University Question Paper Two Marks

1. List the application of Operations Research in functional areas of management.

Answer:

Finance, Budgeting and Investment

Marketing

Physical distribution

Purchasing, procurement and Exploration

Personnel

Production

Research and Development

2. When can the dual Simplex method be applied?

Answer: In Simplex method, every basic solution with all $z_j - c_j \geq 0$ will not be feasible but any basic feasible solution with all $z_j - c_j \geq 0$ will certainly be an optimal solution. Such typical problems for which it is possible to find infeasible but better than optimal starting basic solutions, can be solved more easily by dual simplex method.

3. What is meant by degeneracy in a transportation model?

If the number of basic cells is less than $m + n - 1$ (i.e. , Number of rows + number of columns -1) then degeneracy occurs in a transportation problem.

4. What is an unbalanced case in an Assignment model?

An assignment model is said to be unbalanced if number of rows $\neq$ number of columns.

5. What is a mixed integer programming problem?

If only some of the variables in the optimum solution of a Linear Programming Problem are restricted to assume non-negative integer values while the remaining variables are free to take any non-negative values then it is called a mixed integer programming problem.

6. Define Saddle point.

The saddle point in a pay-off matrix is that position in the payoff matrix where Maximin = Minimax.

7. What is a quantity discount model?

When items are purchased bulk, buyers are usually given discount in the purchase price of goods. This discount may be a step function of purchase quantity.

8. What criteria in decision making under risk deals with maximizing profit?

Criteria for decision making under risk situation

Maximum likelihood rule

Expected pay-off criterion

EMV criterion

EOL criterion

EVPI criterion

Bayesian decision rule

9. List the application of queueing theory.

Planning, scheduling and sequencing of parts and components to assembly lines in a mass production system.

Scheduling of workstations and machines performing

Scheduling and dispatch of war material of special nature based on operational needs.

Determining the number of attendants required at a petrol station.

Determining the size of parking lot

Scheduling of service facilities in a repair and maintenance workshop.

10. What is the significance of 'r' in a replacement model?

'r' in replacement model means present value of the maintenance for each of the years.

11. List the scope of applications of OR techniques.

Scope of Operations Research is

Cash management

Inventory control

Simulation techniques

Capital budgeting

12. What is sensitivity analysis?

The change in parameters of the problem may be discrete or continuous. The study of the effect of discrete changes in parameters on the optimal solution is called the sensitivity analysis.

13. List the methods used to arrive at an initial basic feasible solution in a transportation model.

North-West corner method

Least cost method

Column Minima method

Row Minima method

Vogel's Approximation method

14. How does a travelling salesman problem differ from a routine assignment model?

Travelling salesman problem is similar to the assignment problem with the difference that there is the additional constraint that no city is to be visited again before the tour of all the cities is completed.

15. Define zero sum game

It is a game in which the sum of payments to all the players after the play of the game is zero.

16. Define Simulation.

The imitation of reality which may be in the physical form or in the form of mathematical equations may be called simulation.

17. What is meant by EOL?

EOL means economic order level. There should be enough for each time so that customers orders can be reasonably met from this stock until replenishment. This Stock level, becomes economic order level.

18. Define Constraints.

Linear Programming Problem deals with the optimization of a function of variables known as objective function , subject to set of linear equalities/ inequalities known as constraints. The constraints may be imposed by different sources such as market demand, production processes and equipment, storage capacity, raw material availability.

19. Use an example to show that dual of dual yields the primal.

Primal problem:

$$Max\ z = 2x_1 + 3x_2$$

Subject to

$$x_1 + x_2 \leq 5$$

$$3x_1 + 5x_2 \leq 15$$

$$x_1, x_2 \geq 0$$

Dual of primal problem:

$$Min\ z^* = 5y_1 + 15y_2$$

Subject to

$$y_1 + 3y_2 \geq 2$$

$$y_1 + 5y_2 \geq 3$$

$$y_1, y_2 \geq 0$$

Dual of Dual problem:

$$Max\ z = 2x_1 + 3x_2$$

Subject to

$$x_1 + x_2 \leq 5$$

$$3x_1 + 5x_2 \leq 15$$

$$x_1, x_2 \geq 0$$

∴ Dual of dual problem is primal problem.

20. What are the transient nodes in a transportation problem?

Transportation problems are special minimum cost network flow models for which every node is either a pure supply node or pure demand node. i.e., all flow goes immediately from source node to a sink node where it is demanded.

21. What is Gomory's fraction cut?

A systematic procedure for solving pure integer programming problem was first developed by R.E .Gomory in 1958. Later on the extended the procedure to solve mixed Integer programming problem named as cutting plane algorithm. The method consists in first solving the Integer programming problem as ordinary Linear programming problem by ignoring the integrity restriction and then introducing additional constraints one after the other to cut certain part of the solution space until an integer solution is obtained.

22. Define a stage in dynamic programming.

A stage signifies a portion of the total problem for which a decision can be taken. At each stage there are a number of alternative and the best of those is called the stage decision, which may not be optimal for the stage but contributes to obtain the optimal decision policy.

23. Define pay-off as applied to decision theory.

If the outcome is measured in terms of money then it is called a pay-off. A pay-off matrix is calculated by the cross tabulation of the alternative A and the possible events.

24. List any two applications of Simulation.

Simulation is used for solving inventory problems, queueing problems, training problems etc.

25. Define Operations Research.

Operations Research a scientific approach to problem solving for executive decision making which requires the formulation of mathematical, economic and satisfied models for decision and control problems to deal with situations arising out of risk and uncertainty.

26. Define degenerate solution in Linear Programming Problem.

In Linear Programming Problem, intersection of two constraints will define a corner point of the feasible region. But if more than two constraints pass through any one of the corner points of the feasible region, excess constraints will not serve any purpose and therefore they act as redundant constraints.

27. Write a Linear Programming model of the assignment model.

$$Minimize \ z = c_{11}x_{11} + c_{12}x_{12} + \cdots + c_{1m}x_{1m} + c_{21}x_{21} + c_{22}x_{22} + \cdots + c_{2m} \ x_{2m}$$

$$+ \cdots + c_{m1}x_{m1} + \cdots + c_{mm} \ x_{mm}$$

Subject to

$$x_{11} + x_{12} + \cdots + x_{1m} = 1$$

$$x_{21} + x_{22} + \cdots + x_{2m} = 1$$

$$\vdots$$

$$x_{m1} + x_{m2} + \cdots + x_{mm} = 1$$

$$x_{11} + x_{21} + \cdots + x_{m1} = 1$$

$$x_{12} + x_{22} + \cdots + x_{m2} = 1$$

$$\vdots$$

$$x_{1m} + x_{2m} + \cdots + x_{mm} = 1$$

$$x_{ij} \geq 0; i = 1,2, \dots m; \ j = 1,2, \dots m$$

28. Distinguish between transportation problem and transshipment problem.

Transportation problem	Transshipment problem
Shipments are dent directly from a particular source to particular destination	The objective is to minimize the total cost of shipments and thus the shipment passes through one or more intermediate nodes before it reaches its desired destination
Transportation problem is used to solve the problem	Transshipment problem cannot be solved as such by the usual transportation algorithm but slight modification is required before applying it to the transshipment problem

29. Write the conditions for a fathomed sub problem of branch and bound techniques in integer programming problem.

A problem is said to be fathomed if any one of the following three conditions true

The value of the decision variables of the problem are integer

The upper bound of the problem which as non integer values for its decision variable is not greater than the current best lower bound

The problem has infeasible solution.

30. State Bellman's principle of optimality.

It states that "An optimality policy has the property that whatever be the initial decisions the remaining decision must constitute an optimal policy for the state resulting from the first decision".

31. Define simulation. Mention its advantages.

The representation of reality in some physical form or in some form of mathematical equations may be called as simulation. i.e., Simulation is initiation of reality.

Advantages:

Mathematically less complicated.

Flexible

Modified to suit the changing environments of the real situation

Can be used for training purposes

32. Define the main characteristics of the queueing system.

The input

The service mechanism

The queueing discipline

Customer behavior

33. Distinguish between breakdown maintenance and preventive maintenance.

Breakdown maintenance	Preventive maintenance
Breakdown maintenance is the repair which is generally done after the equipment breaks down	Preventive maintenance is the periodical inspection and service facilities which are aimed to defect potential failures and perform minor adjustments repairs which will prevent major operating problems in future
It is often as emergency which will have as associated penalty in terms of increasing the cost maintenance and downtime cost of equipment	Preventive maintenance will reduce such costs upto a certain event
The cost of Breakdown maintenance is less	The cost of Preventive maintenance is more

34. Define unbalanced transportation problem.

In transportation model, if the sum of the number of supply units available at the source is not equal to the sum of the number of demand units required at destination, then it is called unbalanced transportation problem.

35. Define travelling salesman problem.

There are number of cities a salesman must visit. The distance between every pair of cities is known. He starts from his home city, passes through each city once and only once and returns to his home city. The problem is to find the routes shortest in distance or time or cost.

36. What is linear programming?

Linear programming problem deals with the optimization of a function of decision variables known as objective function subject to set of simultaneous linear equations known as constraints.

The term linear means that all the variables occurring objective function and the constraints are of the first degree in the problem under consideration and the term programming means the process of determining particular course of action.

37. What is a game?

A competitive situation is called a game. There are finite number of competitors called players. A list of finite and or infinite number of possible courses of action is available to each player.

38. What are decision trees?

A decision tree is a directed tree that represents a decision process. The decision trees are useful in finding optimal decisions for lengthy processes. The procedure is to start from the terminal nodes and sequentially to move backwards through the network. Calculate the expected gains at the intermediate nodes.
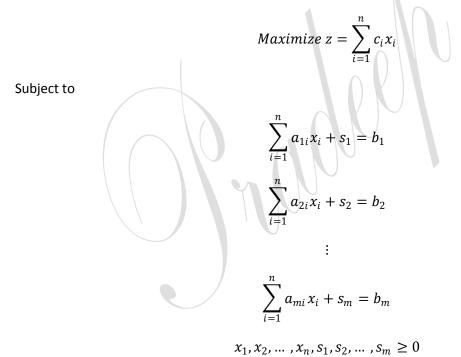
39. What is a queue?

A queue is formed when either with requiring service commonly referred to as customer wait for serviced or the service facilities stand idle and wait for customer.

40. What is a replacement model?

The problem of replacement is felt when the job performing units such as men, machines, equipments, parts etc., becomes less effective or useless due either sudden or gradual determination in their efficiency, failure or breakdown.

41. Write down the standard form of a Linear Programming problem.

$$Maximize\ z = \sum_{i=1}^{n} c_i x_i$$

Subject to

$$\sum_{i=1}^{n} a_{1i} x_i + s_1 = b_1$$

$$\sum_{i=1}^{n} a_{2i} x_i + s_2 = b_2$$

$$\vdots$$

$$\sum_{i=1}^{n} a_{mi} x_i + s_m = b_m$$

$$x_1, x_2, \dots, x_n, s_1, s_2, \dots, s_m \geq 0$$

42. List the applications of operation research model.

Accounting:

Cash flow planning

Credit policy analysis and planning of delinquent account strategy

Construction:

Allocation of resources of projects

Determination of proper work force

Facility planning:

Factory size and location decision

Hospital planning

Finance:

Dividend policy making

Production scheduling

Manufacturing:

Inventory control

Production scheduling

Marketing

Advertising budget allocation

Selection of product mix

Organizational behavior:

Revisional justification

Skills balancing

Purchasing:

Material transfer

Optimal recording

Research and development:

Control and R&D projects

Product introduction planning

43. Distinguish between transportation problem and assignment problem.

Transportation Problem	Assignment Problem
A cost matrix in transportation problem is not a square matrix.	It is a square matrix
Supply and demand at any source and any destination may be positive quantity.	It will be 1.
The allocation x_{ij} can take any positive values satisfying the rim requirements.	x_{ij} take only two positive values 1 or 0.

44. Define mixed strategy in a game.

The optimal strategy mixture for each player may be determined by assigning to each Strategy its probability of being chosen. These strategy are called mixed strategy.

If there is no saddle point then the strategy is a mixed strategy.

45. Name the inventory control systems adopted in practice.

The inventory control problem consists of determination of three basic factors.

When to order?

How much to order?

How much should be the safety stock?

46. What is meant by group replacement model?

Group replacement policy in which all items are replaced irrespective of whether they have failed or not with a provision that if any items fails before the optimal time it may be individually replaced

47. List the components of a queuing system.

Components of a queuing system

Input or arrival distribution

Output or departure distribution

Service channels

Service discipline

Maximum number of customers allowed in the system

Calling source or population

Customer's behavior.

48. List down the variants in Simplex method.

Degeneracy and cycling

Unbounded solution

Multiple solution or alternative optimum solution

No feasible solution

Unrestricted variables

49. Give the applications of duality theory.

If the primal problem contains a large number of constraints and smaller number of variables, the computational procedure can be considerably reduced by converting it into dual and then solving it. Hence it offers an advantage in many applications.

It gives additional information as to how the optimal solution changes as a result of the changes in the coefficients and the formulation of the problem. This form the basis of post optimality or sensitivity analysis.

50. What are the conditions to be satisfied for proceeding with optimality test in a transporting problem?

The availability as well as requirements of the various centers are finite and contains the limited resources.

The cost of transportation is linear.

51. Explain Hungarian algorithm.

The assignment problem is completely a degenerate form of a transportation problem. The units available at each origin and units demanded at each destination are all equal to one. This means exactly one occupied cell in each row and each column of the transportation table, only n occupied cells in place required 2n-1 occupied cells. Because of degeneracy, the problem cannot be solved by either Simplex method or transportation method. In a transportation method, in order to remove degeneracy, n-1 number of dummy allocations will be required to proceed with the transportation model. The problem of degeneracy at each solution makes the computation by the transportation method inefficient. So we go for a method called the Hungarian method, to find the optimal solution without having to make a direct comparison of every solution.

52. Discuss dominance with reference to game theory.

We can sometimes reduce the size of the games pay-off matrix by eliminating a course of action which is so interior to another as never to be used. Such a course of action is said to be dominated by the other. The concept of dominance is especially useful for the evaluation of two-person zero sum games where a saddle point does not exist.

53. Explain branch and bound technique.

This method is applicable to both pure as well as mixed integer programming problems and involves the continuous version of the problem.

Branch and bound is a generic method for solving a class of optimization problems. The optimal solution is selected by successive partitioning of the set of all possible solutions into two mutually exclusive and exhaustive subsets, and establishing limit for each set such that all solutions in the set are more than the limit, the first part of the procedure involving partitioning is called branching while the second part of establishing limit is referred to as bounding.

The branch and bound method first divides the feasible region into smaller subsets and then examines each of them successively until a feasible solution that gives optimal value of objective function is obtained.

54. Explain the application of dynamic programming in inventory problems with an example.

In deciding inventory replenishment decisions, there are two basic replenishment decisions, they are

a) When is it necessary to place an order in an no replenishment inventory?

 If the demand of an item independent of that of other items then the reorder point techniques can be used to know the time of replenishment.

b) How much is to be ordered in each replenishment?

The decision about the number of units to order for replenishment depends on the types of inventory costs.

55. List down the methods of generating random numbers in simulation.

Random numbers may be drawn from the random table stored in the memory of the computer.

An electronic device may be connected as part of the digital computer to generate true random numbers.

In the mid-square method of generating Pseudo- random numbers, a four digit number is taken.

Pseudo random numbers may also be generated by arithmetic operations.

56. Explain the terms a) queue length b) traffic intensity.

Queue length : The average number of customers in the queue waiting to get served.

Traffic intensity:

$$\rho = \frac{\lambda}{\mu}$$

Where λ = average number of customers arriving per unit of time

μ = average number of customers being served per unit of time

57. What are three property of linearity?

Proportionality

Additivity

Divisibility

58. What are the assumptions that must be satisfied in order for a problem to be solved in Linear Programming?

Certainty

Linearity

59. How is degeneracy handled in MODI method?

Degeneracy in MODI method is handled by maintaining m+n-1 basic cells. It can arise in two situations. It is handled in the following ways

By never deleting a row or column of the transportation problem at the same time.

The other situation arises whenever there is more than one basic cell in the closed loop and has minimum shipment amount. Care should be taken to delete only one of these cells.

60. List some application of the assignment model.

Workers to task

Salesman to territories

Contracts to contractors

61. How does integer programming differ from linear programming?

 In integer programming, only integers can be solutions for the maximization or minimization problem. But in linear programming, the solutions can be fractions or integers.

62. What is game theory?

Game theory deals with decision making situation in which two intelligent opponents have conflicting objectives.

63. Define alternative optima in linear programming.

The optimal solution to an linear programming may not be necessarily unique. It is possible that an adjacent extreme point will yield the same profit. This is called as alternative optima.

64. What are the basic elements in queueing?

Calling population

The queue

Service facility

Service calling links

65. What is meant by queue discipline?

Queue discipline is a decision rule that determines which calling unit in the queuing system receives service.

66. What are the special cases of linear programming problem?

Optimum basic feasible solution

Multiple optimal solutions

Unbounded solutions

Infeasible solutions

Corner- point feasible solutions.

67. What are the major assumptions of linear programming?

The major assumptions of linear programming

Proportionality

Adaptivity

Divisibility

Certainty

Finiteness

68. What is transshipment problem?

The transshipment problem is an extension of the classic transportation model. This model allows for intermediate transshipment nodes that lie between source nodes and sink nodes. It recognizes that it may be cheaper to ship through intermediate or transient before reaching the final destination. The problem is to determine the number of units to distribute from the plant to each warehouse and the number of units to distribute from each warehouse to each final destination so as to minimize total cost of distribution.

69. What are the classifications of linear programming?

General linear programming

Transportation model

Assignment model

70. What are the basic reasons for replacement?

The basic reasons for replacement are

Old item has become worse or requires expensive maintenance.

The old item has failed due to accident

A more efficient design of equipment has become available in market

71. What is degeneracy in the transportation problem?

In a transportation problem, whenever the number of non –negative independent allocations is less than m+n-1. The transportation problem is said to be a degenerate one. Degeneracy may occur either at the initial stage or at an intermediate stage at some subsequent iteration.

72. What are the behaviors of customer in a queueing model?

The customer generally behaves in four ways

Balking

Reneging

Priorities

Jockeying

73. Define expected monetary value.

The expected monetary value(EMV) of an act is the sum of all expected conditional profits associated with that act.

74. What is two person Zero-sum game?

A two person zero-sum game is a game with only two players in which the gains of one player are the losses of another player. Two person zero-sum games are also called rectangular games which are usually represented by a pay-off matrix in rectangular form.

75. Define Bellman's optimality principles.

It implies that given the initial state of a system, an optimal policy for the subsequent stages does not depend upon the policy adopted at the proceeding stages.