(6 pages)

DECEMBER 2023 **P/ID 37513/PMA3N**

Time : Three hours Maximum : 80 marks

SECTION A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define a payoff.

2. What is a decision node?

3. What is Expected opportunity loss?

4. Define node in a network.

5. What is enumeration of cuts?

6. Define a cycle inventory.

7. Define an inventory holding cost.

8. What is lead time in inventory system.

9. Define a steady state in queuing system.

10. Define Pure death process.

11. Define a sudden Failure.

12. What is an individual replacement policy?

SECTION B — ($5 \times 6 = 30$ marks)

Answer any FIVE questions.

13. Discuss the types of decision making environments.

14. A retailer purchase cherries every morning at Rs. 50 a case and sells them for Rs. 80 a case. Any case remaining unsold at the end of the day can be disposed of next day at a salvage value of Rs. 20 per case. Past sales have ranged from 15 to 18 cases per day. The following is the record of sales for the past 120 days:

Cases sold	15	16	17	18
Number of days	12	24	48	36

Find out how many cases the retailer should purchase per day to maximize his profit.

15. Write the scope of network applications.

16. A product is sold at the rate of 50 pieces per day and is manufactured at the rate of 250 pieces per day. The set up cost of the machines is Rs. 2,000 and the storage cost is found to be Rs. 0.15 per piece per day. With labour charges of Rs. 3.20 per pieces, material cost at Rs. 2.10 per piece and overhead cost of Rs. 4.10 per piece, find the minimum cost batch size if the interest charges are 8 per cent. Compute the optimal number of cycles required in a year for manufacturing of this product.

17. A company that operates for 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company?

    (a) How would this analysis differ if the company wanted to maximize its profits rather than minimize cost?

    (b) What is the gross profit if the company sells the cable for Rs. 360 a meter?

18. Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one arrivals and the next. The length of phone call is assumed to be distributed exponentially with mean three minutes.

    (a) What is the probability that a person arriving at the booth will have to wait?

    (b) What is the average length of the queue that forms from time to time.

    (c) What is the probability that it will takes him more than ten minutes altogether to wait for the phone and complete his call?

19. Machine A costs Rs. 45,000 and the operating costs are estimated at Rs. 1,000 for the first year increasing by 10,000 per year in the second and subsequent years. Machine B costs Rs. 50,000 and operating costs are Rs. 2,000 for the first year increasing by Rs. 4,000 in the second and subsequent years. If we now have a machine of type A, should we replace it with B? so when? Assume that both machines have no resale value and future costs are not discounted.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

20. A toy manufacturer is considering a project of manufacturing a dancing doll with three different movement designs. The doll will be sold at an average of Rs. 10. The first movement design using gears and levels will provide the lowest tooling and set up cost of Rs. 1,00,000 and Rs. 5 per unit of variable cost. A second design with spring action will have a fixed cost of Rs. 1,60,000 and variable cost of Rs. 4 per unit. Yet another design with weight and pulleys will have a fixed cost of Rs. 3,00,000 and variable cost Rs. 3 per unit. The demand events that can occur for the doll and the probability of their occurrence is given below:

	Demand	Probability
Light demand	25,000	0.10
Moderate demand	1,00,000	0.70
Heavy demand	1,50,000	0.20

(a) Construct a payoff table for the above project.

(b) Which is the optimum design?

(c) How much can the decision maker afford to pay in order to obtain perfect information about the demand?

21. Write the steps of maximum flow Algorithm.

22. The demand for an item in a company is 18,000 units per year and the company can produce the item at a rate of 3,000 per month. The cost of one set up is Rs. 500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Rs. 240 per year. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between set ups.

23. Derive the system of differential difference equation for multi server queuing models.

24. The following mortality rates have been observed for a certain types of fuse:

Week	1	2	3	4	5
Per cent failing by the end of week	5	15	35	75	100

There are 1,000 fuses in use and it costs Rs. 5 to replace an individual fuse. If all fuses were replaced simultaneously it would cost Rs. 1.25 per fuse. It is proposed to replaced all fuses at fixed intervals of time, whether or not they have burnt out and to continue replacing burnt out fuses as they fail. At what intervals the group replacement should be made? Also prove that this optimal policy is superior to the straight forward policy of replacing each fuse only when it fails.

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