

**OPERATIONS RESEARCH**

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions  
All questions carry equal marks  
(Use of graphs permitted)

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- 1 (a) Explain the concept of degeneracy in LP problem.  
) (b) Solve the following LP problem by Big M method  
 $Min Z = x_1 + x_2 + 3x_3$   
subject to  $3x_1 + 2x_2 + x_3 \leq 3$   
 $2x_1 + x_2 + 2x_3 \geq 3$   $x_1, x_2, x_3 \geq 0$ .
- 2 (a) Solve the minimal assignment problem whose effectiveness matrix is given below:

|     |   |   |   |   |
|-----|---|---|---|---|
|     | 1 | 2 | 3 | 4 |
| I   | 2 | 3 | 4 | 5 |
| II  | 4 | 5 | 6 | 7 |
| III | 7 | 8 | 9 | 8 |
| IV  | 3 | 5 | 8 | 4 |

- (b) Explain the steps involved in Johnson's algorithm for n jobs 2 machines.
- 3 (a) Discuss the reasons for replacement.  
(b) An electronic equipment contains 1000 resistors when any resistor falls, it is replaced. The cost of replacing a resistor individually is Rs10. If all the resistors are replaced at the same time, the cost per resistor is Rs 4. The percent surviving,  $S(i)$  at the end of the month ' $i$ ' is tabulated as follows:

|        |     |    |    |    |    |    |   |
|--------|-----|----|----|----|----|----|---|
| $i$    | 0   | 1  | 2  | 3  | 4  | 5  | 6 |
| $S(i)$ | 100 | 96 | 89 | 68 | 37 | 13 | 0 |

What is optimum replacement plan?

- 4 Solve the following game graphically.

|          |    |          |    |     |    |
|----------|----|----------|----|-----|----|
|          |    | Player A |    |     |    |
|          |    | I        | II | III | IV |
| Player B | I  | 2        | 2  | 3   | -2 |
|          | II | 4        | 3  | 2   | 6  |

- 5 (a) State briefly the applications of queuing models.  
) (b) In a big textile mill, trucks loaded with raw cotton arrive at a rate of 12 trucks per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 34 minutes. Determine the following:  
(i) Mean line length. (ii) Probability that the queue size exceeds 12.
- 6 The demand for a small electronic component is at the rate of 7000 units. The cost of a single component is Rs 1.25 and the inventory carrying cost is 20%. For placing an order it costs Rs 50/-. Determine the following:  
(i) EOQ. (ii) Total inventory carrying cost. (iii) Total ordering cost. (iv) Optimum inventory cost. (v) Optimum number of orders. (vi) Number of days supply per optimum order.

- 7 (a) Write a note on decision tree and Bellman's principle of optimality.  
) (b) Write the characteristics of dynamic programming problem.

- 8 (a) What is Monte Carlo simulation?  
) (b) The demand per day for a belt used in the engine of an automobile has the following probability distribution, simulate the demand for 20 days.

|             |      |      |      |      |      |
|-------------|------|------|------|------|------|
| Demand/day  | 3    | 4    | 5    | 6    | 7    |
| Probability | 0.10 | 0.30 | 0.30 | 0.20 | 0.10 |

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