(6 pages)

MAY 2023 **P/ID 37513/PMA3N**

Time : Three hours Maximum : 80 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer any TEN questions

1. Define state of nature.

2. What is a Expected monetary value?

3. State Baye's theorem.

4. Define a path of network.

5. What is safety inventory?

6. Define a transit inventory.

7. What is the purchase cost of inventory models?

8. What is the total inventory cost?

9. What is the Transient state for queuing theory?

10. Define a pure birth process.

11. Define a gradual failure.

12. Define a present worth factor in replacement models.

SECTION B — ($5 \times 6 = 30$ marks)

Answer any FIVE questions

13. Discuss the following.

    (a) Optimism Criterion

    (b) Pessimism criterion.

14. A stall at a certain railway station sells for Rs. 1.50 paise a copy of daily newspaper for which it pays Rs. 1.20. Unsold papers are returned for a refund of Rs. 0.95 a copy. Daily sales and corresponding probability are as follows:

Daily Sales :	500	600	700
Probability :	0.5	0.3	0.2

    (a) How many copies should it order each day to get maximum expected profit?

    (b) If unsold copies cannot be returned and are useless, what should be the optimal order each day?

15. Write the steps of Dijkstra's algorithm.

16. At present a company purchase an item X from outside suppliers. The consumption of this item is 10,000 units per year. The cost of the item is Rs. 5 per unit and the ordering cost is estimated to be Rs. 100 per order. The cost of carrying inventory is 25 per cent. If the consumption rate is uniform, determine the economic purchase quantity.

17. Each unit of an item cost a company Rs. 40. Annual holding costs are 18 per cent of unit cost for interest charges, 1 per cent for insurance, 2 per cent allowances for obsolescence, Rs. 2 for building overheads, Rs. 1.50 for damage and loss amid Rs. 4 miscellaneous costs. Annual demand for the item is constant at 1,000 units and each order costs Rs. 100 to place.

    (a) Calculate EOQ and the total costs associated with stocking the item.

    (b) If the supplier of the item will only deliver batches of 250 units, how are the stock holding costs affected?

18. A warehouse has only one loading dock manned by a three person crew. Trucks arrive at the loading dock at an average rate of 4 trucks per hour and the arrival rate is Poisson distributed. The loading of a truck takes 10 minutes on an average and can be assumed to be exponentially distributed. The operating cost of a truck is Rs. 20 per hour and the members of the loading crew are paid Rs. 6 each per hour. Would you advise the truck owner to add another crew of three persons?

19. An engineering company is offered a material handling equipment A. It is priced at Rs. 60,000 including cost of installation. The costs for operation and maintenance are estimated to be Rs. 10,000 for each of the first five years, increasing every year by Rs. 3,000 in the sixth and subsequent years. The company expects a return of 10 per cent on all its investment. What is the optimal replacement period?

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

Answer any THREE questions

20. A TV dealer finds that the cost of holding a TV in stock for a week is Rs. 50. Customers who cannot obtain new TV sets immediately tend to go to other dealers and he estimated that for every customer he cannot get immediate delivery he loses an average of Rs. 200. For one particular model of TV the probabilities of demand of 0, 1, 2, 3, 4 and 5 TV sets in a week are 0.05, 0.10, 0.20, 0.30, 0.20 and 0.15 respectively.

(a) How many televisions per week should the dealer order? Assume that there is no time lag between ordering and delivery.

(b) Compute EVPI.

21. Write the steps for capacitated network simplex Algorithm.

22. A dealer supplies you the following information with regard to a product that he deals in: Annual demand = 10,000 units; Ordering cost = Rs. 10 per order; Price = Rs. 20 per unit; Inventory carrying cost = 20 per cent of the value of inventory per year. The dealer is considering the possibility of allowing some back-order to occur. He has estimated that the annual cost of back – ordering will be 25 per cent of the value of inventory.

    (a) What should be the optimum number of units of the product he should buy in one lot?

    (b) What quantity of the product should be allowed to be back–ordered, if any?

    (c) What would be the maximum quantity of inventory at any time the year?

23. Consider a single server queuing system with Poisson input and exponential service times. Suppose the mean arrival rate is 3 calling units per hour, the expected service time is 0.25 hour and the maximum permissible calling units in the system is two. Derive the steady state probability distribution of the number of calling units in the system and then calculate the expected number in the system.

24. A computer contains 10000 resistors. When any resistor fails, it is replaced. The cost of replacing a resistor individually is Rs. 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percentage of surviving resistors say *S(t)* at the end of month t and the probability of failure *P(t)* during the month t are

t	0	1	2	3	4	5	6
s(t)	100	97	90	70	30	15	0
P(t)	–	0.03	0.07	0.20	0.40	0.15	0.15

What is the optimal replacement plan?

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