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4583

Your Roll No.

B.A. Programme / III

AS

OPERATIONAL RESEARCH

(T)

Paper III – Operational Research-II

(Admissions of 2004 and onwards)

Time : 3 Hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt any six questions.

All questions carry equal marks.

1. State 'Bellman's principle of optimality' and use it to solve

$$\text{Min } Z = p_1 \log p_1 + p_2 \log p_2 + \dots + p_n \log p_n$$

subject to

$$p_1 + p_2 + \dots + p_n = 1$$

and $p_i \geq 0 \quad \forall \quad i = 1, 2, \dots, n$

2. Describe briefly how a linear programming problem can be solved by Dynamic Programming Approach.

P.T.O.

3. Distinguish between All - integer and mixed - integer Linear Programming problems. Give the outline of one of method to solve an All - integer programming problem.

4. Solve the following mixed integer Programming problem :

$$\text{Max } Z = x_1 + x_2$$

subject to

$$3x_1 + 2x_2 \leq 5$$

$$x_2 \leq 2$$

$$x_1, x_2 \geq 0; x_1 \text{ is an integer.}$$

5. (a) Define Reliability Function, Hazard rate function and mean time before system failure.
- (b) Show that if a system has an exponential failure time distribution function, then its failure rate is constant. Also show that the converse is also true.

6. (a) Compare parallel and standby configuration of n components. Which one is better and why? Justify your answer.

(b) Explain the concept of Preventive maintenance, corrective maintenance and age replacement.

7. What is a replacement problem? When does it arise?

An equipment has a purchase price of Rs. 7000. The running cost per year and resale values are given below :-

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------------------|------|------|------|------|------|------|------|------|
| Running cost (Rs.) | 2000 | 2100 | 2300 | 2600 | 3000 | 3300 | 4100 | 4600 |
| Resale price (Rs.) | 4000 | 3000 | 2200 | 1700 | 1400 | 700 | 700 | 700 |

What is optimal replacement age for the equipment.

8. A project consists of nine activities with the following estimates for their duration :-

| Activity | Time Estimates (in Days) | | |
|----------|--------------------------|-------------|-------------|
| | Optimistic | Most likely | Pessimistic |
| 1 - 2 | 1 | 2 | 9 |
| 2 - 3 | 1 | 4 | 7 |
| 2 - 4 | 2 | 4 | 12 |
| 3 - 5 | 2 | 3 | 4 |
| 4 - 5 | 4 | 6 | 8 |
| 4 - 6 | 3 | 5 | 7 |
| 3 - 7 | 6 | 8 | 16 |
| 5 - 6 | 1 | 2 | 3 |
| 5 - 7 | 5 | 7 | 15 |
| 6 - 7 | 3 | 5 | 13 |

- (a) What is expected duration of the project and its variance.
- (b) What is the probability that the project will be completed within
- (i) 25 days (ii) Its expected duration time

- (c) Which day of completion has 95% chances of being met ?
9. (a) Differentiate between PERT and CPM.
 (b) Define Total and free float for the activities of a network diagram.
10. Seven jobs are to be processed on two machines A & B in the order AB. Each machine can process only one job at a time. The processing times for the jobs on two machines are as follows.

| Job | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----|----|----|---|----|---|----|
| Machine A | 10 | 12 | 13 | 7 | 14 | 5 | 12 |
| Machine B | 15 | 11 | 8 | 9 | 6 | 7 | 16 |

Determine the optimal sequence of jobs on machines so that total elapsed time is minimized.

Suppose that an additional machine is added to the process described job. Let the additional machine be denoted by 'C'. Now the technological order is ABC for each job. The processing times of jobs on machine C are as follows :

| Job | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----|----|----|---|---|---|----|
| Machine C | 12 | 14 | 11 | 8 | 8 | 9 | 10 |

What is the new optimal sequencing order of jobs on machine ? Also find the minimal total elapsed time.