Precise description of goal and objectives
- Identification of controllable & uncontrollable variables.
- Restrictions of the problems.

- Identify the variables and constants
- Establish the relations b/w variables and constants
- Identify the possible alternative solutions.
- Give an optimality test to the alternative solutions.
- Select the optimal soln.
- Install, test and establish the solution.

Ex. A company has 3 operational departments : i) Weaving (W) ii) Processing (P), iii) Packing (K) with capacity to produce 3 different types of clothes : i) Suits (S), ii) Shirts (H) and (iii) Woollen (L) yielding a profit of ₹ 2/m for suits, ₹4/m for shirts and ₹3/m for woollen. 1m of suit requires 3 min in weaving, 2 min in procesing and 1 min in packing. Similarly 1m of shirt requires 4 min in weaving, 1 min in processing and 3 min in packing. And 1 m of woollen, it requires 3 min for each. In a week total runtime of each department is 60hrs of W, 40hrs of P and 80hrs of K. Find the product mix to maximize the weekly profit.

60hrs - Weaving (W) — Suits (S) - Rs. 2/m — 3 min (W), 2 min (P), 1 min (K)

40hrs - Processing (P) — Shirts (H) - Rs. 4/m — 4 min (W), 1 min (P), 3 min (K)

80hrs - Packing (K) — Woollen (L) - Rs. 3/m — 3 min (W), 3 min (P), 3 min (K)

Let S – x_1 metres ≥ 0

H – x_2 ≥ 0

W – x_3 ≥ 0

max

$Z = 2x_1 + 4x_2 + 3x_3$ → objective function

$3x_1 + 4x_2 + 3x_3 \leq 60 \times 60$] time

$2x_1 + x_2 + 3x_3 \leq 40 \times 60$

$x_1 + 3x_2 + 3x_3 \leq 80 \times 60$

$x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0$] → Non-negativity constraint

To solve the problem, we need to look at various solutions for x_1, x_2, x_3 which are feasible based on the constraints. The maximum value of the objective function is called the optimal value and the corresponding values of x_1, x_2, x_3 is called the optimal solution.