Roll No. ..... Total Printed Page - 10

F - 767

M.A./M.Sc. (Third Semester)
EXAMINATION, Dec. - Jan., 2021-22
MATHEMATICS
(Optional Paper)
Paper Fourth (A)
(Operations Research- I)

Time : Three Hours] ***[Maximum Marks : 80***

Note: Attempt all sections as directed.

Section - A

(Objective/Multiple Choice Questions)

(1 mark each)

Note : Attempt all questions.

Choose the correct answers :

1. Operations Research came into existence
   (A) In the year 1940
   (B) In the military context
   (C) During World War -I
   (D) During World War - II

2. Given a system of m simultaneous linear equations in unknowns $(m < n)$, the number of basic variables wil be -
   (A) m
   (B) n
   (C) n - m
   (D) n + m
3. For maximization LPP, the objective function coefficient for an artificial variable is
   (A) + M
   (B) - M
   (C) + 1
   (D) Zero
4. The role of artificial variables in simplex method is:
   (A) To aid in finding initial basic feasible solution.
   (B) To start phases of simplex method.
   (C) To find shadow prices from the final simplex table.
   (D) None of these.
5. If an optimum solution is degenerate then -
   (A) The solution is infeasible.
   (B) There are alternative optimum solutions.
   (C) The solution is of no use to the decision maker.
   (D) None of the above
6. The dual of the primal maximization LPP having m constraints and n non - negative variables should -
   (A) Be a minimization LPP
   (B) Have n constraints and m non - negative variables.
   (C) Both (A) and (B)
   (D) None of these

7. Dual simplex method is applicable to these LPP's that start with:
   (A) An infeasible solution
   (B) An infeasible but optimum solution.
   (C) a feasible solution.
   (D) A feasible and optimum solution.
8. When an additional variable is introduced in LPP, the existing optimum solution can further be improved if
   (A) $Zj - Cj \leq 0$
   (B) $Zj - Cj \geq 0$
   (C) $Zj - Cj = 0$
   (D) Both (A) and (B)
9. Parametric linear programming.
   (A) maximizes the additional computational effort required to obtain the indicated results.
   (B) assumes that there can never be an unbounded solution.
   (C) helps in deternining the feasible as well as optimum solution to an LPP.
   (D) does not investigate the behaviour of the optimum solution as a result of pre - determined linear variations in the parameters of the problems.
10. Deviational variables in goal programming problem must satisfy following conditions:
   (A) $d_i^+ + d_i^- = 0$
   (B) $d_i^+ - d_i^- = 0$
   (C) $d_i^+ \times d_i^- = 0$
   (D) $d_i^+ / d_i^- = 0$

11. In simplex method of goal programming, the non - basic variable to enter the basis is selected with -
   (A) Highest priority row and most positive $(Zj - Cj)$ value in it.
   (B) Lower priority row and most positive $(Zj - Cj)$ value in it.
   (C) Lower priority row and most negative $(Zj - Cj)$ value in it.
   (D) Highest priority row and most negative $(Zj - Cj)$ value in it.
12. The dummy source and destination in a transportation problem is introduced to:
   (A) prevent solution to become degenerate.
   (B) to satisfy rim conditions.
   (C) ensure that total cost not exceed a limit.
   (D) solve the balanced transportation problem.
13. Optimal solution of transportation problem obtained by:
   (A) North - west corner method
   (B) Least - cost method
   (C) Vogel - Approximation method
   (D) MODI method
14. The method used for solving an assignment - problem is called -
   (A) MODI method
   (B) Reduced Matrix Method
   (C) Hungarian method
   (D) None of the above

15. For a salesman, who has to visit n cities following are the ways of his tour plan:
    (A) n
    (B) n!
    (C) (n+1)!
    (D) (n -1)!
16. An assignment problem can be solved by:
    (A) Transportation method
    (B) Simplex method
    (C) Both (A) and (B)
    (D) None of these
17. The objective of network analysis is to:
    (A) minimize total project cost
    (B) minimize total project durations
    (C) minimize production delays, interruption and conflicts
    (D) all of the above
18. If an activity has zero slack, it implies that:
    (A) it is a dummy activity
    (B) it lies on the critical path
    (C) there are more than one critical paths
    (D) the project is progressing well
19. A network has 4 nodes and 3 independent loops. What is the number of branches in the network?
    (A) 5 (B) 6
    (C) 7 (D) 8

20. What is the PERT and CPM.
    (A) Network techniques
    (B) Assignment techniques
    (C) Project evaluation techniques
    (D) None of these

Section - B

(Very Short Answer Type Question)

(2 marks each)

Note : Attempt all questions.

1. Write mathematical formulation of general linear programming problem.
2. Write two advantages and two limitations of Operations Research.
3. Define slack and surplus variables.
4. Write the dual of the following linear programming problem.

   Minimize $Z = 3x_1 - 2x_2 + 4x_3$ subject to the constraints

   $3x_1 + 5x_2 + 4x_3 \geq 7$

   $6x_1 + x_2 + 3x_3 \geq 4$

   $7x_1 - 2x_2 - x_3 \leq 10$

   $x_1 - 2x_2 - 5x_3 \geq 3$

   $4x_1 + 7x_2 - 2x_3 \geq 2$

   $x_1, x_2, x_3 \geq 0$
5. Short notes on goal programming.
6. Define sensitivity analysis in L. P. P.
7. Short notes on network analysis.
8. Explain PERT techniques.

Section - C

(Short Answer Type Questions)

(3 marks each)

Note: Attempt all questions.

1. Briefly explain the characteristic of Operations Research.
2. Write an Algorithm for Big - M to solve LPP.
3. Write mathematical formulation of General Primal - Dual pair.
4. Prove that the dual of the dual is primal.
5. Describe an unbalanced transportation table.
6. Explain Assignment problem.
7. Define:
   (i) Predecessor activity
   (ii) Successor activity
   (iii) Dummy activity
8. Explain rule of network constraction.

Section - D

(Long Answer Type Question)

(4 marks each)

Note: Attempt all questions.

1. Use graphical method to solve the LPP.

   $Max\ Z = 2x_1 + 4x_2$

   subject to the constraints

   $x_1 + 2x_2 \le 5$

   $x_1 + x_2 \le 4$ *and*

   $x_1 + x_2 \ge 0$

OR

Use two - phase simplex method to the following LPP.

Maximize $Z = 5x_1 - 4x_2 + 3x_2$ subject to the constraints

$2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \le 76$

$8x_1 - 3x_2 + 6x_3 \le 50$

$x_1, x_2, x_3 \ge 0$

2. Use dual simplex method to solve the following LPP.

   Minimize $Z = x_1 + 2x_2 + 3x_3$ subject to the constraints

   $x_1 - x_2 + x_3 \ge 4$

   $x_1 + x_2 + 2x_3 \le 8$

   $x_2 - x_3 \ge 2$

   $x_1, x_2, x_3 \ge 0$

OR

Use duality to solve the following LPP:

Max $Z = 2x_1 + x_2$ subject to the constraints

$x_1 + 2x_2 \le 10$

$x_1 + x_2 \le 6$

$x_1 - x_2 \le 2$

$x_1 - 2x_2 \le 1$

$x_{1_1}, x_2 \ge 0$

3. Given the following L.P.P.

Maximize $Z = 3x_1 + 5x_2$ subject to the constraints

$x_1 \le 4$

$x_2 \le 6$

$3x_1 + 2x_2 \le 18$

$x_{1_1}, x_2 \ge 0$

Discuss the effect on the optimality of the solution when the objective function is changes to $3x_1 + x_2$

OR

Write a short notes on Goal programming problem.

4. Given $x_{13} = 50$ units, $x_{14} = 20$ units, $x_{21} = 55$ units, $x_{31} = 30$ units, $x_{32} = 35$ units and $x_{34} = 25$ units. Is it an optimal solution to the transportation problem.

				Supply
6	1	9	3	70
11	5	2	8	55
10	12	4	7	90
Requirement 85	35	50	45	

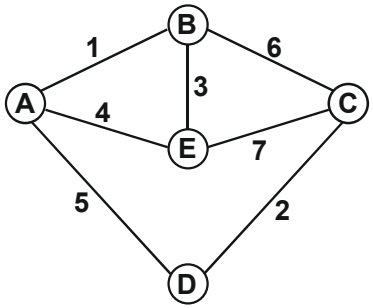
If not, mody it to optimum better feasible solution.

OR

Solve the following assignment problem

	I	II	III	IV	V
1	3	8	2	10	3
2	8	7	2	9	7
3	6	4	2	7	5
4	8	4	2	3	5
5	9	10	6	9	10

5. Use Dijkstra's Algorithm to determine a shortest path from A to C for the following network.



OR

A small project consists of seven activities for which the relevant data are given below:

Activity	Preceeding Activities	Activity Duration(Days)
A	-	4
B	-	7
C	-	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

1. Draw the network and find the project completion time.
2. Calculate total float for each of the activities and highlight the critical path.