

(6 pages)

MAY 2013

**P/ID 77508/PMBH/
PMB1H/PMBSJ**

Time : Three hours

Maximum : 100 marks

PART A — (5 × 6 = 30 marks)

Answer any FIVE questions.

All questions carry equal marks.

1. List and explain the assumptions of linear programming.
2. Discuss the industrial applications of operations research.
3. Distinguish between transportation problem and assignment problem.
4. Illustrate the construction of time/Gantt Chart in project management with an example.
5. Explain the Parameters of Kendal Notation.
6. Distinguish between reorder point and reorder level.

7. Consider the following payoff matrix with respect to Player A and solve it optimally.

		B	
		1	2
A	1	10	8
	2	6	12

8. Discuss the cost trade-off in replacement analysis.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

All questions carry equal marks.

9. Solve the following LP problem graphically.

$$\text{Maximize } Z = 20x_1 + 80x_2$$

$$\text{Subject to } 4x_1 + 6x_2 \leq 90$$

$$8x_1 + 6x_2 \leq 100$$

$$5x_1 + 4x_2 \leq 80$$

$$x_1 \text{ and } x_2 \geq 0.$$

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10. A company has factories at four different places (1, 2, 3 and 4) which supply items to warehouse A, B, C, D and E. Monthly factory capacities are 200, 175, 150 and 325, respectively. Monthly warehouse requirements are 110, 90, 120, 230 and 160, respectively. Unit shipping costs (in rupees) are given in the following table. Shipments from 1 to B and from 4 to D are not possible. Determine the optimum distribution plan to minimize the shipping cost.

		To					Capacity
		A	B	C	D	E	
From	1	13	–	31	8	20	200
	2	14	9	17	26	10	175
	3	25	11	12	17	15	150
	4	10	21	13	–	17	325
Requirements		110	90	120	230	160	

11. Vehicles are passing through a tollgate at the rate of 70 per hour. The average time to pass through the gate is 45 seconds. The arrival rate and service rate follow Poisson distribution. There is a complaint that the vehicles wait for long duration. The authorities are willing to install one more gate to reduce the average time to pass through the tollgate to 35 seconds if the idle time of the tollgate is less than 9% and the average queue length at the gate is more than 8 vehicles. Check whether the installation of the second gate is justified.

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12. Beta industry estimates that it will sell 24,000 units of its product for the forthcoming year. The ordering cost is Rs. 150 per order and the carrying cost per unit per year is 20% of the purchase price per unit. The purchase price per unit is Rs. 50. Find the economic order size, the number of orders per year and the time between successive orders.
13. Consider the following two machines and six jobs flow shop problem.

Job	Machine 1	Machine 2
1	5	7
2	10	8
3	8	13
4	9	7
5	6	11
6	12	10

14. Solve the following game.

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

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[P.T.O.]

15. Give a logical flowchart to simulate the queuing system with single server and single queue to obtain the following average measures of performance.
- (a) Server utilization
 - (b) Average number of customers waiting in the queue as well as in the system
 - (c) Average waiting time per customer in the queue as well as in the system.
16. Solve the following assignment problem using Hungarian method. The matrix entries are processing times in hours.

		Operator				
		1	2	3	4	5
Job	1	20	22	35	22	18
	2	4	26	24	24	7
	3	23	14	17	19	19
	4	17	15	16	18	15
	5	16	19	21	19	25

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PART C — (1 × 20 = 20 marks)

Compulsory

17. A company is planning to replace an equipment whose first cost is Rs. 1,00,000. The operating and maintenance cost of the equipment during its first year of operation is Rs. 10,000 and it increases by Rs. 2,000 every year thereafter. The resale value of the equipment at the end of the first year of its operation is Rs. 65,000 and it decreases by Rs. 10,000 every year thereafter. Find the economic life of the equipment by assuming the interest rate as 12%.
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