LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – **APRIL 2012**

# ST 5400 - APPLIED STOCHASTIC PROCESSES

 Date : 27-04-2012 Dept. No. Max. : 100 Marks

 Time : 1:00 - 4:00

**Section-A 10x2=20 marks**

**Answer all the questions.**

1. Define the term Stochastic process.
2. Define State space with an example
3. What is meant by Martingales?
4. Define the period of a state of a Markov Chain.
5. When is state “I” communicate with state “j”?
6. What is meant by transient state?
7. What is meant by Stationary Increments?
8. Define irreducible Markov Chain with an example
9. Explain the term transitivity.
10. Define mean recurrence time.

**Section-B 5x8=40 marks**

**Answer any FIVE questions.**

 11) Discuss the applications of Stochastic processes with suitable illustrations.**.**

 12) Explain the Gambler’s ruin problem with the TPM .

 13) Explain the one dimensional random walk problem with the TPM

 14) If ‘’I” communicate with “j” and “I” is recurrent then show that “j” is also recurrent.

 15) Discuss in detail the higher order transition probabilities with suitable illustration.

 16) Find the Stationary distribution of a Markov Chain with States 1,2 and 3 with the following 

 TPM $\left[ \begin{matrix}.2&.4&.4\\.1&.5&.4\\.6&.3&.1\end{matrix}\right]$

17) Show that recurrence is a class property.

18) Explain two dimensional random walk..

**Section-C 2x20=40 marks**

 **Answer any TWO questions.**

19a) If the probability of a dry day (state-0) following a rainy day (state-1)is 1/3, and that of a rainy day following a dry day is ½. Find

1. Probability that May 3 is a dry day given that May first is a dry day.
2. ii) Probability that May 5 is a rainy day given that May first is a dry day.

19b) Discuss in detail Pure Birth process. (12 + 8 Marks)

20a) State and prove Chapman-Kolmogrov equation.

20b) Discuss in detail the applications of basic limit theorem of Markov Chains. (12 + 8 Marks)

21) A white rat is put into the maze consisting of 9 compartments. The rat moves through the compartment at random. That is there are k ways to leave a compartment. The rat chooses each of the move with probability1/k.

 a) Construct the Maze

 b)The Transition probability matrix

 c) The equivalence class

 d) The periodicity (5+5+5+5 Marks)

22) Diabetes disease in any Society (with different classes of people ) often considered as a family disease which occurs as successive generations in a family can be regarded as a Markov Chain. Thus the disease of the children is assumed to be depended only on the disease of the parents. The TPM of such model is as follows:

 Children’s Class

 Mild Moderate Severe

 Mild 0.40. 0.50 0.10

 Parent’s Class Moderate 0.05 0.70 0.25

 Severe 0.05 0.50 0.4

Find a) What proportion of people are Moderate class in the long run suffering from diabetes?

 b) Show that the MC is recurrent (12 + 8 Marks)

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