IMPORTANT TWO MARKS Q & A IN AOR FOR ALL 5 UNITS

Part A

1. Define a feasible solution.

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

A set of non-negative decision values xij (i = 1; 2....m; j = 1,2....n) satisfies the constraint equations are called a feasible solution.

2. Define optimal solution.

An optimal solution is a feasible solution where the objective function reaches its maximum or minimum value.

3. What is the difference between basic solution and basic feasible solution?

Basic solution- Solution of a problem which satisfy all the condition. Basically in linear programming more importance is about basic feasible solution rather than basic solution.

Basic Feasible solution- A set of non negative individual allocation which satisfy all the given constraints is termed as feasible solution.

4. Define unbounded solution.

If the constraint coefficient of the entering variable in the simplex table are either less than or equal to zero, then the solution space is unbounded and has no finite optimum solution.

5. What are slack and surplus variables?

Slack variable: It represents an unused quantity of resources; it is added to less than or equal (≤) to type constraints in order to get an equality constraint.

Surplus variable: It represents the amount by which solution values exceed a resource. These variables are also called 'Negative slack variables'. It carry a zero coefficient in the objective function.

6. What is meant by optimality test in a LPP?

7. What are the methods used to solve an LPP involving artificial variables?
   - ✓ The Big M Method or Method of Penalties
   - ✓ The Two-phase Simplex Method

8. Define artificial variable

It refers to a set of non negative variables temporarily added to a linear program to obtain an initial basic feasible solution. The artificial variables must be driven to zero to obtain a basic solution to original constraints.

9. When does an LPP posses a pseudo-optimal solution?

10. What is degeneracy?

The concept of obtaining a degenerate feasible solution in a LPP is known as **Degeneracy**.

11. How to resolve degeneracy in a LPP

12. Define dual of LPP.

Dual in LPP states that every linear programming problem has another linear programming problem related to it and thus can be derived from it. The original linear programming problem is called **Primal** while the derived linear problem is called **Dual**.

13. State the characteristics of canonical form.

- The objective function is of maximization type
- All constraints are of (≤) type
- All variables xi are non-negative

14. State the characteristics of standard form.

- The objective function is of maximization type
- All constraints are expressed as equations
- Right hand side of each constraint is non-negative
- All variables are non-negative.

15. Define basic feasible solution

A feasible solution to an LPP which is also the basic solution is called basic feasible solution. i.e., all variables assume non negative values.

16. Define non-degenerate solution

A basic feasible solution is called non-degenerate if the value of all m basic variables are non-zero and positive.

17. Define degenerate solution

A Linear programming is degenerate if in a basic feasible solution, one of the basuc variables taken on a zero value. It is caused by redundant constraint(s) and could cost simplex method extra iterations.

18. Write the general mathematical model of LPP in matrix form.

19. Define basic solution:

A feasible solution is said to be basic if the number of positive allocations equals m+n-1; that is one less than the number of rows and columns in a transportation problem.

20. What do you understand by transportation problem?

The main objective of transportation problem is to shift the commodity from the sources to the desired destination, so that the transportation cost is minimum.

21. Define feasible solution of a transportation problem.

A feasible solution is said to be basic if the number of positive allocation equals **m+n-1**; that is one less than the number of rows and columns in a transportation problem. A feasible solution (not necessarily basic) is said to be optimal if it minimizes the total transportation cost.

22. Define basic feasible solution of a transportation problem.

A feasible solution (not necessarily basic) is said to be optimal if it minimizes the total transportation cost.

23. Define degenerate basic feasible solution of a transportation problem.

If the no of allocation in basic feasible solution is less than (m+n-1).

24. Define the optimal solution to a T.P?

A feasible solution is said to be optimal solution if it minimizes the total transportation cost.

25. What is the purpose of MODI method?

The modified distribution method also known as MODI method or (u-v) method provides a minimum cost solution to the transportation problem. It is an improvement over stepping method.

26. What do you mean by degeneracy in a T.P?

In a transportation problem, whenever the no of non-negative independent allocations is less than m+n-1, the transportation problem is said to be a degenerate one.

27. Explain how degeneracy in a T.P may be resolved?

To resolve degeneracy, we allocate an extremely small amount (close to zero) to one or more empty cells of the transportation table (generally minimum cost cells if possible), so that the total no of occupied cells becomes **(m+n-1)** @ independent positions.

28. What do you mean by an unbalanced T.P?

If total demand [TD ≠ TS] is not equal to total supply then the problem is said to be a unbalanced transportation problem.

29. What is an assignment problem? Give two applications?

The assignment problem objective is to assign a number of tasks to an equal number of facilities or machines or persons or destinations at a minimum cos or maximum profit or minimum time.

Applications:

- ✓ Assignment of jobs to the right person
- ✓ Assignment of job to the right machine in production side.

30. What do you mean by an unbalanced assignment problem?

If total number of rows [ROWS ≠ COLUMNS] is not equal to total number of columns then the problem is said to be a unbalanced assignment problem.

31. What is the objective of the travelling salesman problem?

- Salesman has to go through all the cities but he should not repeat the same city.
- When a salesman starts from one city he should come back to the same city itself atlast.

32. How do you convert the maximization assignment problem in to a minimization one?

- The Hungarian method can solve such assignment problem.
- It is easy to obtain an equivalent minimization problem by converting every number in the matrix to an opportunity loss.
- The conversion is accomplished by subtracting all the elements of the given matrix from the highest element.
- It turns out that minimizing opportunity loss produces the same assignment solution as the original maximization problem.

33. Give some applications of LPP?

- It is applied for determining the optimal allocation of such resources as materials, machines, man power.,etc
- It is used to determine the optimal product-mix of the firm to maximize its revenue.
- It is also used for product smoothing and assembly line balancing.
- It helps the firm is faced with the problem of inventory management of raw materials and finished products.

34. Why not round off the optimum values instead of resorting to Integer Programming? Explain.

35. Write the mathematical formulation for transportation problem?

m n

Minimize $Z = \sum_{i=1} \sum_{j=1} c_{ij} x_{ij}$

subject to constraints

$x_{ij} \geq 0$, for all I and j

36. Write the mathematical formulation for assignment problem?

Minimize = $\sum_{n\ i=1} \sum_{n\ j=1} C_{ij} X_{ij}$….

37. Write the mathematical formulation for travelling salesman problem?

38. What is the optimality test used while solving an Assignment Problem using Hungarian method?

39. How do you solve an A.P if the profit is to be maximized?

40. What do you mean by integer programming problem?

An integer programming problem is a mathematical optimization or feasibility program in which some or all the variables are restricted to be integers.

41. Define a pure integer programming problem?

This problem is called the (linear) integer-programming problem. It is said to be a mixed integer program when some, but not all, variables are restricted to integer, and is called a pure integer program when all decision variables must be integers.

42. Define a mixed integer programming problem?

A mixed integer programming (MIP) problem is one where some of the decision variables are constrained to be integer values (i.e. whole numbers such as -1,0,1,2,etc) at the optimal solution.

43. Explain the need for integer programming.

There are two main reasons for using integer variables when modelling problems as a linear program:

1. The integer variables represent quantities that can only be integer. For example, it is not possible to build 3.7 cars.
2. The integer variables represent decisions and so should only take on the value 0 or 1.

44. What are the methods used in solving IPP?

Integer programming can be categorized as

(i) Cutting methods

(ii) Search Methods.

47. Give some applications of IPP.

- IPP occur quite frequently in business and industry.
- All transportation, assignment and traveling salesman problems are IPP, since the decision variables are either Zero or one.
- All sequencing and routing decisions are IPP as it requires the integer values of the decision variables.
- Capital budgeting and production scheduling problem are PP. In fact, any situation involving decisions of the type either to do a job or not to do can be treated as an IPP.
- All allocation problems involving the allocation of goods, men, machines, give rise to IPP since such commodities can be assigned only integer and not fractional values.

48. Why not round off the optimum values instead of resorting to integer programming? Explain.

There is no guarantee that the integer valued solution (obtained by simplex method) will satisfy the constraints. i.e. ., it may not satisfy one or more constraints and as such the new solution may not feasible. So there is a need for developing a systematic and efficient algorithm for obtaining the exact optimum integer solution to an IPP.

49. Differentiate between pure and mixed IPP.

When an optimization problem, if all the decision variables are restricted to take integer values, then it is referred as pure integer programming. If some of the variables are allowed to take integer values, then it is referred as mixed integer programming.

50. What is the other name for Gomory's constraint?

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

51. State the general integer programming problem?

The general IPP is given by

Maximize $Z = CX$

Subject to the constraints

$AX \leq b$,

$X \geq 0$ and some or all variables are integer.

52. Define 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.

53. Define a saddle point.

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

54. Define 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.

55. Define payoff.

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.

56. Define value of the game.

The value of game is defined as the expected gain to a player

57. What is meant by Maximin and Minimax?

Minimax is maximum of row minima, and maximin is minimum of column maxima

58. When do you say a game is stable?

A game is stable when there is a saddle point

59. Define simulation. Why is it used?

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

60. Define random number.

Random numbers are numbers selected in such a way that every number has an equal chance or probability of selection.

61. Define pseudo-random number.

A pseudorandom number generator (PRNG), also known as a deterministic random bit generator (DRBG),[1] is an algorithm for generating a sequence of numbers whose properties approximate the properties of sequences of random numbers. The PRNG-generated sequence is not truly random, because it is completely determined by a relatively small set of initial values, called the PRNG's seed (which may include truly random values).

62. What are the advantages of simulation?

Advantages:

- Mathematically less complicated.
- Flexible
- Modified to suit the changing environments of the real situation
- Can be used for training purposes

63. What are the limitations of simulation?

- Simulation does not generate optimal solutions.
- It may take a long time to develop a good simulation model.
- In certain cases simulation models can be very expensive.
- The decision-maker must provide all information (depending on the model) about the constraints and conditions for examination, as simulation does not give the answers by itself.

64. What are the uses of simulation?

Simulation should be used when the consequences of a proposed action, plan or design cannot be directly and immediately observed (i.e., the consequences are delayed in time and/or dispersed in space) and/or it is simply impractical or prohibitively expensive to test the alternatives directly.

65. What are the two types of decisions?

- Programmed decisions
- Non programmed decisions

66. What are the different types of decision making situations?

Decision under uncertainty

- Maximin criterion or Minimax criterion
- Maximax criterion or mimimin criterion
- Regret criterion
- Laplace criterion
- Hurweiz criterion

Decision under risk

- Maximum weighted criterion
- Baye's criterion

67. What is Expected Monetary Value (EMV)?

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

68. What is Expected Opportunity Loss (EOL)?

A way of maximizing monetary value is to minimize the expected opportunity loss or expected value of regret. The conditional EOL or regret function for a particular course of action is determined by taking the difference between payoff value of the most favorable course of action i.e. maximum pay off and pay off for each.

69. What is Expected Value of Perfect Information (EVPI)?

The expected value with perfect information would be the total expected value of actions selected on assumption of a perfect forecast. The expected value of perfect information can be computed as the expected value with perfect information minus the expected value with existing information.

70. What are the methods which are useful for decision making under uncertainty.

- Maximin criterion or Minimax criterion
- Maximax criterion or mimimin criterion
- Regret criterion
- Laplace criterion
- Hurweiz criterion

71. What are the two types of strategies?

- Pure strategy

- Mixed strategy

72. Define '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.

73. What are the basic characteristics of a queuing system?

- The input
- The service mechanism
- The queuing discipline
- Customer behavior

74. Explain customer's behaviour.

Consumer Behavior is a branch which deals with the various stages a consumer goes through before purchasing products or services for his end use.

75. Explain queuing system.

Queuing systems constitute a central tool in modeling and performance analysis of e.g. telecommunication systems and computer systems

76. Define transient and steady state

Transient condition— when a queuing system has recently begun, the state of the system will be greatly affected by the initial state and by the time that has since elapsed.

Steady-state condition—after sufficient time has elapsed, the state of the system becomes essentially independent of the initial state and the elapsed time.

77. Define traffic intensity or utilization factor.

Traffic intensity:

$\rho = \lambda / \mu$

Where,

λ = average number of customers arriving per unit of time

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

78. If the arrival rate follows Poisson distribution, what is the distribution followed by inter-arrival time?

The inter-arrival times are independent and obey the Exponential (λ) distribution: P {inter-arrival time > t} = e −λt

79. Write Little's formula?

Relations between average Queue length and Average waiting time is called Little's formula. WKT for (M/M/1) : (∞/FCFS) model,

$L_s = \lambda/(\mu-\lambda)$ $L_q = \lambda 2 /(\mu (\mu-\lambda))$,$W_q = \lambda/(\mu (\mu-\lambda))$, $W_s = 1/(\mu-\lambda)$

Using these expression, we get

$L_s = \lambda W_s$, $Lq = \lambda W_q$, $W_s = W_q + 1/\mu$

80. If the traffic intensity of M/M/1 system is given to be 0.76, find the % of time the system would be idle?

The server utilization factor or busy period or traffic intensity ($\rho = \lambda/\mu$) is the proportion of customers. Here λ stands for the average no. of customers arriving per unit of time, and μ stands for the average no. of customers completing per unit of time.

Given that $\rho = 0.76$

Expected idle time $= 1-\rho = 1-o.76 = 0.24$

Percent of time the system would be idle = .24x100=24%

81. What is the utilization factor under multi-server model?

When we have a single queue with more than one parallel servers, then we have what is called the M/M/s

U= Utilization factor=Percentage of the time that all servers are busy,

$U = \rho/s = \lambda/s\mu$

82. What is the formula for P_n under (M/M/1: N/FCFS)?

$P_n = (1- \rho) / (1- \rho\ N +1)$ where $\rho = \lambda/\mu$.