



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**M.Sc. DEGREE EXAMINATION – STATISTICS**

**THIRD SEMESTER – NOVEMBER 2014**

**ST 3816 - STOCHASTIC PROCESS**

Date : 01/11/2014  
Time : 09:00-12:00

Dept. No.

Max. : 100 Marks

**Section-A**

**Answer all the questions:**

**(10x2=20 marks)**

1. Briefly explain one dimensional Stochastic Processes with an example.
2. Define a point process
3. What is meant by discrete time space?
4. Briefly explain the n step TPM with an example.
5. Define transient state.
6. Define an absorbing state.
7. State the postulates of Poisson process..
8. What is meant by total life?
9. Give any two examples of stationary distribution.
10. State the generating function relation of a branching process.

**Section-B**

**Answer any FIVE questions:**

**( 5x8=40 marks)**

11. A lion is put into a cage consisting of 9 compartments. The lion moves through the compartment at random. That is there are k ways to leave a compartment. The lion chooses each of the move with probability  $1/k$ .
  - a) Construct the Maze
  - b) The Transition probability matrix
  - c) The equivalence class.
  - d) The periodicity of the state
12. Distinguish between Markov chain and Martingale with suitable illustration.
13. Explain the brand switching model for consumer behavior and derive the TPM.
14.  $W_n = X_n / m^n$ , n is greater than or equal to zero. Show that a  $\{ W_n, n \geq 0 \}$  is a Martingale.
15. Explain Age and block replacement policy.
16. Given  $\Phi(s) = p_0 + p_1 s$  ( $0 < p_0 < 1, p_0 + p_1 = 1$ ), that is the probability generating function corresponding to a branching process in which each generation an individual either dies or replaced by one progeny. Find ' $\pi$ ', which is the smallest positive root of the equation  $\Phi(s) = s$ .
17. Discuss two type branching process with an example.
18. Explain the applications of branching process in i) Electron multiplier and ii) Survival of family name..

**Section-C**

**Answer any TWO questions.**

**(2 x 20=40 marks)**

19. Sociologist often assumes that the social classes of a successive generation in a family can be regarded as a Markov chain. The TPM of such model is as follows.

		Son's Class		
		Lower	Middle	Upper
Father's Class	Lower	0.4	0.5	0.1
	Middle	0.05	0.7	0.25
	Upper	0.05	0.5	0.45

Find

- i. What proportion of people are lower class in the long run
  - ii. What proportion of people are middle class in the long run
  - iii. What proportion of people are upper class in the long run(10 +5+5 marks)
20. a) Define the following i) Martingale ii) Sub and super martingales with an example.(4+4 marks)  
b) State and prove the sums and variances of the independent random variables are martingales.(4+8 marks)
21. a) Briefly explain Poisson process and hence derive  $P_n(t)$ .(10 marks)  
b) Derive the differential equations for a pure birth process.(10 marks)
22. Write short notes on the following
- a) Diffusion process.
  - b) Terminating Renewal process.
  - c) Extinction Probability
  - d) Stationary Distribution (5+5+5+5 marks)

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