**Code: 9A03701**

**R09**

B.Tech IV Year I Semester (R09) Supplementary Examinations June 2017

**OPERATIONS RESEARCH**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) How do you classify OR models?
(b) Old hens can be bought at Rs.50 each and young ones at Rs.120 each. The old hens lay 3 eggs per week and the young ones 5 eggs per week, each egg being worth Rs.3. A hen costs Rs.20 per week to be fed. If there are only Rs.2000 available to be spent on purchasing the hens and at most 20 hens can be accommodated in the space. Formulate this as an LP model to find each kind of hen that should be bought to have a maximum profit per week.

2 (a) Explain the Vogel's approximation method for obtaining an initial basic feasible solution of a transportation problem.
(b) A project work consists of 4 major jobs for which 4 contractors have submitted tenders (in lakhs of rupees), shown in the matrix. Find the assignment which maximizes the total cost of the project, when each contractor has to be assigned at least one job.

| Contractor \ Job | I | II | III | IV |
|---|---|---|---|---|
| 1 | 10 | 24 | 30 | 15 |
| 2 | 16 | 22 | 28 | 12 |
| 3 | 12 | 20 | 32 | 10 |
| 4 | 9 | 26 | 34 | 16 |

3 (a) Describe some important replacement situations.
(b) The cost of a machine is Rs.60,000 and its scrap value is only Rs.1500. Given the following details, when should the machine be replaced?

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Maintenance cost (Rs.) | 1000 | 2500 | 4000 | 5500 | 9000 | 12500 | 16500 | 19500 |

4 (a) Explain the graphical method of solving 2Xn and mX2 games.
(b) Obtain the optimal strategies for both players and the value of the game for two-person-zero-sum games whose payoff matrix is given by:

| Player A \ Player B | $B_1$ | $B_2$ | $B_3$ |
|---|---|---|---|
| $A_1$ | 1 | 3 | 11 |
| $A_2$ | 8 | 5 | 2 |

5 (a) Discuss the fields of applications for queuing.
(b) If for a period of two hours in a day (8 am to 10 am) trains arrive at the yard every 20 minutes but the service time continues to remain 36 minutes, then estimate for this period (i) the probability that the yard is empty and (ii) the average number of trains in the system, on the assumption that the line capacity of the yard is limited to four trains only.

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6 (a) Discuss the various costs involved in inventory models.

(b) Annual demand for a particular item of inventory is 11,000 units. Inventory carrying cost per unit per year is 20%. Ordering cost in Rs.400 per order. The price quoted by the supplier is Rs.55 per unit. However the supplier will give a discount of 5% for orders of 1,500 or more. Is it worth-while avail of the discount offer?

7 (a) With suitable examples discuss dynamic programming.

(b) Apply Bellman's principle to solve the following problem:

Max $Z = x_1, x_2, \ldots\ldots\ldots\ldots x_n$

Subject to the constraint

$x_1 + x_2 + \ldots\ldots\ldots\ldots + x_n = C$

And $x_1, x_2 \ldots\ldots x_n \geq 0$

8 (a) Distinguish between solutions derived from simulation models and solutions derived from analytical models.

(b) A shop keeps stock of a popular item. Previous experience shows the daily demand pattern for the item with associated probabilities, as shown below:

| Daily demand (number) | 0 | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|---|
| Probability | 0.01 | 0.20 | 0.15 | 0.50 | 0.12 | 0.02 |

Use the following sequence of random numbers to simulate the demand for the next 10 days.

Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49

Also estimate the daily average demand for the item on the basis of simulated data.

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