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Your Roll No.

B.A. Programme / III
OPERATIONAL RESEARCH
(R)

J

Paper III – Operational Research-II

(New Course : 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.)*

Answer any six questions.

All questions carry equal marks.

1. Given for the following project are three time estimates for various activities :

Activity	Optimistic	Time Estimates (Weeks)	
		Most Likely	Pessimistic
1-2	3	4	5
1-3	1	2	3
2-3	6	8	10

[P.T.O.]

2-4	0	0	0
2-5	2	5	8
3-4	3	5	7
4-7	6	9	12
5-6	1	1	1
5-7	2	5	8
6-7	4	8	12

Calculate expected length of the project and its variance.
Also find the critical path.

2. Find the optimal time schedule for the following project using CPM technique.

Activity	Normal		Crash	
	Time (Days)	Cost (Rs.)	Time (Days)	Cost (Rs.)
1-2	3	360	2	400
2-3	6	1440	4	1620
2-4	9	2160	5	2380
2-5	7	1120	5	1600
3-4	8	400	4	800
4-5	5	1600	3	1770
5-6	3	480	2	760

Indirect cost per day is Rs. 160/-.

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

$$\text{Max } Z = y_1 \cdot y_2 \cdot y_3 \cdots y_n$$

subject to

$$y_1 + y_2 + \dots + y_n = c,$$

$$y_j \geq 0 \quad \forall j = 1, 2 \dots n$$

4. Describe briefly that how a linear programming problem can be solved by using Dynamic Programming Approach.

5. Explain Gomory's cutting plane Algorithm for solving an Integer Programming Problem.

6. Solve the following Mixed Integer Programming problem :

$$\text{Min } Z = x_1 - 3x_2$$

$$\text{s.t. } x_1 + x_2 \leq 5$$

$$-2x_1 + 4x_2 \leq 11$$

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

7. A fleet owner finds from his past records that the costs per year of running a vehicle whose purchase price is Rs. 50,000/- are as under :

Year	Running Cost (Rs.)	Resale Value (Rs.)
1	5,000	30,000
2	6,000	15,000
3	7,000	7,500
4	9,000	3,750
5	11,500	2,000
6	16,000	2,000
7	18,000	2,000

Thereafter running cost increases by Rs. 2000/- per year but resale value remains constant at Rs. 2000/-. What is the optimal replacement age ?

8. (a) Explain the following :
- (i) reliability function
 - (ii) hazard rate function
 - (iii) MTBF
- (b) Prove that if failure time for a component is exponential then its failure rate is constant.

(c) Which arrangement of components is better series or parallel. Explain your answer in detail.

9. Two jobs are to be processed on four machines A, B, C and D. The technological order of these jobs is as follows :

Job 1 : A B C D

Job 2 : D B A C

The processing times (in hours) of the jobs on the machines are :

	Machine			
	A	B	C	D
Job 1	2	4	5	1
Job 2	6	4	2	3

Find the optimal sequences of jobs on the four machines.

10. Write short notes on the following :

- Johnson's optimality rule for solving n-jobs/m-machine flow shop problem.
- Branch and Bound Method.