(6 pages)

MAY 2024 **P/ID 37513/PMA3N**

Time : Three hours Maximum : 80 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define a decision alternatives.

2. What is an event node?

3. What is an expected value of perfect information?

4. What is a direct network?

5. What is a residuals?

6. Define a safety inventory.

7. Define an inventory set up cost.

8. Define an order cycle.

9. Define Markovian property of inter–arrival times.

10. Define queue size.

11. Define a random failure.

12. Define an Group replacement policy.

PART B — ($5 \times 6 = 30$ marks)

Answer any FIVE questions.

13. The probability of the demand for lorries for hiring on any day in a given district is as follows:

No of lorries demanded	0	1	2	3	4
Probability	0.1	0.2	0.3	0.2	0.2

Lorries have a fixed cost of Rs. 90 each day to keep; the daily hire charges Rs. 200. If the lorry hire company owns 4 lorries, what is its daily expectation? If the company is about to go into business and currently has no lorries, how many lorries should it buy?

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

15. Write the steps of Dijkstra's algorithm.

16. A contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that when he starts production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for a year is Rs. 200 and the set up cost of a production run is Rs. 1,800. How frequently should production run be made?

17. The production department for a company requires 3,600 kg of raw materials for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs. 36 and the cost of carrying inventory is 25 per cent of the investment in the inventories. The price is Rs. 10 per kg. Determine an ordering policy for a raw material.

18. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate (a) expected queue size (b) probability that the queue size exceeds 10. If the input of trains increases to an average of 33 per day, what will be the change in (a) and (b).

19. A firm is considering replacement of a machine, whose cost price is Rs. 12,200 and the scrap value Rs. 200. From experience the running costs are found to be as follows:

Year	1	2	3	4
Running cost (Rs.)	200	500	800	1200
Year	5	6	7	8
Running cost (Rs.)	1800	2500	3200	4000

When should the machine be replaced?

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

20. The manager of a flower shop promises its customers delivery within four hours on all flowers orders. All flowers are purchased on the previous day and delivered to Parker by 8.00 am the next morning. The daily demand for roses is as follows:

Dozens of roses	70	80	90	100
Probability	0.1	0.2	0.4	0.3

The manager purchases roses for Rs.10 per dozen and sells them for Rs. 30. All unsold roses are donated to a local hospital. How many dozens of roses should Parker order each evening to maximize its profits? What is the optimum expected profit?

21. Write the steps of capacitated network simplex algorithm.

22. A commodity is to be constant rate of 200 units per day. Supplies of any amount can be obtained at any required time, but each ordering costs Rs. 50; costs of holding the commodity in inventory is Rs. 2 per unit per day while the delay in the supply of the item induces a penalty of Rs. 10 per unit per day. Find the optimal policy (Q,t), where t is the reorder cycle period and Q is the inventory after reorder. What would be the best policy to adopt if the penalty cost becomes infinite?

23. A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can, on an average, service 12 customers per hour. After stating your assumptions, answer the following:

    (a) What is the average number of customers waiting for the service of the clerk?

    (b) What is the average time a customer has to wait, before being served?

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

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

There are 1,000 fuses in uses 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 replace 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.
