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Your Roll No.....

5602

B.A. Programme/III

D

OPERATIONAL RESEARCH

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. Write short note on characteristics of dynamic programming.
What do you understand by forward and backward recursive algorithm ? 12.5
2. A firm has divided its marketing area into three zones. The amount of sales depends upon number of salesman in each zone. The firm is collecting data regarding sales and salesmen in each area over a number of past years.

P.T.O.

The information is summarized in the following table. For the next year firm has only 9 salesmen and the problem is to allocate these salesmen to these three different zones so that the total profit is maximum : 12.5

Profit in thousands of rupees :

No. of salesmen	Zone 1	Zone 2	Zone 3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110
8	100	100	110
9	90	100	110

3. Define and briefly explain Integer programming problem, all I.P.P. and mixed I.P.P.

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

$$2x_1 + 5x_2 \leq 16$$

$$6x_1 + 5x_2 \leq 30, \quad x_2 \geq 0,$$

$$x_1 \geq 0 \text{ and integer.} \quad 12.5$$

4. (a) Define hazard rate function. For a continuous random variable with hazard rate function $\phi(a)$, show that life distribution function and failure density function are respectively given by :

$$(i) \quad F(x) = 1 - e^{-\int_0^x \phi(u) du}$$

$$(ii) \quad f(x) = \phi(x) e^{-\int_0^x \phi(u) du}$$

- (b) Show that for a series system, system hazard rate is sum of the components' hazard rate. 3

5. Find the reliability function and MTSF (mean time to system failure) for the following n component systems when the failure time distribution function of each component is exponential :

(i) series system

(ii) parallel system

(iii) series-parallel system. 12.5

6. (a) Discuss the replacement policy of an item whose maintenance cost increases with time and the value money doesn't change with time, time being a continuous variable. 6

(b) The maintenance cost and resale value per year of the machine whose purchase price is Rs. 7000 is given below :

Year	Maintenance cost (in Rs.)	Resale value (in Rs.)
1	900	4000
2	1200	2000
3	1600	1200
4	2100	600
5	2800	500
6	3700	400
7	4700	400
8	5900	400

- When should the machine be replaced ? 6.5
7. Explain sequencing problem in detail. Give an algorithm for "2 jobs and m machines" job shop problem. 12.5
8. Write assumptions for Johnson's rule and give the procedure for determining an optimal sequence for processing n jobs on

two machines. There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing time in hours are given as :

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

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

9. The time estimates in week for the activities of a PERT network are given below :

Activity	t_o	t_m	t_p
1—2	1	1	7
1—3	1	4	7
1—4	2	2	8
2—5	1	1	1
3—5	2	5	14
4—6	2	5	8
5—6	3	6	15

- (i) Draw the project network and identify all the paths through it.
- (ii) Determine the expected project length.
- (iii) Calculate the standard deviation and variance of the project length.

- (iv) What is the probability that the project will be completed at least 4 weeks earlier than expected time ?
- (v) What should be the scheduled completion time for the probability of completion to be 90% ? 12.5
10. (a) Define *four* types of floats in network. 8
- (b) Write a short note on Preventive Maintenance Policy. 4.5