OPERATIONS RESEARCH

Multiple Choice Questions

1. Operations research is the application of _____methods to arrive at the optimal Solutions to the problems.
   A. economical
   B. scientific
   C. a and b both
   D. artistic

2. In operations research, the ----------are prepared for situations.
   A. mathematical models
   B. physical models diagrammatic
   C. diagrammatic models

3. Operations management can be defined as the application of ----------to a problem within a system to yield the optimal solution.
   A. Suitable manpower
   B. mathematical techniques, models, and tools
   C. Financial operations

4. Operations research is based upon collected information, knowledge and advanced study of various factors impacting a particular operation. This leads to more informed ----------.
   A. Management processes
   B. Decision making
   C. Procedures

5. OR can evaluate only the effects of ----------.
   A. Personnel factors.
   B. Financial factors
   C. Numeric and quantifiable factors.

True-False

6. By constructing models, the problems in libraries increase and cannot be solved.
   A. True
   B. False
7. Operations Research started just before World War II in Britain with the establishment of teams of scientists to study the strategic and tactical problems involved in military operations.
   A. True

B. False

8. OR can be applied only to those aspects of libraries where mathematical models can be prepared.
   A. True
   B. False
9. The main limitation of operations research is that it often ignores the human element in the production process.
   A. True
   B. False

10. Which of the following is not the phase of OR methodology?
    A. Formulating a problem
    B. Constructing a model
    C. Establishing controls
    D. Controlling the environment

11. The objective function and constraints are functions of two types of variables, _____ variables and _____ variables.
    A. Positive and negative
    B. Controllable and uncontrollable
    C. Strong and weak
    D. None of the above

12. Operations research was known as an ability to win a war without really going in to ____
    A. Battle field
    B. Fighting
    C. The opponent
    D. Both A and B

13. Who defined OR as scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control?
    A. Morse and Kimball (1946)
    B. P.M.S. Blackett (1948)
    C. E.L. Arnoff and M.J. Netzorg
    D. None of the above

14. OR has a characteristics that it is done by a team of
    A. Scientists
    B. Mathematicians
    C. Academics
    D. All of the above

15. Hungarian Method is used to solve
    A. A transportation problem
    B. A travelling salesman problem
    C. A LP problem
    D. Both a & b

16. A solution can be extracted from a model either by
    A. Conducting experiments on it
    B. Mathematical analysis
    C. Both A and B
    D. Diversified Techniques

17. OR uses models to help the management to determine its _____
    A. Policies
    B. Actions
    C. Both A and B
    D. None of the above

18. What have been constructed from OR problems an methods for solving the models that are available in many cases?
    A. Scientific Models
    B. Algorithms
    C. Mathematical Models
    D. None of the above

19. Which technique is used in finding a solution for optimizing a given objective, such as profit maximization or cost reduction under certain constraints?
    A. Quailing Theory
    B. Waiting Line
    C. Both A and B
    D. Linear Programming

20. What enables us to determine the earliest and latest times for each of the events and activities and thereby helps in the identification of the critical path?
    A. Programme Evaluation
    B. Review Technique (PERT)
    C. Both A and B
    D. Deployment of resources

21. OR techniques help the directing authority in optimum allocation of various limited resources like_____
    A. Men and Machine
    B. Money

C. Material and Time
D. All of the above

22. The Operations research technique which helps in minimizing total waiting and service costs is
A. Queuing Theory
B. Decision Theory
C. Both A and B
D. None of the above

UNIT II
LINEAR PROGRAMMING PROBLEMS

23. What is the objective function in linear programming problems?
A. A constraint for available resource
B. An objective for research and development of a company
C. A linear function in an optimization problem
D. A set of non-negativity conditions

24. Which statement characterizes standard form of a linear programming problem?
A. Constraints are given by inequalities of any type
B. Constraints are given by a set of linear equations
C. Constraints are given only by inequalities of >= type
D. Constraints are given only by inequalities of <= type

25. Feasible solution satisfies _____
A. Only constraints
B. only non-negative restriction
C. [a] and [b] both
D. [a],[b] and Optimum solution

26. In Degenerate solution value of objective function _____.
A. increases infinitely
B. basic variables are nonzero
C. decreases infinitely
D. One or more basic variables are zero

27. Minimize Z = _____
A. –maximize(Z)
B. -maximize(-Z)
C. maximize(-Z)
D. none of the above

28. In graphical method the restriction on number of constraint is _____.
    A. 2
    B. not more than 3
    C. 3
    D. none of the above

29. In graphical representation the bounded region is known as _____ region.
    A. Solution
    B. basic solution
    C. feasible solution
    D. optimal

30. Graphical optimal value for Z can be obtained from
    A. Corner points of feasible region
    B. Both a and c
    C. corner points of the solution region
    D. none of the above

31. In LPP the condition to be satisfied is
    A. Constraints have to be linear
    B. Objective function has to be linear
    C. none of the above
    D. both a and b

State True or False:

32. Objective function in Linear Programming problems has always finite value at the optimal solution-TRUE
33. A finite optimal solution can be not unique- FALSE
34. Feasible regions are classified into bounded, unbounded, empty and multiple: TRUE
35. Corner points of a feasible region are located at the intersections of the region and coordinate axes: TRUE

36. Identify the type of the feasible region given by the set of inequalities
x - y <= 1
x - y >= 2
where both x and y are positive.
    A. A triangle
    B. A rectangle
    C. An unbounded region
    D. An empty region

37. Consider the given vectors: a(2,0), b(0,2), c(1,1), and d(0,3). Which of the following vectors are linearly independent?

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A. a, b, and c are independent
B. a, b, and d are independent
C. a and c are independent
D. b and d are independent

38. Consider the linear equation
2 x1 + 3 x2 - 4 x3 + 5 x4 = 10
How many basic and non-basic variables are defined by this equation?

A. One variable is basic, three variables are non-basic
B. Two variables are basic, two variables are non-basic
C. Three variables are basic, one variable is non-basic
D. All four variables are basic

39. The objective function for a minimization problem is given by
z = 2 x1 - 5 x2 + 3 x3
The hyperplane for the objective function cuts a bounded feasible region in the space (x1,x2,x3). Find the direction vector d, where a finite optimal solution can be reached.

A. d(2,-5,3)
B. d(-2,5,-3)
C. d(2,5,3)
D. d(-2,-5,-3)

40. What is the difference between minimal cost network flows and transportation problems?

A. The minimal cost network flows are special cases of transportation problems
B. The transportation problems are special cases of the minimal cost network flows
C. There is no difference
D. The transportation problems are formulated in terms of tableaus, while the minimal cost network flows are formulated in terms of graphs

41. With the transportation technique, the initial solution can be generated in any fashion one chooses. The only restriction is that

A. the edge constraints for supply and demand are satisfied.
B. the solution is not degenerate.
C. the solution must be optimal.
D. one must use the northwest-corner method.

42. The purpose of the stepping-stone method is to

B. develop the initial solution to the transportation problem.
C. assist one in moving from an initial feasible solution to the optimal solution.
D. determine whether a given solution is feasible or not.
E. identify the relevant costs in a transportation problem.

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43. The purpose of a dummy source or dummy destination in a transportation problem is to
F. prevent the solution from becoming degenerate.
G. **obtain a balance between total supply and total demand**.
H. make certain that the total cost does not exceed some specified figure.
I. provide a means of representing a dummy problem.

44. Which of the following is NOT needed to use the transportation model?

A. the cost of shipping one unit from each origin to each destination
B. the destination points and the demand per period at each
C. the origin points and the capacity or supply per period at each
D. degeneracy

45. Which of the following is a method for improving an initial solution in a transportation problem?
J. northwest-corner
K. intuitive lowest-cost
L. southeast-corner rule
M. stepping-stone

46. The transportation method assumes that
N. there are no economies of scale if large quantities are shipped from one source to one destination.

B. the number of occupied squares in any solution must be equal to the number of rows in the table plus the number of columns in the table plus 1.
C. there is only one optimal solution for each problem.
D. the number of dummy sources equals the number of dummy destinations.

47. In a transportation problem, we must make the number of _____ and _____ equal.
A. destinations; sources
B. units supplied; units demanded
C. columns; rows
D. positive cost coefficients; negative cost coefficients
E. warehouses; suppliers

48. _____ or _____ are used to "balance" an assignment or transportation problem.

F. Destinations; sources
G. Units supplied; units demanded
H. Dummy rows; dummy columns

I. Large cost coefficients; small cost coefficients
J. Artificial cells; degenerate cells

49. The net cost of shipping one unit on a route not used in the current transportation problem solution is called the _____.

K. change index
L. new index
M. MODI index
N. idle index
O. Improvement index

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50. The procedure used to solve assignment problems wherein one reduces the original assignment costs to a table of opportunity costs is called _____.

A. stepping-stone method
B. matrix reduction
C. MODI method
D. northwest reduction
E. simplex reduction

51. The method of finding an initial solution based upon opportunity costs is called _____.

F. the northwest corner rule
G. Vogel's approximation
H. Johanson's theorem
I. Flood's technique
J. Hungarian method

52. An assignment problem can be viewed as a special case of transportation problem in which the capacity from each source is _____ and the demand at each destination is _____.

K. 1; 1
L. Infinity; infinity
M. 0; 0
N. 1000; 1000
O. -1; -1

53. _____ occurs when the number of occupied squares is less than the number of rows plus

P. Degeneracy
Q. Infeasibility
R. Unboundedness
S. Unbalance
T. Redundancy

54. Both transportation and assignment problems are members of a category of LP problems called _____.

U. shipping problems
V. logistics problems
W. generalized flow problems
X. routing problems
Y. network flow problems

55. The equation Ri + Kj = Cij is used to calculate _____.

A. an improvement index for the stepping-stone method
B. the opportunity costs for using a particular route
C. the MODI cost values (Ri, Kj)
D. the degeneracy index
E. optimality test

56. In case of an unbalanced problem, shipping cost coefficients of _____ are assigned to each created dummy factory or warehouse.
A. very high positive costs
B. very high negative costs
C. 10
D. zero
E. one

57. The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that
F. The solution be optimal
G. The rim conditions are satisfied
H. The solution not be degenerate
I. All of the above

58. The dummy source or destination in a transportation problem is added to
J. Satisfy rim conditions
K. Prevent solution from becoming degenerate
L. Ensure that total cost does not exceed a limit
M. None of the above

59. The occurrence of degeneracy while solving a transportation problem means that
N. Total supply equals total demand
O. The solution so obtained is not feasible
P. The few allocations become negative
Q. None of the above

60. An alternative optimal solution to a minimization transportation problem exists whenever opportunity cost corresponding to unused route of transportation is:
R. Positive & greater than zero
S. Positive with at least one equal to zero
T. Negative with at least one equal to zero
U. None of the above

61. One disadvantage of using North-West Corner rule to find initial solution to the transportation problem is that
V. It is complicated to use

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B. It does not take into account cost of transportation
C. It leads to a degenerate initial solution
D. All of the above

62. The solution to a transportation problem with 'm' rows (supplies) & 'n' columns (destination) is feasible if number of positive allocations are
A. m+n
B. m*n
C. m+n-1
D. m+n+1

63. If an opportunity cost value is used for an unused cell to test optimality, it should be
E. Equal to zero
F. Most negative number
G. Most positive number
H. Any value

64. During an iteration while moving from one solution to the next, degeneracy may occur when
B. The closed path indicates a diagonal move
C. Two or more occupied cells are on the closed path but neither of them represents a corner of the path.
D. Two or more occupied cells on the closed path with minus sign are tied for lowest circled value
E. Either of the above

65. The large negative opportunity cost value in an unused cell in a transportation table is chosen to improve the current solution because
A. It represents per unit cost reduction
B. It represents per unit cost improvement
C. It ensure no rim requirement violation
D. None of the above

66. The smallest quantity is chosen at the corners of the closed path with negative sign to be assigned at unused cell because
F. It improve the total cost
G. It does not disturb rim conditions
H. It ensure feasible solution
I. All of the above

67. When total supply is equal to total demand in a transportation problem, the problem is said to be
A. Balanced

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B. Unbalanced
C. Degenerate
D. None of the above

68. Which of the following methods is used to verify the optimality of the current solution of the transportation problem
A. Least cost method
B. Vogel's approximation method
C. Modified distribution method
D. All of the above

69. The degeneracy in the transportation problem indicates that
E. Dummy allocation(s) needs to be added
F. The problem has no feasible solution
G. The multiple optimal solution exist
H. a & b but not c

70. In a transportation problem, when the number of occupied routes is less than the number of rows plus the number of columns -1, we say that the solution is:
I. Unbalanced.
J. Infeasible.
K. Optimal.
L. impossible.
M. Degenerate.

71. The only restriction we place on the initial solution of a transportation problem is that: we must have nonzero quantities in a majority of the boxes.
N. all constraints must be satisfied.
O. demand must equal supply.
P. we must have a number (equal to the number of rows plus the number of columns minus one) of boxes which contain nonzero quantities.
Q. None of the above

72. The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that
R. the solution be optimal
S. the rim condition are satisfied
T. the solution not be degenerate
U. all of the above

73. The dummy source or destination in a transportation problem is added to
V. satisfy rim condition
W. prevent solution from becoming degenerate

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C. ensure that total cost does not exceed a limit
D. all of the above

74. The occurrence of degeneracy while solving a transportation problem means that
A. total supply equals total demand
B. the solution so obtained is not feasible
C. the few allocations become negative
D. none of the above

75. An alternative optimal solution to a minimization transportation problem exists whenever opportunity cost corresponding to unused routes of transportation is:
E. positive and greater than zero
F. positive with at least one equal to zero
G. negative with at least one equal to zero
H. all of the above

76. One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that
I. it is complicated to use
J. it does not take into account cost of transportation
K. it leads to degenerate initial solution
L. all of the above

77. In an assignment problem involving 5 workers and 5 jobs, total number of assignments possible are _____.

A. 5
B. 10
C. 15
D. 20

View answer A

78. Graphical method of linear programming is useful when the number of decision variable are _____

A. 2
B. 3
C. 4
D. 5

View answer A

79. The cost of a surplus variable is _____.

A. 0
B. 1
C. 2
D. -1

View answer A

80. The dual of the dual is _____.

A. dual-primal
B. primal-dual
C. dual
D. primal

View answer D

81. Solution of a Linear Programming Problem when permitted to be infinitely large is called _____.

A. unbounded
B. bounded
C. optimum solution
D. no solution

View answer C

82. When the total demand is not equal to supply then it is said to be _____.

A. balanced
B. unbalanced
C. maximization
D. minimization

View answer B

83. All equality constraints can be replaced equivalently by _____ inequalities

A. 1
B. 2
C. 3
D. 4

View answer B

84. If the primal has an unbound objective function value then the dual has _____.

A. solution
B. basic solution
C. basic feasible solution
D. no feasible solution

View answer D

85. If there is no non-negative replacement ratio in a solution which is sought to be improved, then the solution is _____.

A. bounded
B. unbounded
C. no solution
D. alternative solution

View answer B

86. The similarity between assignment problem and transportation problem is _____.

A. both are rectangular matrices
B. both are square matrices
C. both can be solved y graphical method
D. both have objective function and non-negativity constraints

View answer D

87. If all aij values in the entering variable column of the simplex table are negative, then _____.

A. solution is unbounded
B. solution is degenerate
C. there exist no solution
D. there are multiple solutions

View answer A

88. An unoccupied cell in the transportation method is analogous to a_____.

A. Zj-Cj value in the simplex table.
B. variable in the B-column in the simplex table.

C. variable not in the B-column in the simplex table.
D. value in the XB column in the simplex table.

View answer B

89. The area bounded by all the given constraints is called _____.

A. feasible region
B. basic solution
C. non feasible region
D. optimum basic feasible solution

View answer A

90. An activity is critical if its _____ float is zero

A. total
B. free
C. independent
D. interference

View answer A

91. _____ occurs when the number of occupied squares is less than the number of rows plus

A. Degeneracy
B. Infeasibility
C. Unboundedness
D. Unbalance

View answer A

92. Hungarian Method is used to solve

A. A transportation problem
B. A travelling salesman problem
C. A LP problem
D. Both a & b

View answer B

93. In assignment problem of maximization, the objective is to maximise

A. Profit
B. optimization
C. cost
D. Loss

View answer A

94. In Degenerate solution value of objective function _____.

A. increases infinitely
B. basic variables are nonzero
C. decreases infinitely
D. One or more basic variables are zero

View answer D

95. In graphical method the restriction on number of constraint is _____.

A. 2
B. not more than 3
C. 3
D. none of the above

View answer D

96. In graphical representation the bounded region is known as _____ region.

A. Solution
B. basic solution
C. feasible solution
D. optimal

View answer C

97. In LPP the condition to be satisfied is

A. Constraints have to be linear
B. Objective function has to be linear
C. none of the above
D. both a and b

View answer D

98. In operations research, the _____ are prepared for situations.

A. mathematical models
B. physical models diagrammatic
C. diagrammatic models
D. all of above

View answer A

99. One disadvantage of using North-West Corner rule to find initial solution to the transportation problem is that

A. It is complicated to use
B. It does not take into account cost of transportation
C. It leads to a degenerate initial solution
D. All of the above

View answer B

100. Operations management can be defined as the application of _____ to a problem within a system to yield the optimal solution.

A. Suitable manpower
B. mathematical techniques, models, and tools
C. Financial operations
D. all of above

View answer B