

Printed Pages : 7



EME051

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140851

Roll No.

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B. Tech.**(SEM. VIII) THEORY EXAMINATION, 2014-15
OPERATIONS RESEARCH**

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all the questions. Assume missing data suitably.

Attempt any two of the following questions-

10x2=20

- 1 (a) What is meant by a mathematical model of a real situation? Discuss the importance of models in the solution of OR problems.
- (b) Use the graphical method to solve the following LP problem :
- Maximize $Z = 3x_1 + 4x_2$
- Subject to the constraints
- (i) $x_1 - x_2 = -1$
- (ii) $-x_1 + x_2 \leq 0$ and $x_1, x_2 \geq 0$.

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- (c) Solve the following LP problem by using the two-phase simplex method

$$\text{Minimize } Z = x_1 - 2x_2 - 3x_3$$

Subject to the constraints :

$$(1) \quad -2x_1 + x_2 + 3x_3 = 2$$

$$(2) \quad 2x_1 + 3x_2 + 4x_3 = 1 \text{ and } x_1, x_2, x_3 \geq 0$$

Attempt any two of the following questions :

10x2=20

- 2 (a) A manufacturer wants to ship 22 loads of his products as shown below. The matrix gives the kilometers from sources of supply to the destinations.

| | D_1 | D_2 | D_3 | D_4 | D_5 | Supply |
|--------|-------|-------|-------|-------|-------|----------|
| S_1 | 5 | 8 | 6 | 6 | 3 | 8 |
| S_2 | 4 | 7 | 7 | 6 | 5 | 5 |
| S_3 | 8 | 4 | 6 | 6 | 4 | 9 |
| Demand | 4 | 4 | 5 | 4 | 8 | 22 25 |

The shipping cost is Rs. 10 per load per km.

What shipping schedule should be used in order to minimize the total transportation cost?

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- (b) A Marketing manager has five salesman and five sales districts. Considering the capabilities of the salesman and the nature of the districts, the marketing manager estimates that the sales per month (in hundred rupees) for each salesman in each district would be as follows:

| | Districts | | | | | |
|----------|-----------|----|----|----|----|----|
| | | A | B | C | D | E |
| Salesman | 1 | 32 | 38 | 40 | 28 | 40 |
| | 2 | 40 | 24 | 28 | 21 | 36 |
| | 3 | 41 | 27 | 33 | 30 | 37 |
| | 4 | 22 | 38 | 41 | 36 | 36 |
| | 5 | 29 | 33 | 40 | 35 | 39 |

Find the assignment of salesman to district that will remain in maximum sales.

- (c) State Bellman's "principle of optimality" and explain with the help of an illustrative example how it can be used to solve a multistage decision problem.

Attempt any two of the following questions :

10x2= 20

- 3 (a) An investor is given the following investment alternatives and percentage rates of return.

States of Nature (Market Conditions)

| | Low | Medium | High |
|----------------|------|--------|------|
| Regular shares | 7% | 10% | 15% |
| Risky shares | -10% | 12% | 25% |
| Property | -12% | 18% | 30% |

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Over the past 300 days, 150 days have been medium market conditions and 60 days have had high market increases. On the basis of these data, state the optimum investment strategy for the investment.

- (b) For what value of X , the game with following pay-off matrix is strictly determinable?

| Player A | Player B | | |
|----------|-----------|-----------|-----------|
| | B_1 | B_2 | B_3 |
| A_1 | λ | 6 | 2 |
| A_2 | -1 | λ | -7 |
| A_3 | -2 | 4 | λ |

- (c) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are as follows:

| Job | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|---|----|----|---|----|----|---|
| Machine A | 3 | 12 | 15 | 6 | 10 | 11 | 9 |
| Machine B | 8 | 10 | 10 | 6 | 12 | 1 | 3 |

Determine a sequence of these jobs that will minimize the total elapsed time T . Also find T and idle time for machine A and B.

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Attempt any two of the following questions :

10x2=20

- 4 (a) The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of 3,000 ✓ per month. The cost of one set up is Rs 500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Rs 240 per year. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between set-ups.
- (b) What is Monte Carlo simulation? Describe the idea of experimentation (Random Sampling) in simulation.
- (c) Using random numbers to simulate a sample, find the probability that a packet of 6 products does not contain any defective product, when the production line produces 10 percent defective products. Compare the answer with the expected probability.

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Attempt any two of the following questions :

10x2=20

5 (a) Explain the following terms in PERT/CPM.

- (i) Earliest time
- (ii) Latest time
- (iii) Total activity time
- (iv) Event slack
- (v) Critical path.

(b) The following tasks has to be performed periodically on the heat exchangers in a refinery:

| Task | Immediate predecessors | Time (days) |
|------|------------------------|-------------|
| A | - | 14 |
| B | A | 22 |
| C | B | 10 |
| D | B | 16 |
| E | B | 12 |
| F | C | 10 |
| G | C | 6 |
| H | F,G | 8 |
| I | D,E,H | 24 |
| J | I | 16 |

- (i) Draw a network diagram of activities for the project.
- (ii) Identify the critical path. What is its length?

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- (c) 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 (the time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate:
- (i) expected queue size (line length)
 - (ii) Probability that the queue size exceeds 10.

If the input of trains increases to an average of 33 per day, What will be the change in (a) and (b) ?
