



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – STATISTICS

FIFTH SEMESTER – NOVEMBER 2022

UST 5501 – APPLIED STOCHASTIC PROCESSES

Date: 23-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART-A

Answer ALL the questions

(10 x 2 =20 Marks)

1. Define Stochastic Process.
2. What is state space? Give example.
3. Define Stationary distribution.
4. Define Markov process.
5. State the postulates for Poisson process.
6. What is Birth and Death process?
7. Define renewal process.
8. State the basic renewal theorem.
9. Define Probability of extinction.
10. Explain the probability generation functions of Branching processes.

PART-B

Answer any FIVE questions

(5x8=40 Marks)

11. Elaborate on the classification of stochastic processes based on time and state space with example.
12. Describe Poisson process with two examples.
13. Derive $P_n(t)$ for the Poisson process.
14. Discuss age replacement policy in renewal process.
15. Find the mean and variance of Branching process.
16. Derive the differential equation of pure birth process.
17. Show that one-dimensional random walk is recurrent.
18. Let $\{X_n, n \geq 0\}$ be a markov chain having state space $S = \{1,2,3,4\}$ and transition matrix

$$P = \begin{bmatrix} 1/3 & 2/3 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1/2 & 0 & 1/2 & 0 \\ 0 & 0 & 1/2 & 1/2 \end{bmatrix}$$

Find equivalence classes. Also find period of states.

PART-C

Answer any TWO questions

(2x20=40 Marks)

19. Explain in detail different types of stochastic processes.
20. (i) State and prove the elementary Renewal Theorem. (10 marks)
(ii) State and prove the necessary and sufficient condition for state i to be recurrent. (10 marks)
21. Show that the Poisson process can be viewed as a renewal process.
22. (i) State and prove the backward Kolmogorov differential equations for birth and death process. (10 marks)
(ii) Explain Type I counter model in renewal process. (10 marks)

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