



Date: 04-04-2019

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**PART - A**

Answer ALL the questions.

[10x2 = 20]

1. Define a slack and a surplus variable.
2. Give the standard form of a general LPP.
3. Write dual of the following problem:

$$\text{Maximize } z = 2x_1 + 2x_2$$

Subject to the constraints

$$5x_1 + 3x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

4. State the use of artificial variables in an LPP.
5. Explain the North West Corner method of obtaining a basic feasible solution to a Transportation problem.
6. Explain the travelling salesman problem.
7. State the rules of constructing a network diagram.
8. Define total float and free float of an activity in network analysis.
9. Define a saddle point and value of a game.
10. Define a two person Zero sum game.

**PART - B**

Answer ANY FIVE questions.

[5x8 = 40]

11. Give illustrations of a LPP problem having an Unbounded Solution.
12. Explain the mathematical formulation of a Transportation Problem & the North West Corner Rule.
13. Explain the Mini-max Criterion & Hurwitz Criterion of Decision Making.
14. Differentiate between PERT & CPM and stating its significance. Also list out the Rules of Network Construction.
15. Solve the following LPP graphically:

$$\text{Maximize } z = 2X_1 + 3X_2$$

Subject to the Constraints:

(i)  $X_1 + X_2 \leq 30$  (ii)  $X_2 \geq 3$  (iii)  $0 \leq X_2 \leq 12$

$X_1, X_2 \geq 0$ .

16. Obtain Optimal Strategies for both players and the value of the game for the Two Person Zero-Sum Game with pay-off matrix given below:

| Player A | Player B |    |
|----------|----------|----|
|          | B1       | B2 |
| A1       | 1        | -3 |
| A2       | 3        | 5  |
| A3       | -1       | 6  |
| A4       | 4        | 1  |
| A5       | 2        | 2  |
| A6       | -5       | 0  |

17. A company has four sales representatives who are to be assigned to four different sales territories. The monthly sales increase estimated for each sales representative for different sales territories (in Lakh rupees) are given below:

| Sales Representatives | Sales Territories |     |     |     |
|-----------------------|-------------------|-----|-----|-----|
|                       | S1                | S2  | S3  | S4  |
| A                     | 200               | 150 | 170 | 220 |
| B                     | 160               | 120 | 150 | 140 |
| C                     | 190               | 195 | 190 | 200 |
| D                     | 180               | 175 | 160 | 190 |

Obtain the Optimal Assignment of Representatives to the Territories.

18. Draw a Network diagram for building a steel works shed, whose activities are given below:

| Activity | Description            | Preceding Activity |
|----------|------------------------|--------------------|
| A        | Erect Site Workshop    | --                 |
| B        | Fence Site             | --                 |
| C        | Bend Reinforcement     | A                  |
| D        | Dig Foundation         | B                  |
| E        | Fabricate Steel Work   | C,D                |
| F        | Install Concrete Plant | B                  |
| G        | Place Reinforcement    | C,D                |
| H        | Concrete Foundation    | G,F                |
| I        | Paint Steel Work       | E                  |
| J        | Erect Steel Work       | H,I                |

**PART - C**

Answer ANY TWO questions.

[2x20 = 40]

19. A company has two manufacturing plants, each of which can produce two products X,Y from a common raw material. The time required in hours for producing one unit of each product is given

| Plant    | Products |   |
|----------|----------|---|
|          | X        | Y |
| <b>A</b> | 2        | 4 |
| <b>B</b> | 4        | 3 |

Plant A can work for 60 hours per week. Plant B can work for 72 hours.

Find the number of units that produced to minimize the cost.

20. Solve the LPP given below using two-phase simplex method:

$$\text{Minimize } Z = X_1 + X_2$$

Subject to the constraints

$$2X_1 + 4X_2 \leq 4$$

$$X_1 + 7X_2 \leq 7$$

$$X_1, X_2 \geq 0$$

21. A company has factories in four cities and warehouses in five cities. The monthly production capacities of each factory A,B,C& D are 35,25, 40 & 32 units respectively. Monthly warehouse requirements are 15, 12, 22, 30 & 20 units respectively. The unit shipping costs in rupees are:

| Factory  | Warehouse |    |    |    |    |
|----------|-----------|----|----|----|----|
|          | W1        | W2 | W3 | W4 | W5 |
| <b>A</b> | 8         | 9  | 12 | 7  | 18 |
| <b>B</b> | 6         | 8  | 13 | 9  | 21 |
| <b>C</b> | 20        | 7  | 10 | 11 | 8  |
| <b>D</b> | 12        | 7  | 14 | 15 | 22 |

Solve the above Transportation problem to minimize the shipping cost.

22. The following table shows the tasks with time estimates (in weeks) for various Tasks involved in publication of a book:

| Activity | Description                               | Precedence | Time Estimates (Weeks) |            |             |
|----------|---|------------|------------------------|------------|-------------|
|          |   |            | Most Likely            | Optimistic | Pessimistic |
| <b>A</b> | <b>Appraisal of Book by Reviewers</b>     | ----       | 8                      | 4          | 10          |
| <b>B</b> | <b>Initial Pricing of Book</b>            | ----       | 2                      | 2          | 2           |
| <b>C</b> | <b>Assessment of Marketability</b>        | A &B       | 2                      | 1          | 3           |
| <b>D</b> | <b>Revisions by Author</b>                | A          | 6                      | 4          | 12          |
| <b>E</b> | <b>Editing of Final Draft</b>             | C &D       | 4                      | 3          | 5           |
| <b>F</b> | <b>Typesetting of Text</b>                | E          | 3                      | 3          | 3           |
| <b>G</b> | <b>Plates for Artwork</b>                 | E          | 4                      | 3          | 5           |
| <b>H</b> | <b>Designing &amp; Printing of Jacket</b> | C &D       | 6                      | 4          | 9           |
| <b>I</b> | <b>Printing &amp; Binding of Book</b>     | F &G       | 8                      | 6          | 16          |
| <b>J</b> | <b>Inspection and Final Assembly</b>      | I &H       | 1                      | 1          | 1           |

- (i) Draw a network and find the Critical Path, its expected length & variance.
- (ii) Find the probability that the length of the critical path does not exceed 36 weeks.

★★★★★