G-3/379/22

Roll No. .....

III Semester Examination, January 2022

M.Sc.

MATHEMATICS

Paper IV

(Operations Research-I)

Time : 3 Hours] [Max. Marks : 80

Note : *All questions are compulsory. Question Paper comprises of 3 Sections. Section A is objective type/multiple choice questions with no internal choice. Section B is short answer type with internal choice. Section C is long answer type with internal choice.*

SECTION A **1×10=10**

(Objective Type/Multiple Choice Questions)

Choose the correct answer :

1. Operation Research is the application of ..... methods to arrive at the optimal solutions to the problem.

(a) Economical

(b) Scientific

(c) Both (a) and (b) both

(d) Artistic

2. Feasible solution satisfies :

(a) Only constraints

(b) Only non negative restrictions

(c) Both (a) and (b)

(d) None is correct

3. In primal-dual solutions, the dual problem solution can be obtained by solving other problems classified as :

(a) Unrestricted problem

(b) Original problem

(c) Double problem

(d) Restricted problem

4. In the dual simplex method the following conditions must be satisfied to start a simplex iteration :

(a) Optimality

(b) Feasibility

(c) Both optimality and feasibility

(d) None of the above

5. The variation of the parametric linear programming problem will be :

(a) Linear (b) Non linear

(c) Both (a) and (b) (d) None is correct

6. Goal programming model is preferred when :

(a) More than one objective is set to be achieved

(b) Goals are multiple and in commensurable

(c) Goals are satisfied in an ordinal sequence

(d) None of the above

7. The dummy source or destination in a transportation problem is added to :

(a) Balance the transportation problem

(b) Prevent solution from becoming degenerate

(c) Ensure that total cost does not exceed a limit

(d) The solution not be degenerate

8. An assignment problem is a :

(a) Non-linear programming problem

(b) Linear programming problem

(c) A quadratic programming problem

(d) None of the above

9. An activity (i, j) is said to be critical if :

(a) $E_i = L_i$

(b) $E_j = L_j$

(c) $E_j - E_i = L_j - L_i = t_{ij}$

(d) All of the above

10. CPM/PERT techniques were developed first in :

(a) USA (b) UK

(c) France (d) Japan

SECTION B **5×4=20**

(Short Answer Type Questions)

Note : *Answer the following questions.*

Unit-I

1. Define the following :

(a) Feasible solution of a LPP

(b) Basic feasible solution to a LPP

Or

Obtain the dual of the linear programming problem :

Max $Z = 2x_1 + 3x_2 + x_3$

Subject to :

$$4x_1 + 3x_2 + x_3 = 6$$

$$x_1 + 2x_2 + 5x_3 = 4$$

and $x_1, x_2, x_3 \geq 0$

Unit-II

2. Solve the following problem by dual simplex method :

$$\text{Max } Z = -4x_1 - 6x_2 - 18x_3$$

Subject to :

$$x_1 + 3x_3 \geq 3$$

$$x_2 + 2x_3 \geq 5$$

and $x_1, x_2 \geq 0$

Or

Explain in short :

(a) Advantage of Dual simplex method over simplex method.

(b) Difference between simplex and dual simplex method.

Unit-III

3. Write a short note on parametric linear programming.

Or

Define the following in Goal programming :

(a) Differential weight

(b) Goal equation

(c) Bounds

(d) Multiple Goals with Equal Priorities

Unit-IV

4. What is an unbalanced assignment problem and explain the method to solve it.

Or

Find the initial basic feasible solution of the following transportation problem using the North-West corner rule (method) :

	D_1	D_2	D_3	Available
S_1	2	7	4	5
S_2	3	3	1	8
S_3	5	4	7	7
S_4	1	6	2	14
Requirement	7	9	18	34

Unit-V

5. Explain the forward pass calculation for the network diagram.

Or

Explain the following terms in PERT/CPM :

(i) Earliest time

(ii) Latest time

SECTION C **10×5=50**

(Long Answer Type Questions)

Note : *Answer the following questions.*

Unit-I

1. Solve the following LPP using simplex method :

$$\text{Max } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to constraints :

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

and $x_1, x_2, x_3 \geq 0$

Or

Solve the following LPP problem by Big-M method :

$$\text{Max } Z = x_1 + 2x_2 + 3x_3 - x_4$$

Subject to :

$$x_1 + 2x_2 + 3x_3 = 15$$

$$2x_1 + x_2 + 5x_3 = 20$$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$

and $x_1, x_2, x_3, x_4 \geq 0$

Unit-II

2. Use dual Simplex method to solve :

$$\text{Min } Z = 3x_1 + x_2$$

Subject to :

$$x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2, \quad x_1, x_2 \geq 0$$

Or

Use dual Simplex method to solve :

$$\text{Min } Z = 2x_1 + 3x_2 + 5x_3$$

Subject to :

$$x_1 + 2x_2 + 3x_3 \geq 2$$

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

and $x_1, x_2, x_3 \geq 0$

Unit-III

3. For $t \geq 0$ determine the critical values of t for which the solution of the following parametric L.P.P. remains optimal basic feasible :

$$\text{Max } Z = (3 - 6t)\, x_1 + (2 - 2t)\, x_2 + (5 + 5t)\, x_3$$

Subject to :

$$x_1 + 2x_2 + x_3 \leq 40$$

$$3x_1 + 2x_3 \leq 60$$

$$x_1 + 4x_2 \leq 30$$

and $x_1, x_2, x_3 \geq 0$

Or

Write a short note on interior point Algorithm and Karmakar's contribution in this.

Unit-IV

4. Sove the following transportation problem in which cell entries represent unit costs.

		T_0			Available
From		2	7	4	5
		3	3	1	8
		5	4	7	7
		1	6	2	14
Required		7	9	18	34

Or

Solve the following assignment problem :

		Job			
		J_1	J_2	J_3	J_4
Person	A	10	14	22	12
	B	16	10	18	12
	C	8	14	8	14
	D	20	8	16	6

Unit-V

5. A project has the following time schedule :

Activity	Time in Months
1-2	2
1-3	2
1-4	1
2-5	4
3-6	8
3-7	5
4-6	3
5-8	1
6-9	5
7-8	4
8-9	3

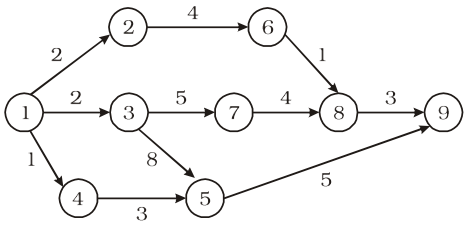
Construct PERT network and compute :

(i) Compute float for each activity.

(ii) Critical path and its duration.

Or

Find the critical path and calculate the slack time for each event for the following PERT diagram.



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