

M.B.A. (CBCS Pattern) Semester - III  
**PCB3C01 - Applied Operations Research**

P. Pages : 3

Time : Three Hours



**GUG/S/23/10690**

Max. Marks : 70

- Notes : 1. Attempt **any five** questions.  
2. All questions carry equal marks.

1. a) Consider the pay-off matrix of player A as shown below and solve it graphically: 7

Player A	Player B					
		1	2	3	4	5
	1	4	2	5	-6	6
	2	7	-9	7	4	8

- b) Solve the following game:- 7

	B1	B2	B3
A1	1	7	2
A2	6	2	7
A3	6	1	6

2. The data for a project are 14

Activity	Preceding Activity	Time (in weeks)		Cost (in Rs.)	
		Normal	Crash	Normal	Crash
A	None	3	2	18000	19000
B	None	8	6	600	1000
C	B	6	4	10000	12000
D	B	5	2	4000	10,000
E	A	13	10	3000	9000
F	A	4	4	15000	15000
G	F	2	1	1200	1400
H	C, E, G	6	4	3500	4500
I	F	2	1	7000	8000

- a) Draw a project network diagram and find the critical path.  
b) If a dead line of 17 weeks is imposed for completion of the project, what activities will be crashed, what would be the additional costs, and what would be the critical activities of the network after crashing?

3. A firm has a machine whose purchase price is Rs. 20,000. It's maintenance cost and resale price at the end of each year are as under: 14

Year	1	2	3	4	5	6
Maintenance cost (Rs.)	1500	1700	2000	2500	3500	5500
Resale price (Rs.)	17000	15300	14000	12000	8000	3000

The firm has obtained a contract to supply the goods produced by the machine for a period of five years from now. After this time period, the firm does not intend to use the machine. If the firm has a machine of this type that is one year old, what replacement policy should it adopt intends to replace the machine not more than once?

4. The following mortality rates have been observed for certain type of bulbs. 14

Week	1	2	3	4	5	6
Probability of failure	0.09	0.25	0.49	0.85	0.97	1.00

If bulb fails, it cost Rs. 3 to replace it individually but if all the bulbs are replaced at once then it costs Rs. 0.70 per bulb. Suggest the optimal replacement policy. Assume 1000 bulbs are in service.

5. A refrigeration company has six plants located in different parts of a city. Every year, it is necessary for each plant to be completely overhauled. The overhauling is carried out in two stages 'A' and 'B', and each stage requires a crew of workmen with completely different skills. The work on stage 'B'. Can start only when stage A has been completed. The plant has to be closed for the entire period of its overhauling. The present schedule of the overhaul of the six plants is as follows:- 14

Plant	P1	P2	P3	P4	P5	P6
Crew A	10	10	8	10	9	12
Crew B	8	6	14	9	7	10

- a) Determine the optimal sequence.  
b) If downtime of any of the six plant cost Rs.4,000 per day for plant. Idle time for crew 'A'. Cost Rs.1,250 per day and idle time for crew 'B'. Cost Rs. 2,150 per day, which of the two schedules, the present one and the one determined in (a), will be more economical? What are their respective costs?

6. Given the frequency distribution of contribution (profit) per unit, annual demand and requirement of investment for a particular manufacturing Plant. Calculate the percentage of return on investment using Monte-Carlo Simulation. Also recommend the optimum investment strategy. 14

Required Investment (Rs.)	Relative frequency
17,50,000	0.25
20,00,000	0.50
25,00,000	0.25
Contribution per unit (Rs.)	Relative frequency
3	0.10
5	0.20
7	0.40
9	0.20
10	0.10
Annual Demand in 1000 units	Relative frequency
20	0.05
25	0.10
30	0.20
35	0.30
40	0.20
45	0.10
50	0.05

Use the following random number's for all the variables.  
93, 03, 51, 59, 77, 61, 71, 62, 99, 15

7. A drug manufacturing concern has ten medical representatives working in three sales area. The profitability for each representative in three areas is as under:- **14**

No. of Representatives	Profitability (in Rs. 000)		
	Area 1	Area 2	Area 3
0	15	26	30
1	22	35	38
2	30	40	44
3	38	46	50
4	45	55	60
5	48	62	65
6	54	70	72
7	60	76	80
8	65	83	85
9	70	90	90
10	70	95	85

Determine the optimum allocation of medical representatives in order to maximize the profit.

8. What is simulation? Explain the process and applications of simulation. **14**
9. Discuss briefly, how does dynamic programming differ conceptually from linear programming? **14**
10. Write short note on **any two**:- **14**
- PERT vs CPM.
  - Staff Replacement.
  - Important assumptions made in sequencing problems.
  - Application of computer in ORT.

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