K20P 0120

Reg. No. : ....

Name : ....

IV Semester M.Sc. Degree (CBSS – Reg./Suppl./Imp.) Examination, April 2020
(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 forward difference operator Δ and backward difference operator ∇. Describe the properties of these two operators.

2. Describe the meaning of "crashing" in network techniques.

3. Describe the basic characteristics of an inventory system.

4. Define the terms :
   i) Reliability
   ii) Failure rate.

5. Distinguish between joint and marginal entropy.

6. With usual notation, prove that $I(X, Y) = H(X) – H(X|Y) = H(Y) – H(Y|X)$.   **(4×4=16)**

PART – B

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

UNIT – I

7. The state-transition matrix for retentions, gains and losses of firms A, B and C is given below. Using this matrix, determine the steady-state equilibrium condition :

		To		
		A	B	C
	A	0.7	0.1	0.2
From	B	0.1	0.8	0.1
	C	0.2	0.1	0.7

P.T.O.

8. An industry has three alternatives namely :

   a) Start production commercially

   b) Build a pilot plant and then decide about the commercial production

   c) Stop production

   It is estimated that the pilot plant has a 0.8 chance of high yield and 0.2 chance of low yield; if the yield is high, the commercial production will have a 0.85 chance of high profit and 0.15 chance of low profit and if yield is low the commercial production will have 0.1 chance of high profits and 0.9 chance of low profits. However, direct commercial production is expected to have 0.7 chance of high profit and 0.3 chance of low profit. Draw a decision tree to illustrate the situation for decision-making. Expected values of high profits and low profits are Rs. 12 lakhs and Rs. 1.5 lakhs. The cost of the pilot plant is Rs. 3.5 lakhs. What should be your decision ?

9. A project consists of 9 activities. Table below shows the duration for each activity and the corresponding labour requirements. Draw a network and establish critical path. Also draw a square network assuming that all the activities begin at the earliest start time. Adjust the project work such that there will be smooth demand for this resource :

Activity	Duration	No. of labour
1 - 2	3	5
2 - 4	2	3
2 - 3	3	7
3 - 4	0	0
3 - 5	3	2
4 - 5	7	2
3 - 6	2	1
5 - 6	6	6
4 - 6	5	5

UNIT – II

10. A truck owner finds from his past records that the maintenance costs per year of a truck whose purchase price is Rs. 8,000, are as given below :

Year	:	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	:	1,000	1,300	1,700	2,200	2,900	3,800	4,800	6,000
Resale price (Rs.)	:	4,000	2,000	1,200	600	500	400	400	400

Determine at which time it is profitable to replace the truck.

11. Let the value of money be assumed to be 10% per year and suppose that machine A is replaced after every 3 years whereas machine B is replaced after every six years. The yearly costs of both the machines a given below :

Year	:	1	2	3	4	5	6
Machine A	:	1,000	200	400	1,000	200	600
Machine B	:	1,700	100	200	300	400	500

Determine which machine should be purchased.

12. The demand for an item in a company is 18000 units per year and the company can produce the item at a rate of 3000 per month. The cost of one set-up is Rs. 500 and the holding cost of 1 unit per month is 15 paise. Determine the optimum manufacturing quantity and the total cost per year assuming the cost of 1 unit as Rs. 2.00.

UNIT – III

13. Define instantaneous code. Describe the construction of binary instantaneous code.

14. 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 Shanon-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 ?

15. Let S be the discrete source without memory with a communication entropy H(X) and a noiseless channel with capacity C bits per message. Show that it is possible to encode that output S so that, if the encoded messages are transmitted through the channel, the rate of transmission of information approaches C per symbol as closely as desirable.

(4×16=64)