K19P 0176

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree (Reg.) Examination, April 2019
(2017 Admission Onwards)
MATHEMATICS
MAT4E03 : Operations Research

Time : 3 Hours Max. Marks : 80

PART – A

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

1. Define Markov process. Give an example. Describe transition probability matrix of a Markov process.
2. Describe time-cost optimization algorithm.
3. What is an inventory system ? Give examples of various types of inventory systems.
4. Discuss in brief the replacement procedure for items that deteriorate with time.
5. Define Entropy. Illustrate it through an example.
6. With usual notation, prove that $I(X, Y) = H(X) + H(Y) - H(X, Y)$. **(4×4=16)**

PART – B

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

Unit – I

7. a) The purchase patterns of two brands of toothpaste can be expressed as a Markov process with the following transition probabilities :

	Formula X	Formula Y
Formula X	0.90	0.10
Formula Y	0.05	0.95

i) Which brand appears to have most loyal customers ? Explain.

ii) What are the projected market shares for the two brands ?

P.T.O.

b) Suppose that in problem a) a new toothpaste brand enters the market such that the following transition probabilities exist :

	Formula X	Formula Y	Formula Z
Formula X	0.80	0.10	0.10
Formula Y	0.05	0.75	0.20
Formula Z	0.40	0.30	0.30

i) What are the new long-run market shares ?

ii) Which brand will suffer most from the introduction of the new brand of toothpaste ?

8. Under an employment promotion programme it is proposed to allow sale of newspapers on buses during off-peak hour. The vender can purchase the papers at a special concessional rate of 25 paise and sell it for 40 paise (a piece). Any unsold copy is a dead loss. A vendor has estimated the following probabilities for the number of copies demanded :

No. of copies :	15	16	17	18	19	20
Probability :	0.04	0.19	0.33	0.26	0.11	0.07

Prepare a pay-off table and find out how many copies should be ordered so that his expected profits will be a maximum.

9. The following table gives the activities in a construction project and other relevant information.

Activity i-j	Normal time (days)	Crash time (days)	Normal cost (Rs.)	Crash cost (Rs.)
1 – 2	20	17	600	720
1 – 3	25	25	200	200
2 – 3	10	8	300	440
2 – 4	12	6	400	700
3 – 4	5	2	300	420
4 – 5	10	5	300	600
4 – 6	5	3	600	900
5 – 7	10	5	500	800
6 – 7	8	3	400	700

a) Draw the activity network of the project.

b) Find the total float and free float for each activity.

c) Using the above information crash the activity step by step until all paths are critical.

Unit – II

10. A firm is considering replacement of a machine whose cost price is Rs. 17,500 and the scrap value is Rs. 500. The maintenance costs (in Rs.) are found from experience to be as follows.

Year	:	1	2	3	4	5	6	7	8
Maintenance Cost (in Rs.)	:	200	300	3500	1200	1800	2400	3300	4500

When should the machine be replaced ?

11. The following failure rates have been observed for a certain type of transistors in a digital computer :

End of the week	:	1	2	3	4	5	6	7	8
Probability of failure to date	:	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00

The cost of replacing an individual failed transistor is Rs. 1.25. The decision is made to replace all these transistors simultaneously at fixed intervals and to replace the individual transistors as they fail in service. If the cost of group replacement is 30 paise per transistor, what is the best interval between group replacements ? At what group replacement price per transistor would a policy of strictly individual replacement become preferable to the adopted policy ?

12. Describe deterministic inventory problem. Derive the EOQ formula.

Unit – III

13. State and prove Noiseless coding theorem.

14. Describe the various requirements on the uncertainty function. Prove that the only function satisfying these requirements is $H(p_1, p_2, \ldots p_m) = -C \sum_{i=1}^{m} p_i \log p_i$, where C is any arbitrary positive constant.

15. Describe the various important properties of Entropy function. **(4×16=64)**