K21P 0243

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree (CBSS – Reg./Suppl. (Including Mercy Chance)/Imp.) Examination, April 2021
(2017 Admission Onwards)
MATHEMATICS
MAT 4E03 : Operations Research

Time : 3 Hours Max. Marks : 80

PART – A

Answer **four** questions from this part. **Each** question carries **4** marks.

1. Explain the Savage criterion in decision analysis.

2. A market survey is made on two brands of breakfast foods A and B. Every time a customer purchases, he may buy the same brand or switch to another brand. The transition matrix is given below :

$$\begin{array}{c} \\ \text{From} \end{array} \begin{array}{c} \begin{array}{cc} \text{To} & \\ \text{A} & \text{B} \end{array} \\ \begin{array}{c} \text{A} \\ \text{B} \end{array} \begin{bmatrix} 0.8 & 0.2 \\ 0.6 & 0.4 \end{bmatrix} \end{array}$$

At present, it is estimated that 60 per cent of the people buy brand A and 40 per cent buy brand B. Determine the market shares of brand A and brand B in the steady state.

3. An electronic circuit consists of 15 valves, 20 resistors and 10 capacitors all connected in a series. The components in each category are identical and their failure times are found to follow exponential distribution with the following mean failure times :

	Valves	Resistors	Capacitors
Mean failure time (hrs) :	10,000	20,000	20,000

What is the mean time between failure of the system ? What is its liability for 100 hours ?

P.T.O.

4. A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs. 0.60 per unit per year. The set-up cost per run is 80.00. Find the optimum run-size and the minimum average yearly cost.

5. Explain the terms lead time, re-order point, safety stock and buffer stock.

6. Define entropy. Briefly describe its requirements.

7. Evaluate the entropy associated with the following probability distribution :

Event :	**A**	**B**	**C**	**D**
Probability :	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

8. What do you know about various components of communication system ?

PART – B

Answer **any four** questions from this part without omitting **any** Unit. **Each** question carries **16** marks.

Unit – I

9. The following payoff table is given :

	Event			
Action	E_1	E_2	E_3	E_4
A_1	40	200	– 200	100
A_2	200	0	200	0
A_3	0	100	0	150
A_4	– 50	400	100	0

i) Calculate the opportunity loss table.

ii) Suppose that the probabilities of the events of this table are $P(E_1) = 0.20$, $P(E_2) = 0.15$, $P(E_3) = 0.40$, $P(E_4) = 0.25$. Calculate the expected payoff and the expected loss of each action.

10. A finance manager is considering drilling a well. In the past, only 70% of wells drilled were successful at 20 metres depth in that area. Moreover on finding no water at 20 metres, some persons in that area drilled it further up to 25 metres but 20% struck water at that level. The prevailing cost of drilling is Rs. 500 per

metre. The finance manager estimated that in case he does not get water in his own well, he will have to pay Rs. 15,000 to buy water from outside for the same period of getting water from the well. The following decisions are considered :

i) Do not drill any well,

ii) Drill up to 20 metres, and

iii) If no water is found at 20 metres, drill further upto 25 metres.

Draw an appropriate decision-tree and determine the Finance Manager's optimal strategy.

11. Consider the setting up a 'Q' system of inventory control for a vital spare part. Though a demand pattern has not been established, yet the quantities demanded during the past 50 weeks are known. Similarly, the supplier's delivery lead time has been found to vary between 1 and 4 weeks with no established pattern. We know that the carrying cost is 30% per annum and the ordering cost is Rs. 60 per order. The stock-out cost in this case is around Rs. 75 per unit per week while the inventory carrying cost works out to Rs. 15 per unit per week. Simulate the demand for 20 weeks and obtain an optimal solution.

12. The following table gives the arrival pattern at a coffee counter for one minute intervals. The service is taken as 2 persons in one minute in one counter :

No. of persons arriving :	0	1	2	3	4	5	6	7
Probability percentage :	5	10	15	30	20	10	5	5

Using Monte-Carlo simulation technique and the following random numbers, generate the pattern of arrivals and the queue formed when the following 20 random numbers are given :

5, 25, 16, 80, 35, 48, 67, 79, 90, 92, 9, 14, 1, 55, 20, 71, 30, 42, 60, 85. Find the queue length if two contents are used.

Unit – II

13. Describe the EOQ problem with instantaneous production and variable order cycle time.

14. Explain the concepts of Q-system and P-system for management of inventories.

15. A baking company sells cake by the kg. It makes a profit to Re. 0.50 per kg on every kg sold on the day it is baked. It disposes of all cakes not sold on the date it is baked; at a loss of 12 paise per kg. If demand is known to be rectangular between 2,000 and 3,000 kg, determine the optimum daily amount baked.

16. The following thirty numbers represent the annual value in thousand of rupees of some thirty items of materials selected at random. Carry out an ABC analysis and list out the values of 'A' items only :

1	2	4	9	75	4	25	3	6	13	2	4	12	30	100
2	7	40	15	55	1	11	15	8	19	1	20	1	3	5

Unit – III

17. If $p_1, p_2, \ldots, p_M$ and $q_1, q_2, \ldots, q_M$ are arbitrary non-negative numbers with $\sum_{i=1}^{M} p_i = \sum_{j=1}^{M} q_j$, show that $-\sum_{i=1}^{M} p_i \log p_i \leq -\sum_{i=1}^{M} p_i \log q_i$ with equality if and only if $p_i = q_i$, for all i.

18. Show that $H(Y/X) \leq H(Y)$ with equality if and only if X and Y are independent.

19. A source without memory has six characters with the following probabilities of transmission :

A	B	C	D	E	F
1/3	1/4	1/8	1/8	1/12	1/12

Devise the Shannon-Fano encoding procedure to obtain uniquely decodable code to the above message ensemble. What is the average length, efficiency and redundancy of the code that you obtain ?

20. Find the capacity of the memoryless channel specified by the channel matrix.

$$P = \begin{bmatrix} 1/2 & 1/4 & 1/4 & 0 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 0 & 0 & 1 & 0 \\ 1/2 & 0 & 0 & 1/2 \end{bmatrix}$$