

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – STATISTICS

FIFTH SEMESTER – APRIL 2023

UST 5501 – APPLIED STOCHASTIC PROCESSES

Date: 15-05-2023

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART A

Answer ALL the questions:

(10 X 2 = 20)

1. Define stochastic process.
2. Define State space.
3. Define mean recurrence time.
4. Define transient.
5. Define aperiodicity.
6. Define persistent.
7. Consider a markov chain with state space $\{0,1, 2\}$ and t.p.m is given below
$$\begin{bmatrix} 1/4 & 3/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 1/2 & 1/2 \end{bmatrix}$$
 find $P\{X_2 = 1, X_1 = 1|X_0 = 2\}$
8. Define renewal process.
9. What is meant by ancestors in branching process?
10. Write the mean and variance of branching process.

PART B

Answer any FIVE questions:

(5 X 8=40)

11. Explain the different types of state space in Stochastic processes with an example.
12. Explain the classifications of states and chains in Markov chain.
13. Classify the states for the following t.p.m. and also verify the chain is irreducible
$$\begin{bmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$$
14. Derive the differential equations for pure birth process.
15. Explain Yule process.
16. Derive the elementary renewal theorem.
17. Explain type I and type II counter model in renewal process.
18. Establish the probability generating function relations of branching processes.

PART C

Answer any TWO questions:

(2 X 20 = 40)

19. State and prove forward and backward Kolmogorov differential equations for birth and death process.
20. Derive Poisson process by clearly stating the postulates.
21. Show that two-dimensional random walk is recurrent.
22. State and prove the probability of ultimate extinction of branching process.

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