RESOURCE MANAGEMENT TECHINQUES

2/5 MARKS

1. What is an operation research?

Operations research (OR) are an analytical method of problem-solving and decision-making that is useful in the management of organizations. In operations research, problems are broken down into basic components and then solved in defined steps by mathematical analysis.

Operations research can be applied to a variety of use cases, including:

- Scheduling and time management.
- Urban and agricultural planning.
- Enterprise resource planning (ERP) and supply chain management (SCM).
- Inventory management.
- Network optimization and engineering.
- Packet routing optimization.
- Risk management.

2. What is payoff matrix?

The payoff matrix is simply a double entry table, with all the payments made by one player to the other, for each strategy adopted, like in Table 6.13-1. As the payment of one player is equal to the gain of the other player, the game is called zero-sum (which is a type of constant-sum game).

		Player 2		
		Rock	Paper	Scissors
Player 1	Rock	0 0	1 -1	-1 1
	Paper	-1 1	0 0	1 -1
	Scissors	1 -1	-1 1	0 0

Decision analysis tool that summarizes pros and cons of a decision in a tabular form. It lists payoffs (negative or positive returns) associated with all possible combinations of alternative actions (under the decision maker's control) and external conditions (not under decision maker's control).

3. What is assignment problem?

An assignment problem is a particular case of transportation problem. The objective is to assign a number of resources to an equal number of activities . So as to minimize total cost or maximize total profit of allocation.

assignment problem with example:

For example, suppose an accounts officer has 4 subordinates and 4 tasks. The subordinates differ in efficiency and take different time to perform each task. If one task is to be assigned to one person in such a way that the total person hours are minimized, the problem is called an assignment problem.

assignment problem and its types:

The assignment problem consists of finding, in a weighted bipartite graph, a matching of a given size, in which the sum of weights of the edges is minimum. If the numbers of agents and tasks are equal, then the problem is called balanced assignment. Otherwise, it is called unbalanced assignment.

4. Write the concept of duality?

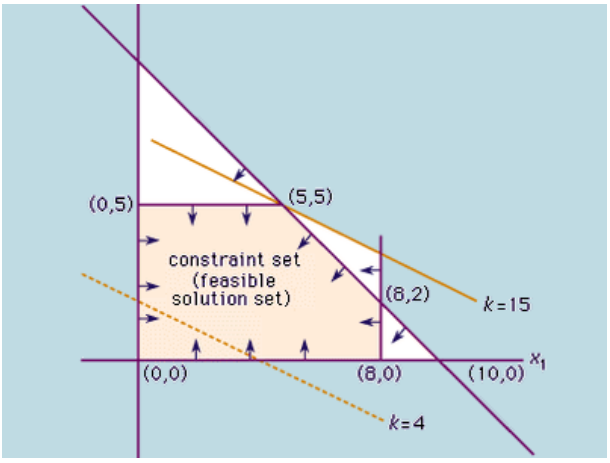
As hinted at by the word "dual" within it, duality refers to having two parts, often with opposite meanings, like the duality of good and evil. If there are two sides to a coin, metaphorically speaking, there's a duality.

$$\begin{aligned} \underset{x,u}{\text{maximize}} \quad & f(x) + \sum_{j=1}^{m} u_j g_j(x) \\ \text{subject to} \quad & \nabla f(x) + \sum_{j=1}^{m} u_j \, \nabla g_j(x) = 0 \\ & u_i \geq 0, \quad i = 1, \ldots, m \end{aligned}$$

Descartes is often called The Father of Dualism, due to his proposing the theory of substance dualism, or Cartesian dualism. Dualism is a theory which entails the belief that the mind and the body are two completely separate substances.

5. What is simplex method?

Simplex method, standard technique in linear programming for solving an optimization problem, typically one involving a function and several constraints expressed as inequalities. The inequalities define a polygonal region, and the solution is typically at one of the vertices.



Example (part 1): Simplex method

Maximize **$Z = f(x,y) = 3x + 2y$**

subject to: $2x + y \leq 18$

$2x + 3y \leq 42$

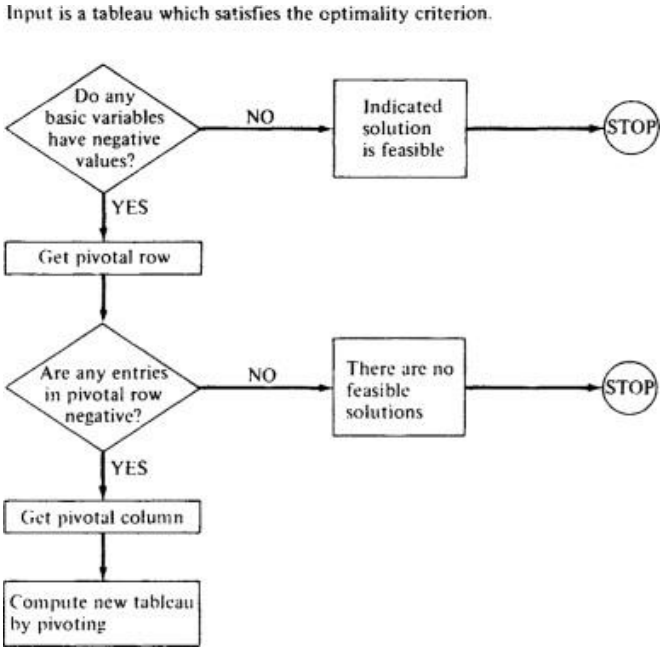
$3x + y \leq 24$

$x \geq 0 , y \geq 0$

Simplex method is considered one of the basic techniques from which many linear programming techniques are directly or indirectly derived. The method is an iterative, stepwise process which approaches an optimum solution in order to reach an objective function of maximization or minimization.

6. What is primal problem?

So, in the primal problem for income optimization, the maximum from the retailing of the optimally manufactured product is subject to the constraints of the quantity of available resources optimally spent during the production.



In mathematical optimization theory, duality or the duality principle is the principle that optimization problems may be viewed from either of two perspectives, the primal problem or the dual problem. If the primal is a minimization problem then the dual is a maximization problem (and vice versa).

7. Short note on game theory.

In environmental and natural resource management, Game Theory is a helpful tool to analyze e.g., international environmental problems, situations when international environmental treaties are decided, or competition over exhaustible natural resources.

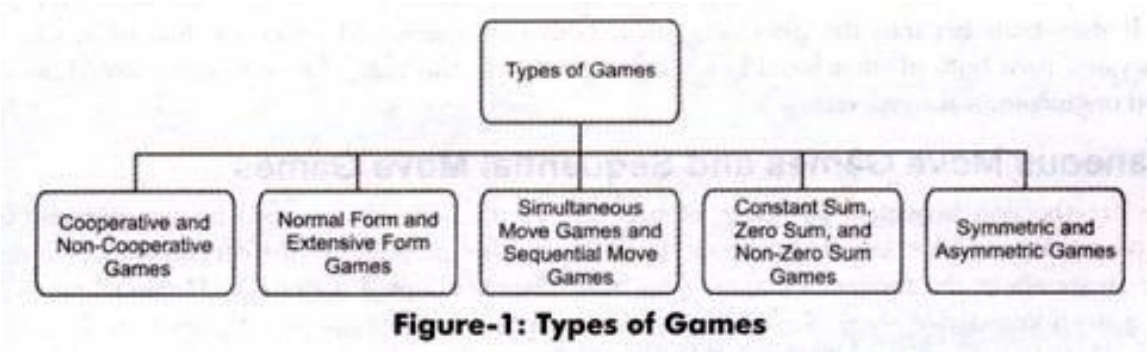


Figure-1: Types of Games

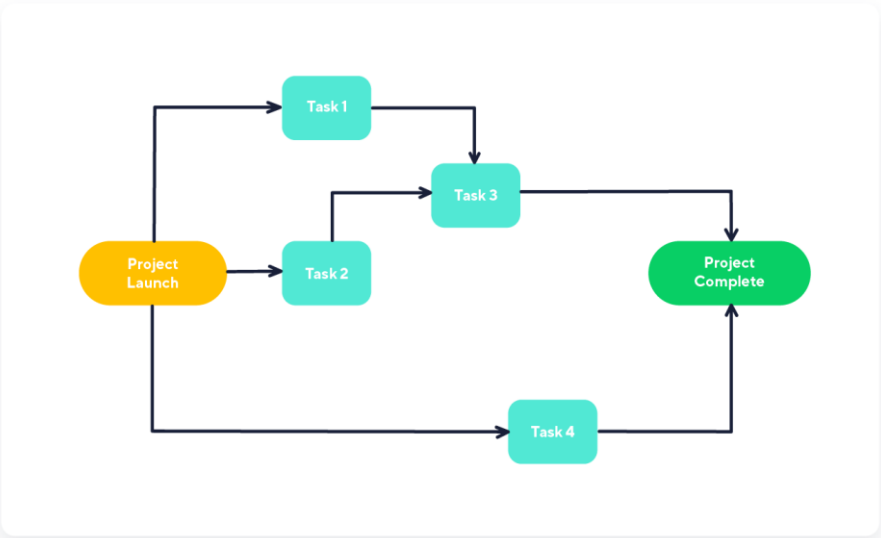
Game theory is a theoretical framework to conceive social situations among competing players. The intention of game theory is to produce optimal decision-making of independent and competing actors in a strategic setting.

8. Write the expansion of PERT.

In the vast world of project management, there are several methods and strategies that can help in the planning, scheduling, and coordination of tasks and resources. One of these tools is a PERT chart.

In this article, we will discuss what PERT charts in project management are and how they were developed.

Before we get started, if you would like to streamline all your projects right now and boost your productivity with powerful project management features such as Gantt charts and Kanban boards, you can unlock a free trial with Wrike today.



What does a PERT chart contain?

PERT is similar to critical path in that they are both used to visualize the timeline and the work that must be done for a project. However with PERT, you create three different time estimates for the project:

- The shortest possible amount of time each task will take
- The most probable amount of time
- The longest amount of time tasks might take if things don't go as planned

PERT is calculated backward from a fixed end date since contractor deadlines typically cannot be moved.

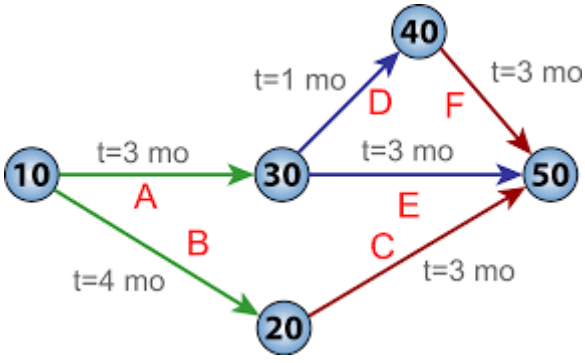
9. Define optimum.

Optimum utilization of resources is a concept in Economics and Management and can be applied in businesses. Management principles are helpful in the optimum utilization of resources. Optimum Utilization of resources means using the resources available at hand and making best use of them.

The use of manpower is a corporate term that clarifies how effectively an organisation uses its workers or workforce. In particular, businesses use the definition of manpower utilisation to analyse performance in relation to labour costs. Furthermore, corporations use this term to explore innovative ways of tackling labour production more efficiently.

10. What is CPM?

The critical path method (CPM) is a technique where you identify tasks that are necessary for project completion and determine scheduling flexibilities. A critical path in project management is the longest sequence of activities that must be finished on time in order for the entire project to be complete.



Any delays in critical tasks will delay the rest of the project. CPM revolves around discovering the most important tasks in the project timeline, identifying task dependencies, and calculating task durations.

11. Name any two uses of replacement model.

In an organisation, replacement problems arise when fixed assets, such as machines, equipment and other tools, need to be replaced due to reduced efficiency, failure or breakdown. Sometimes, replacement takes place when more efficient equipment is available in the market or the maintenance of the existing equipment is incurring a huge cost on an organisation.

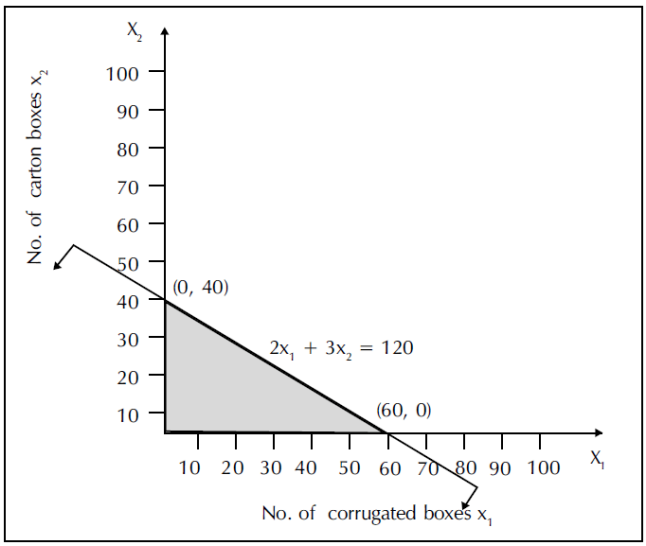
He replacement situations may be placed into the following two main categories:

(1) Replacement of capital equipment that deteriorates with time, e.g., machine tools, buses in transport organization, planes, etc.

(2) Individual or group replacement of items that fail completely, e.g., light bulbs, tubes, etc.

12. What is graphical method?

Graphical method to solve Linear Programming problem (LPP) helps to visualize the procedure explicitly. It also helps to understand the different terminologies associated with the solution of LPP. Linear programming problems with two variables can be represented and solved graphically with ease.



The Graphical Method

- Step 1: Formulate the LP (Linear programming) problem. ...
- Step 2: Construct a graph and plot the constraint lines. ...
- Step 3: Determine the valid side of each constraint line. ...
- Step 4: Identify the feasible solution region. ...
- Step 5: Plot the objective function on the graph. ...
- Step 6: Find the optimum point.

1. What are the necessity of O.R.?

When you execute resource management properly, you can help your organization reduce costs, improve efficiencies, and boost productivity. You also reduce risk, seeing potential resource conflicts early on for more responsive mitigation, typically by reprioritizing projects or resources.

The resources you need to start a business can be broken into five broad categories: financial, human, educational, emotional and physical resources.

- Financial Resources: Funding. ...
- Human Resources: Employees. ...
- Educational Resources: Industry Know How. ...
- Physical Resources: Premises and Equipment.

2. List out any two applications of O.R.

Organizations use the following resource management techniques to maximize resource efficiency, often relying on software to provide transparency to help leaders make smarter resource decisions.

- Resource Allocation. ...
- Resource Utilization. ...
- Resource Levelling. ...
- Resource Forecasting.

3. What is Travelling Salesman problem?

The traveling salesman problem (TSP) is an algorithmic problem tasked with finding the shortest route between a set of points and locations that must be visited. In the problem statement, the points are the cities a salesperson might visit.

The importance of the TSP is that it is representative of a larger class of problems known as combinatorial optimization problems. The TSP problem belongs in the class of such problems known as NP-complete.

4. Write the expansion of CPM.

The critical path method (CPM) is a technique where you identify tasks that are necessary for project completion and determine scheduling flexibilities. A critical path in project management is the longest sequence of activities that must be finished on time in order for the entire project to be complete.

5. What is Assignment problem?

Abstract. The assignment problem (AP) is a discrete and combinatorial problem where agents are assigned to perform tasks for efficiency maximization or cost (time) minimization. AP is a part of human resource project management (HRPM).

An assignment problem is a particular case of transportation problem. The objective is to assign a number of resources to an equal number of activities. So as to minimize total cost or maximize total profit of allocation.

For example, suppose an accounts officer has 4 subordinates and 4 tasks. The subordinates differ in efficiency and take different time to perform each task. If one task is to be assigned to one person in such a way that the total person hours are minimized, the problem is called an assignment problem.

6. What is linear programming?

Linear programming is a mathematical technique that determines the best way to use available resources. Managers use the process to help make decisions about the most efficient use of limited resources – like money, time, materials, and machinery.

Applications of Linear Programming Problem (LPP):

- Transportation Problem: ...
- Proficiency in Operation of Dam System: ...
- Optimum Estimation of Executive Compensation: ...
- Agricultural Applications: ...
- Marketing Management: ...
- Manpower Management: ...
- Physical Distribution:

Uses of linear programming:

Some areas of application for linear programming include food and agriculture, engineering, transportation, manufacturing and energy.

- Linear Programming Overview. ...
- Food and Agriculture. ...
- Applications in Engineering. ...
- Transportation Optimization. ...
- Efficient Manufacturing. ...
- Energy Industry.

7. What is Simulation?

Simulation training provides context through hands-on application. Administrators can review and provide real-time feedback. Employees can access customized training based on their unique role. Employees can refine both technical and soft skills. Simulation training allows employees to make mistakes.

Simulation is normally used to assess the current, or predict the future, performance of a business process. The concept is designed to help practitioners and business owners discover new ways to improve their business processes through the use of mathematical, statistical and other analytical methods.

8. What are the two important forms of Primal-dual pairs?

In mathematical optimization theory, duality or the duality principle is the principle that optimization problems may be viewed from either of two perspectives, the primal problem or the dual problem. If the primal is a minimization problem then the dual is a maximization problem (and vice versa).

Types of Primal –Dual Problem

1. Symmetric: Here all constraints of both primal and dual problems are in equations and variables are non-negative.

2. Un-Symmetric: Here all constraints of primal are equations and primal variables are non-negative.

9. What are the advantages of CPM?

Advantages of Critical Path Method. The critical path method is a reliable way for project managers to budget time and allocate resources. Advantages of CPM include improved accuracy and flexibility in scheduling, clearer communication between project managers and stakeholders, easier task prioritization, and more.

Advantages of critical path analysis

- Enhanced project management. ...
- Clear identification of critical tasks. ...
- Clear communication of project plans. ...
- Accurate determination of project length. ...
- Precise scheduling. ...
- Impvoed cost control. ...
- Improved allocation of human resources. ...
- Minimised slowdowns.

10. What is Computer simulation?

Computer simulation, the use of a computer to represent the dynamic responses of one system by the behaviour of another system modelled after it. A simulation uses a mathematical description, or model, of a real system in the form of a computer program.

Some examples of computer simulation modelling familiar to most of us include: weather forecasting, flight simulators used for training pilots, and car crash modelling.

11. What is Sequencing model?

Sequence Models: improve the steps of a task. Sequence Models make the detailed structure of a task explicit. They show how the task is broken into activities, the intents that people are trying to accomplish in doing the task, the different strategies people use, and the individual steps which make up the task.

Sequencing can be defined as the selection of an order for a series of jobs to be done on a number of service facilities (machine). In sequencing, a systematic procedure is adopted in assigning priorities to waiting jobs thereby determining the sequence in which jobs will be processed.

12. What are the examples of Assignment Model?

The assignment method is a way of allocating organizational resources in which each resource is assigned to a particular task. The resource could be monetary, personnel, or technological.

Example of Assignment Method

A bank is allocating its sales force to grow its mortgage lending business. The bank has over 50 branches in New York but only ten in Chicago. Each branch has a staff that is used to bring in new clients.

The bank's management team decides to perform an analysis using the assignment method to determine where their newly-hired salespeople should be allocated. Given the past performance results in the Chicago area, the bank has produced fewer new clients than in New York. The fewer new clients are the result of having a small market presence in Chicago.

The applications of assignment model:

The assignment method has various applications in maximizing resources, including: Allocating the proper number of employees to a machine or task. Allocating a machine or a manufacturing plant and the number of jobs that a given machine or factory can produce.

1. **What is Idle time on machines?**

Idle time, sometimes referred to as waiting time, is the time lost due to work stoppages in which machines and/or employees are ready and available but cannot be productive.

Formula: Idle Time = Scheduled Production Time (what was planned) – Actual Production Time (what actually happened)

It should not be confused with planned or unplanned downtime. Idle time is when work can be performed but isn't, while downtime is when work cannot be performed at all.

There are two main types of idle time: Planned idle time and unplanned idle time.

2. **What are two limitations of an OR model?**

The human behaviour is most uncertain and it is not possible to predict how man will react into a particular policy decision. It is not possible to formulate definite principle. — Uniform principles, rules and policies cannot be laid down for all type of organization.

Some of the limitations of HRM are: 1. recent origin 2. Lack of support of top management 3. Improper actualization

3. **Define zero-sum game.**

A zero-sum game is a situation where one person's loss in a transaction is equivalent to another person's gain. After the losses and gains, the net effect on both sides is equal to zero.

The clearest examples of market-related zero-sum games involve stock options and futures contracts. In both circumstances, if the buyer wins, there's a good chance the seller will lose, and vice versa.

4. **What is sequencing problem?**

Sequencing problems are concerned with an appropriate order (sequence) for a series of jobs to be done on a finite number of service facilities (like machines) in some well-defined technological order so as to optimize some efficiency measure such as total elapsed time or overall cost etc.

sequencing problem and its uses:

Sequencing problems deals with the selection of an optimum order for the number of jobs to perform with a finite number of facilities. The objective of sequencing is to determine the sequence of performing jobs such that we can minimize the total cost/time

5. Write any two characteristics of standard form of LPP.

Characteristics of standard form LPs

- They are about maximizing, not minimizing.
- They have a positivity constraint for each variable.
- The other constraints are all of the form “linear combination of variables constant”.

11. What are the transportation models?

The transportation model addresses the concept of moving a thing from one place to another without change. It assumes that any damage en route has negative consequences, and so it's used to analyze transportation systems and find the most efficient route for resource allocation.

Transportation Model

- Linear Programming.
- Vehicular Network.
- Intelligent Transportation System.
- Transportation Network.
- Transportation Problem.
- Computer Network.
- System Analysis.

12. What is Monte Carlo method?

The Monte Carlo Analysis is a risk management technique, which project managers use to estimate the impacts of various risks on the project cost and project timeline. Using this method, one can easily find out what will happen to the project schedule and cost in case any risk occurs.

1. **What are the objectives of Operation Research?**

The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering.

Operations research is often concerned with determining the extreme values of some real-world objective: the maximum (of profit, performance, or yield) or minimum (of loss, risk, or cost). Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries.

2. **What is the test of optimality in the simplex method?**

Simplex method. The model is checked for an optimal solution, which exists on the vertices of the feasible region, after construction of the tableau. If all values in the last row are greater-than-or-equal-to zero, it means that the variable has reached its optimal value.

Simplex method is an approach to solving linear programming models by hand using slack variables, tableaus, and pivot variables as a means to finding the optimal solution of an optimization problem. Simplex tableau is used to perform row operations on the linear programming model as well as for checking optimality.

3. What is feasible solution?

A feasible solution is a set of values for the decision variables that satisfies all of the constraints in an optimization problem. The set of all feasible solutions defines the feasible region of the problem.

The different types of feasible solutions:

Basic feasible solutions are of two types:Degenerate:A basic feasible solution is called degenerate if value of at least one basic variable is zero. Non-degenerate: A basic feasible solution is called non-degenerate if values all m basic variables are non-zero and positive.

A feasible solution to a linear program is a solution that satisfies all the constraints of the linear programming problem. There could be many solutions that satisfy all the constraints. All of those solutions which satisfy all the constraints are feasible constraints.

4. What is Duality problem?

The dual problem is an LP defined directly and systematically from the primal (or original) LP model. The two problems are so closely related that the optimal solution of one problem automatically provides the optimal solution to the other.

The steps in duality problem:

Steps for formulation are summarized as
Step 1: write the given LPP in its standard form.
Step 2: identify the variables of dual problem which are same as the number of constraints equation.
Step 3: write the objective function of the dual problem by using the constants of the right had side of the constraints.

5. What is Transportation problem?

The transportation problem is a special type of linear programming problem where the objective consists in minimizing transportation cost of a given commodity from a number of sources or origins (e.g. factory, manufacturing facility) to a number of destinations (e.g. warehouse, store).

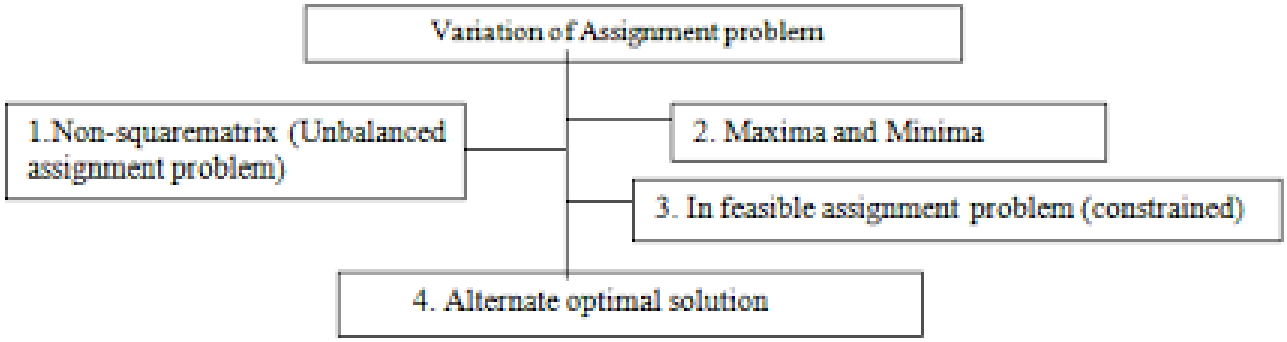
Transportation problem and application:

Transportation is one of the most frequent problems in the business world. The major feature of the problem is that there are many warehouses and many delivery places. The objective of solving this problem is to find the amount of goods that should be sent from each warehouse to each customer while minimizing cost.

8. What is variation of Assignment problem?

Types of assignment problem in Operational Research

The assignment problem is classified into balanced assignment problem and unbalanced assignment problem. If the number of rows is equal to the number of columns, then the problem is termed as a balanced assignment problem; otherwise, an unbalanced assignment problem.



Unbalanced Assignment Problem:

Any assignment problem is said to be unbalanced if the cost matrix is not a square matrix, i.e. the no of rows and the no of columns are not equal. To make it balanced we add a dummy row or dummy column with all the entries is zero.