

**Bachelor of Science (B.Sc.) (Information Technology) (I.T.) Semester—VI Examination**  
**OPERATIONS RESEARCH**  
**Paper—6**

Time : Three Hours]

[Maximum Marks : 50

- N.B. :—** (1) All the questions are compulsory and carry equal marks.  
 (2) Assume suitable data wherever necessary.  
 (3) Draw neat and labelled diagram wherever necessary.

**EITHER**

1. (a) What do you mean by models in Operations Research and also explain various OR Techniques. 5
- (b) Use two phase method to following LPP :  
 Max  $Z = 5x_1 + 3x_2$   
 subject to constraints  $2x_1 + x_2 \leq 1$   
 $x_1 + 4x_2 \geq 6$   
 where  $x_1, x_2 \geq 0$ . 5

**OR**

- (c) Solve the following LPP by Graphical method :  
 Min  $Z = -x_1 + 2x_2$   
 subject to constraints  $-x_1 + 3x_2 \leq 10$   
 $x_1 + x_2 \leq 6$   
 $x_1 - x_2 \leq 2$   
 where  $x_1, x_2 \geq 0$ . 5
- (d) Solve the following LPP by Simplex method :  
 Max  $Z = 3x_1 + 2x_2 + 5x_3$   
 subject to constraints  $x_1 + 2x_2 + x_3 \leq 430$   
 $3x_1 + 2x_3 \leq 460$   
 $x_1 + x_2 \leq 420$   
 where  $x_1, x_2, x_3 \geq 0$ . 5

**EITHER**

2. (a) Solve the following Transportation problem by North West Corner Rule :  
 North West Corner Rule :

|        |                | Destinations   |                |                |                |        |
|--------|----------------|----------------|----------------|----------------|----------------|--------|
|        |                | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | Supply |
| Source | S <sub>1</sub> | 19             | 30             | 50             | 10             | 7      |
|        | S <sub>2</sub> | 70             | 30             | 40             | 60             | 9      |
|        | S <sub>3</sub> | 40             | 8              | 70             | 20             | 18     |
| Demand |                | 5              | 8              | 7              | 14             |        |

- (b) Explain the first feasible solution in Assignment problem and find the optimal solution by using Hungarian Method :

|      |                | Machines       |                |                |                |  |
|------|----------------|----------------|----------------|----------------|----------------|--|
|      |                | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | M <sub>4</sub> |  |
| Jobs | J <sub>1</sub> | 5              | 8              | 8              | 6              |  |
|      | J <sub>2</sub> | 4              | 6              | 5              | 8              |  |
|      | J <sub>3</sub> | 6              | 10             | 7              | 4              |  |
|      | J <sub>4</sub> | 9              | 9              | 7              | 3              |  |

**OR**

- (c) What is Transportation Problem ? Explain. Also find the minimum cost solution for the following Transportation problem by VAM.

|         |                | Destinations   |                |                |                |        |
|---------|----------------|----------------|----------------|----------------|----------------|--------|
|         |                | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | Supply |
| Sources | S <sub>1</sub> | 6              | 1              | 9              | 3              | 70     |
|         | S <sub>2</sub> | 11             | 5              | 2              | 8              | 55     |
|         | S <sub>3</sub> | 10             | 12             | 4              | 7              | 90     |
| Demand  |                | 80             | 35             | 50             | 45             |        |

5

- (d) Solve the following Assignment problem to find the maximum total expected sale.

|          |   | Area |    |     |    |
|----------|---|------|----|-----|----|
|          |   | I    | II | III | IV |
| Salesmen | A | 42   | 35 | 28  | 21 |
|          | B | 30   | 25 | 20  | 15 |
|          | C | 30   | 25 | 20  | 15 |
|          | D | 24   | 20 | 16  | 12 |

5

**EITHER**

3. (a) Draw the network for the following project :

|              |     |     |     |     |     |     |     |     |     |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Activities : | 1-2 | 1-3 | 2-6 | 3-4 | 3-5 | 4-6 | 5-6 | 5-7 | 6-7 |
| Duration :   | 4   | 6   | 8   | 7   | 4   | 6   | 5   | 19  | 10  |

Determine : (i) Critical Path

(ii) Maximum project length.

5

- (b) Explain the Branch and Bound algorithm.

5

**OR**

- (c) What do you mean by forward and backward recursion, in dynamic programming ?

5

- (d) The time estimates (in weeks) for the activities of PERT Network are given below :—

|                  |     |     |     |     |     |     |     |
|------------------|-----|-----|-----|-----|-----|-----|-----|
| Activities :     | 1-2 | 1-3 | 1-4 | 2-5 | 3-5 | 4-6 | 5-6 |
| t <sub>o</sub> : | 1   | 1   | 2   | 1   | 2   | 2   | 3   |
| t <sub>m</sub> : | 1   | 4   | 2   | 1   | 5   | 5   | 6   |
| t <sub>p</sub> : | 7   | 7   | 8   | 1   | 14  | 8   | 15  |

(i) Construct the network.

(ii) Determine the expected project length.

5

**EITHER**

4. (a) Explain the zero-one Programming Model for Assignment Problem. 5  
(b) Explain the different types of Assignment Problems. 5

**OR**

- (c) Solve the following Assignment Problem :

|         |                | Jobs           |                |                |                |   |
|---------|----------------|----------------|----------------|----------------|----------------|---|
|         |                | J <sub>1</sub> | J <sub>2</sub> | J <sub>3</sub> | J <sub>4</sub> |   |
| Workers | W <sub>1</sub> | 10             | 15             | 24             | 30             | 5 |
|         | W <sub>2</sub> | 16             | 20             | 28             | 10             |   |
|         | W <sub>3</sub> | 12             | 18             | 30             | 16             |   |

- (d) Explain the branch and bound technique for Assignment problem. 5
5. Attempt **ALL** :—
- (a) Explain the following terms :—
- (i) Artificial variable
- (ii) Surplus variable. 2½
- (b) Distinguish between Primal and dual problem in linear programming problem. 2½
- (c) Explain Fulkerson's Rule for numbering the events in Network construction. 2½
- (d) How to solve the non-square assignment problem ? Explain. 2½