LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

FIFTH SEMESTER – **NOVEMBER 2019**

16/17UST5MC01 – APPLIED STOCHASTIC PROCESSES

Date: 29-10-2019   Dept. No.   Max. : 100 Marks
Time: 09:00-12:00

Section A

Answer ALL the questions   (10X2=20)

1. Define process with independent increments.

2. Define transition probability matrix.

3. Define Periodicity.

4. When is a state said to be ergodic?

5. State the basic limit theorem.

6. Define Regular Chain.

7. State the additive property of Poisson process.

8. What are the postulates of Poisson process?

9. Write the mean and variance of Poisson process.

10. Define the PGF of branching process.

Section B

Answer any FIVE of the following   (5X8=40)

11. Check whether the process is stationary or evolutionary. $X(t)=A_1+A_2t$ when A_1,A_2 are independent random variables with $E(A_i)=a_i$, $V(A_i)=\sigma_i^2$, i=1,2

12. Describe the classification of chains.

13. Explain pure birth process.

14. State and Prove Chapman-Kolmogorov equation.

15. Explain the one dimensional random walk.

16. Explain the Martingale and show that the sum of iid random variables is a Martingale.

17. Let $\{X_n, n \geq 0\}$ be a Markov chain with three states 0,1,2 and with Transition matrix $\begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{bmatrix}$

    and initial distribution $p(X_0 = i)=1/3$, i=0,1,2.

    Find $p(X_2, = 2, X_1 = 1, X_0 = 2)$

18. Prove that $P_n(s)=P_{n-1}(P(s))$ for a branching process.

Section C

Answer any TWO of the following   **(2X20=40)**

19. Explain the classification of stochastic process with examples.

20. a) Define irreducible Markov chain. When it is said to be recurrent and aperiodic?

   b) Consider Markov chain with t.p.m

$$\begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 1/4 & 1/8 & 1/8 & 1/2 \end{pmatrix}$$

   Check whether the chain is irreducible, recurrent and aperiodic. (6+14)

21. Derive the forward and backward differential equation for birth and death process.

22. Derive the expression for $P_n(t)$ in a Poisson process.

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