



CONCEPTS OF OPERATION RESEARCH

SUMMITTED BY

KAJAL PURI

ASSTT. PROF IN COMMERCE

INTRODUCTION

Operation Research is a discipline that deals with analytical approach to decision making. It is often considered to be inter disciplinary subject which includes concepts of mathematics , economics, business, engineering , science, statistics, psychology and many other. In 1967 STAFFORD BEER characterized the field of management science as the business of Operation Research . It uses various research based scientific principles, strategies, mathematical models, analytical , numerical algorithms to reach to sound management decisions. The technique is not restricted to management decisions but extends to practical life and applied to military, medical, public administration , charitable groups, political groups and other community groups.

Thus concept of Operation Research extends to many fields and the techniques adopted in it are applicable to all spheres of life.

FEATURES OF OPERATION RESEARCH

The important features of Operation Research are as follows:

- System Orientation
- Inter disciplinary team approach
- Scientific approach
- Decision making
- Use of computers
- Objectives
- Quantitative solution
- Human factors

PROCESS OF OPERATION RESEARCH

- Observe the problem environment
- Analysis & defining the problem
- Developing a model
- Collecting data required by the model
- Coming up with solution
- Qualifying the models and the solution
- Implement the solution

TECHNIQUES OF OPERATION RESEARCH

- Linear Programming
- Assignment problem
- Transportation problem
- Queuing theory
- Game theory
- Network analysis- PERT & CPM

LINEAR PROGRAMMING

Linear programming is a mathematical technique which is applied for choosing the best alternative from set of feasible solutions. LPP is designed to help managers in planning and decision making and to allocate the resources. **LEONID KANTROVICH**, A Russian mathematician developed the LPP in 1939, **GEORGE B DANTZIA** published the simplex method in 1947, **JOHN VON NEUMANN** developed the theory of Duality in the same year.

In the words of **SAMUELSON & SLOW**- “ The analysis of problems in which a linear function of a number of variables is to maximize or minimize when these variables are subject to number of restraints in the form of linear inequalities”.

REQUIREMENTS OF LPP

The following are the points of terminology and requirements of LPP:

- Objective Function
 - Presence of constraints
 - Alternative course of action
 - Non negativity constraint
 - Linearity
 - Finite number of variables
 - Certainty
 - Additivity
 - Divisibility
 - Decision variables
 - Basic variables
 - Slack variables
 - Surplus variables
 - Artificial variables
- Optimum solution

ASSIGNMENT PROBLEM

It is a special type of LPP which deals in allocating the various resources to various activities on one to one basis such away that the time or cost involved is minimized and sale or profit is maximized. It is also called **HUNGARIAN METHOD** developed by **D.KONIG** which is simpler and more efficient method of solving assignment problem. It is based on following principles:

- If a constant is added to every element of a row or column of the cost matrix of an assignment problem the resulting assignment problem has the same optimum solution as the original problem and vice versa.
- The solution having zero total cost is considered as optimum solution.

Following steps are followed:

- **Subtract row minima** - Subtract the smallest entry in each row from each entry in that row.
- **Subtract column minima** - Subtract the smallest entry in each column from each entry in that column.
- **Cover all zeros with the minimum number of lines** - Using the smallest number of lines possible, draw lines over rows and columns in order to cover all zeros in the matrix. If the number of lines is equal to the number of rows in your square matrix, stop here. Otherwise, go to step 4.
- **Create additional zeros** - Find the smallest element, call it c , that is not covered by a line. Subtract c from all uncovered elements in the matrix and add it to any element that is covered twice. Go back to step 3.

TRANSPORTATION PROBLEM

It is the one of the types of LPP , in which the objective is to transport various quantities of a single homogeneous commodity, to different destinations in such a way that total transportation cost is minimum. It give direct relevance to decisions in the area of distribution policy making, where the objective is minimization of transportation cost.

TERMINOLOGY :

- Feasible solution
- Basic feasible solution
- Optimal solution
- Balanced transportation problem
- Unbalanced transportation problem
- Matrix terminology
- Degenerate Basic feasible solution

QUEUING THEORY

Queuing theory is mainly seen as a branch of probability theory. Queues are formed to get service at that time when demand for a service is more than the capacity of service facility. In a queue customer arrive at a greater rate than the service facility. In case queue starts building up and a time will come when queue will become large that customers may leave the queue and new customers may join it now. This will cause losses to business and also customer waste time standing in queue, known as waiting time cost. The objective of queuing theory is to maintain a balance between waiting time cost and service cost, so that these two are minimum.

FEATURES:

- Length of the queue
- Waiting time
- Total time
- Idle time
- Arrival pattern
- Service pattern
- Service management

GAME THEORY

Game theory is type of decision theory which is based on choice of action. In all these competitions persons have conflicting interests and everybody tries to maximize his gains and minimize his losses. It involves the players having different goals and objectives. It is based on reasoning in which the choice of action is determined after considering the possible alternatives available to the opponents playing the same game. The aim is to choose best course of action, because every player has got an alternative course of action.

FEATURES:

- Finite number of competitors
- Finite number of actions
- Knowledge of alternatives
- Choice
- Outcome or gain
- Choice of opponent

NETWORK ANALYSIS- PERT & CPM

PROGRAMME EVALUATION AND REVIEW

TECHNIQUE (PERT) & CRITICAL PATH METHOD

(CPM) are the network techniques widely used in the project management. These techniques are useful in planning, scheduling and executing large time bound projects which involves coordination of variety of complex and interrelated activities, estimating resource requirements and time for each activity and establishing interrelationship amongst the activities. Important aspects of any project such as:

- Expected completion time
- Effect of any delay in any activity
- How to use additional resources if projects are to be completed before time
- Probability of completing the project in time.

TERMINOLOGY OF PERT & CPM

The basic understanding of PERT & CPM will be done after taking into consideration following concepts

- Event
- Activity
- I. Predecessor activity
- II. Successor activity
- III. Concurrent activity
- IV. Dummy activity
- V. Logic dummy

RULES TO FRAME A NETWORK

- In network diagram arrows represent activities and circle represent events.
- Each activity must start and end in a node.

- The tail of an activity represents the start and head the completion of work.
- The event no. 1 denotes the start of project and is called the initial node or event. All activities emerging from event should be preceded by any other activity. Event carrying the highest number denotes the completion event.
- Events should be numbered in an ascending order so that for each activity (i,j) (I is less than j)
- Only one activity can span across a pair of events.
 - i. An event number should not be repeated or duplicated
 - ii. Two activities should not be identified by the same completion events.
 - iii. Activities must be represented either by their symbol or by the corresponding order of starting and completion events.
 - No dangling is allowed unless especially desired in the problem
 - The logical sequence between activities must follow the rules.

CONCLUSION

In nutshell Operation Research as a technique is emerging very fast and is applicable to all spheres of life wherever conceptual framework or any kind of assignment or project completion is required.

Operation Research is a systematized body of knowledge having different concepts which should be used in everyday life.