Question Bank- Operations Research

Q. 1 Multiple Choice Questions

1. IBFS of L.P.P. is obtained by assuming the values of ______variables equal to zero.
   A) Basic B) non-basic
   C) Slack D) Surplus
2. In the optimal simplex table, $zj_{-} c_j = 0$ value indicates
   A) unbounded solution B) cycling
   C) alternative solution D) infeasible solution
3. A variable which does not appear in the basic variable (B) column of simplex table is
   A) never equal to zero B) always equal to zero
   C) called a basic variable D) none of the above
4. In the simplex table the vector Ar enters the basis if the ratio of XB_i / a_{ir} is…….
   A) Minimum B) Maximum
   C) Not restricted D) Positive and minimum
5. If a linear programming problem has the objective function max Z= $3x_1+2X_2$ with constraints $x_1- x_2 >1$ and $x_1+x_2 >3$ then the LPP has …………
   A) infinite solutions B) unique solutions
   C) no solutions D) unbounded solution
6. A variable used to convert ≤ inequality to equation is called as…
   A) Surplus B) Slack C) Artificial D) Basic
7. The method of solving Transportation problem is known as …..
   A) MODI method B) reduced matrix method
   C) Hungarian method D) None of the above.
8. In Big-M method, where M is very big number, is the cost of
   A) Slack variables B) Surplus variables
   C) Basic variables D) artificial variables
9. If two constraints do not interest in the positive quadrant of the graph then
   A) the problem is infeasible B) the solution is unbounded
   C) no unique solution D) none of the above
10. For any primal problem and its dual.
    A) optimal value of objective functions is same
    B) primal will have an optimal solution if and only if dual does too.
    C) both primal and dual may be infeasible
    D) all of the above

11. The dual of primal minimization LPP having m- constraints and n- non negative variables should

A) be a minimization LPP

B) be a maximization LPP

C) have n-constraints and m- non negative variable

D) both b and c

12. An LPP with constraints $2x1+2x2\leq 8$ and $x1+x2\leq 6$ which constraint can be ignored?

A) $2x1+2x2\leq 8$

B) $x1+x2\leq 6$

C) both constraints are necessary

D) none of these

13. A LPP with constraints $2x1+x2\geq 2$ and $x1+x2=2$ has…..

A) No feasible

B) Infinite number of feasible solutions

C) Only one feasible solution

D) None of these

14. In a linear programming problem, a basic solution is said to be non-degenerate basic feasible solution if … basic variables are zero.

A) All B) Some C) One D) at least one

15. If at least one artificial variable appears in the basis at positive level and the optimality condition is satisfied then the original problem has….

A) No feasible solution B) No solution

C) Feasible solution D) None of these

16. For maximization problem, coefficient for an artificial variable in the objective function is….

A) +M B) -M C) Zero D) None of these

17. In canonical form of LPP…..

A) Objective function is of maximization type

B) All variables xi's are non-negative.

C) All constraints are of $\leq$ type.

D) All of these

18. When the value of objective function can be …. such solutions are called unbounded solutions

A) Increased indefinitely B) Decreased indefinitely

C)Bothe A) and B) D) Either A) or B)

19. If dual has unbounded solution, primal has

A) no feasible solution B) unbounded solution
C) feasible solution D) none of the above

20. When the artificial variable presents at positive level and optimality condition obtained then current solution is ……

A) feasible solution B) pseudo-optimal solution
C) optimal solution D) degenerate solution

21. Transportation problem (TP) having Minimization of objective function has an alternate optimal solution whenever in optimal TP table …..for each empty cell.

A) $c_{ij} - (u_i + v_j) > 0$ B) $c_{ij} - (u_i + v_j) < 0$
C) $c_{ij} - (u_i + v_j) \geq 0$ D) $c_{ij} - (u_i + v_j) \leq 0$

22. The solution to a transportation problem with m rows (supplies) and n-columns(destinations) is feasible if number of positive allocations are………..

A) m+n B) mxn C) m+n-1 D) m+n+1

23. The initial solution of T.P. can be obtained by applying any known method. However, the only condition is that

A) the solution be optimal. B) the rim conditions are satisfied
C) the solution not be degenerate D) none of the above

24. The solution to a transportation problem with m rows (supplies) and n-columns(destinations) is non- degenerate if number of positive allocations are………..

A) m+n-1 B) at an independent positions
C) both a) and b) D) less than m+n-1

25. An assignment problem is considered particular case of transportation problem because

A) the number of rows equals to no. of columns
B) all Xij = 0 or 1
C) all rim conditions are 1
D) all of the above

26. If there are 5 –workers and 5-jobs in assignment problem then there would be

A) 9 solutions B) 24 solutions
C) 16 solutions D) 120 solutions

27. The assignment problem is said to be unbalanced if number of ---------

A) A) rows> columns B) rows < columns
B) C) rows = columns D) all the above

28. The solution to a transportation problem with m rows (supplies) and n-columns(destinations) is non- degenerate if number of positive allocations are………..

A) m+n-1 B) at an independent position

C) both A) and B) D) less than m+n-1

29. The Method for obtaining optimal solution toT.P. is called

A) N.W.C.R method B) MODI method

C) V.A.M D) Both (i) and (iii)

30. Maximization assignment problem is transformed into minimization problem by

A) adding each entry in a column from the maximum value in that column
B) Subtracting each entry in a column from the maximum value in that column
C) subtracting each entry in the table from the maximum value in table
D) any one of the above

31. The transportation problem is said to be unbalanced if

A) Total Demand > Total Supply
B) No. Of origins < No. Of Destinations
C) Both (A)and (B)
D) None of the above

32. If there were n workers and n jobs there would be

A) n! solutions B) (n -1)! solutions
C) (n!)” solutions D) n solutions

33. There are 5 jobs, each of which must go through the two machines A and B in the order AB.

Jobs	Processing time (hrs)				
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

Then the optimal sequence is….

A) 2-5-1-4-3 B) 2-1-3-5-4

C) 2-5-3-4-1 D) 2-4-3-5-1

34. For sequencing problems of processing n jobs through three machines A, B and C in the order ABC, optimal sequence can be obtained converting it into two machines problem if jobs on machine

A) Min $A_i \geq$ Max B_i B) Min Ci $\geq$ Max B_i.

C) both A) and B) D) either A) or B)

35. In sequencing problem which is incorrect statement?

A) No machine can process more than one operation at a time.

B) Each operation, once started, must be performed till completion.

C) There are more than one machines each of type.

D) The time required to transfer the jobs between two machines is negligible.

36. Random number satisfies….

A) Uniformity B) Independence

C) Both A & B D) None of these

37. If U ~ U (0,1) & 0<p<1, then X= integer (log U/log(1-p)) is

A) Binomial Variate B) Poisson Variate

C) Geometric Variate D) Negative Binomial

38. If X~U (0,1) then Y=a+(b-a) X follows……. distribution

A) U(a,b) B) exp(a,b)

C) Gamma(a,b) D) Binomial(a,b)

39. Sample value of random variable X~U(0,0.5) for random number 0.5 is ------

A) 0.5 B) 0.25

C) 1 D) 0

40. If U ~ U(0,1) & 0<p<1, then X=integer(log U/log(1-p)) is

A) Binomial Variate B) Poisson Variate

C) Geometric Variate D) Negative Binomial

41. A sample value of a random variable X having exponential distribution with mean 2 for random variable 0.5 is….

A) ln 2 B) 0.5*ln 2

C) 2* ln 2 D) ln 0.5

42. In queue mode completely specified in the symbolic from (a/b/c): (d/e), the first symbol a specifies

A) customers join or arrival in the queue

B) the distribution of arrival

C) The number of servers

D) the distribution of departure

43. In queue model completely specified in the symbolic from (a/b/c): (d/e), the second symbol b specifies

A) Distribution of service time
B) the distribution of arrival
C) Both A & B
D) none of these

44. In queue model completely specified in the symbolic from (a/b/c): (d/e), the third symbol c specifies

A) The number of customers arrive
B) the distribution of arrival
C) The number of servers or service channels
D) none of these

45. 33. In queue model completely specified in the symbolic from (a/b/c): (d/e), the symbol d specifies

A) Capacity of system
B) the distribution of arrival
C) The number of servers
D) the distribution of departure

46. In queue mode completely specified in the symbolic from (a/b/c) : (d/e), the symbol e specifies

A) Service discipline
B) the distribution of arrival
C) The number of servers
D) the distribution of departure

47. Mean time between two successive arrivals is equal to__.

A) Arrival rate B) Service rate
B) C) Reciprocal of arrival rate D) Reciprocal of service rate

48. For queuing model (M/M/1): ∞/FCFS), arrival rate is 16 and service rate is 20.Then probability that there is no customer in system is____.

A) 0.8 B) 0.2 C) 0 D)1

49. For queuing model (m/m/1): (∞/FCFS), arrival rate is 9 and service rate is15, then probability that there is no customer in the system is ……...

A) 0.8 B) 0.2 C) 0.4D) 1

50. The customers who move from one queue to another are said to be…….

A) Balking B) jockeying C) reneging D) none of these

51. When there is more than one server, customer in which he moves from one queueto another is known as…...

A) Balking B) Jockeying C) Reneging D) Alternating

52. Jockeying is said to be there in queuing system if number of servers is……….
A) 0 B) 1 C) 0 or 1 D) None of these

53. Jockeying is said to be done if there are …

A) More than one server in queuing system
B) Only one server in queuing system
C) No servers in the system
D) None of these

54. If a customer decides not to enter the queue because of its length is known as…...
A) Balking B) Jockeying C) Reneging D) Alternating

55. If the customer decides not to enter a waiting line as it is too long and has no timeto wait, this customer behavior is known as
A) Balking B) Jockeying C) Reneging D) None of these.

56. If a customer enters in the queue but after some time loses patience and decided to leave then he is said to have……
A) Balking B) Jockeying C) Reneging D) Alternating

57. The behavior of a customer in a queue where he leaves the queue due to impatiencein multi-channel system is….
A) Jockey B) Reneging C) Balking D) None of these

58. The probability distribution of customers joining queue is___.
A) exponential B) normal C) Poisson D) None of these

Long Answer Questions

1. Explain Simplex algorithm to solve L.P.P.
2. Define the following terms in L.P.P. a) Feasible solution b) Basic feasible solution c) Degenerate solution d) Optimum solution.
3. Define the following terms in L.P.P. a) solution b) Basic feasible solution c) non-degenerate solution d) Optimum solution.
4. Define i) mathematical formulation of Linear programming problem.
   i. ii) Standard form of L.P.P. iii) Canonical form of L.P.P.
5. Define i) slack variable ii) surplus variable iii) artificial variable iv) basic variable in L.P.P.
6. Define i) Primal L.P.P. ii) Dual L.P.P. Also explain the steps for forming dual from its primal.

7. Explain Modified distribution method (MODI) to obtain optimal solution for Transportation problem.
8. Define transportation problem and explain VAM method to obtain initial basic feasible solution.
9. Explain terms in transportation problem i) balanced T.P.ii) unbalanced T.P.ii) Basic feasible solution iv) optimal feasible solution.
10. Explain North-West corner rule and Vogel's approximation method.
11. Explain North-West corner rule and least cost method.
12. Define Assignment problem and explain Hungarian method to solve it.
13. Explain following random number generation method
14. Mid-Square Method
15. Congruential Random Generator
16. Explain Monte-Carlo Method of simulation State any two i) Advantages ii) Disadvantages iii) Application of Simulation.
17. Explain Mathematical model of Transportation problem and Assignment problem. Show that Assignment problem is particular case of transportation problem.
18. Define the probability distribution of arrivals, interarrival time, departure and service time.
19. If arrivals of a queue are completely random then obtain distribution of number of arrivals in fixed interval of time.
20. Explain queuing model: M/M/1 using FCFS queue discipline and find expected number of customers in the system and in queue.
21. Define Ideal time and Describe Johnson Algorithm for n jobs on two machines.
22. Define Total elapsed time and Describe the Algorithm of processing of n jobs through m machines.
23. Explain single server queue model: $(M/M/1):(\infty /FCFS)$.

Short Answer Questions

1. Explain standard form and canonical form of L.P.P.
2. Show that assignment problem is a particular case of Transportation problem.
3. State general rules of solving sequential problem with n jobs on 2 machines.
4. Explain the principal assumptions made while dealing with a sequencing problem.
5. Explain i) slack variable ii) surplus variable
6. Explain role of artificial variable in L.P.P.
7. Explain the steps for forming dual from its primal
8. Explain mathematical formulation of assignment problem.

9. Explain VAM method to obtain initial basic feasible solution.
10. Explain role of artificial variable in L.P.P.
11. For T.P define (i) Basic feasible solution (ii) optimal solution
    1. (iii)degenerate basic feasible solution.
12. State criterion for a) unique optimum solution b) alternative optimal solution of a) L.P.P. by simplex method b) T.P. by MODI method.
13. Explain graphical method of solving L.P.P.
14. Explain Big-M method for solving L.P.P.
15. State Primal and Dual forms of L.P.P.
16. Explain balanced and unbalanced assignment problem. Also write steps to convert unbalanced A.P. to balanced A.P.
17. Define the term random number. Explain properties of random numbers.
18. Explain use of Artificial Variable in Linear Programming Problem.
19. State Primal and Dual forms of L.P.P.

20. Write dual of the following Linear Programming Problem.
    - i. Max $Z= 5X_1+ 4X_2-3X_3$
    - ii. Subject to
    - iii. $2X_1+4X_2-X_3\leq14$
    - iv. $X_1-2X_2+X_3=10$
    - v. $X_1, X_3\geq0$, X_2 is unrestricted in sign.

21. Explain essential features of characteristics of queuing system.
22. Write note on pure birth process.
23. Explain the queuing model M/M/1: ∞/FCFS.
24. Suppose that customers arrive at a counter in accordance with a Poisson process with mean rate of 2 per minute. Then obtain the probability that the interval between two successive arrivals is more than one minute.
25. Explain the Classification of queuing model.
26. What do you mean by Poisson Process?
27. Explain Advantages of Simulation.
28. Generate 5 random number using Mid-square method for given seed value 2500.
29. Define i) Processing time ii) Total Elapsed time iii) idle time in Sequencing Problem.
30. Define Elapsed time and processing time with reference to Sequencing Problem.
31. Explain Mid-Square method of random number generation.
32. State Limitation of Mid-Square method of random number generation.
33. Explain Advantages of Simulation.

34. What do you mean by simulation? Give any two advantages of simulation.
35. Define the term Random Number. Explain properties of random numbers.