| Hall Ticket Number : | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

**R-17**

**Code:** **7P1C27**

M.B.A. II Semester Supplementary Examinations February 2021

# Operations Research

Max. Marks: 60 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 12 = 60 Marks )

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Marks CO Blooms Level

## UNIT–I

1. a) Define OR and discuss its scope. 6M

b) Solve the following L.P.P by using graphical method.

$$\text{Maximize } Z = 4x_1 + 3x_2$$
$$\text{subject to } 2x_1 + x_2 \le 1{,}000$$
$$x_1 + x_2 \le 800$$
$$x_1 \le 400 \text{ and } x_2 \le 700$$
$$x_1 \ge 0 \text{ and } x_2 \ge 0$$
6M

**OR**

2. a) Describe the types of OR models. 4M

b) Using Penalty method solve the following LPP:

$$\text{Maximize } Z = 2x_1 + 3x_2$$
$$\text{subject to } x_1 + 2x_2 \le 4$$
$$x_1 + x_2 = 3$$
$$x_1, x_2 \ge 0$$
8M

## UNIT–II

3. a) Illustrate MODI method to determine the optimum solution. 4M

b) Find the starting solution in the following transportation problem by Vogel's Approximation Method. Also obtain the optimum solution :

| | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| S1 | **3** | **7** | **6** | **4** | 5 |
| S2 | **2** | **4** | **3** | **2** | 2 |
| S3 | **4** | **3** | **8** | **5** | 3 |
| Demand | 3 | 3 | 2 | 2 | |

8M

**OR**

4. a) Explain the Mathematical model of transportation Problem. 4M

b) Solve the transportation problem to maximize the profit

| | A | B | C | D | |
|---|---|---|---|---|---|
| P | 15 | 51 | 42 | 33 | 23 |
| Q | 80 | 42 | 26 | 81 | 44 |
| R | 90 | 40 | 66 | 60 | 33 |
| | 23 | 31 | 16 | 30 | |

8M

**UNIT–III**

5. A department head has four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate, of the time each man would take to perform each task, is given in the matrix below:

| | Men | | | |
|---|---|---|---|---|
| Tasks | E | F | G | H |
| A | **18** | **26** | **17** | **11** |
| B | **13** | **28** | **14** | **26** |
| C | **38** | **19** | **18** | **15** |
| D | 19 | 26 | 24 | 10 |

How should the tasks be allocated, one to a man so as to minimize the total man-hours? 6M

b) Maximize the total sales of profit for the problem of assigning four sales persons to four different sales regions as shown in the following table

| | $R_1$ | $R_2$ | $R_3$ | $R_4$ |
|---|---|---|---|---|
| $s_1$ | **10** | **22** | **12** | **14** |
| $s_2$ | **16** | **18** | **22** | **10** |
| $s_3$ | **24** | **20** | **12** | **18** |
| $s_4$ | **16** | **14** | **24** | **20** |

6M

**OR**

6. a) Differentiate between Transportation problem and Assignment problem 6M

b) There are five jobs to be assigned one each to five machines. Find the minimum cost of the assignment.

Machine

| ~~job~~ | **1** | **2** | **3** | **4** | 5 |
|---|---|---|---|---|---|
| **A** | 11 | 17 | 8 | 16 | 20 |
| **B** | 9 | 7 | 12 | 6 | 15 |
| **C** | 13 | 16 | 15 | 12 | 16 |
| **D** | 21 | 24 | 17 | 28 | 20 |
| **E** | 14 | 10 | 12 | 11 | 15 |

6M

**UNIT–I**

7. a) Explain (i) Pure strategy (ii) Mixed strategy (iii)Dominance principle 6M

b) Consider the following payoff matrix with respect to player A and solve it optimally.

| | | **Player B** | |
|---|---|---|---|
| | | $B_1$ | $B_2$ |
| **Player A** | $A_1$ | **6** | **9** |
| | $A_2$ | **8** | **4** |

6M

**OR**

8. a) Solve the following $3 \times 5$ game using dominance property.

| | | Player B | | | | |
|---|---|---|---|---|---|---|
| | | $B_1$ | $B_2$ | $B_3$ | $B_4$ | $B_5$ |
| | $A_1$ | **2** | **5** | **10** | **7** | **2 2** |
| **Player A** | $A_2$ | **3** | **3** | **6** | **6** | **4 4** |
| | $A_3$ | **4** | **4** | **8** | **12** | **1** |

6M

b) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following:

I. the mean queue size(line length), and
II. the probability that the queue size exceeds 10.
III. If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii)?

6M

**UNIT–I**

9. The following table lists the jobs of a networks with their estimates.

| Jobs (i-j) | Duration (days) | | |
|---|---|---|---|
| | Optimistic | Most likely | Pessimistic |
| 1-2 | 3 | 6 | 15 |
| 1-6 | 2 | 5 | 14 |
| 2-3 | 6 | 12 | 30 |
| 2-4 | 2 | 5 | 8 |
| 3-5 | 5 | 11 | 17 |
| 4-5 | 3 | 6 | 15 |
| 6-7 | 3 | 9 | 27 |
| 5-8 | 1 | 4 | 7 |
| 7-8 | 4 | 19 | 28 |

i) Draw the project network,
ii) Calculate the length and variance of the critical path, and
iii) What is the approximate probability that the jobs on the critical path will be completed in 41 days?

12M

**OR**

10. Consider the following table summarizing the details of a project involving 10 activities.

| **Activity** | **Immediate Predecessors** | **Duration (weeks)** |
|---|---|---|
| A | - | 15 |
| B | - | 15 |
| C | A | 3 |
| D | A | 5 |
| E | B,C | 8 |
| F | B,C | 12 |
| G | E | 1 |
| H | E | 14 |
| I | D,G | 3 |
| J | F,H,I | 14 |

i) Construct a CPM network
ii) Determine the critical path and project completion time.
iii) Compute the total floats and free floats for non-critical activities.

12M

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