LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



M.Sc. DEGREE EXAMINATION - STATISTICS

THIRD SEMESTER – APRIL 2012

# ST 3812/3809 - STOCHASTIC PROCESSES

Date : 24-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**Section – A**

**Answer all the questions: 10 x 2 = 20 marks**

1. Define convergence in quadratic mean.
2. Define periodicity and aperiodicity of a Markov chain.
3. Give an example for a reducible Markov chain.
4. Write the infinitesimal generator of a birth and death process.
5. Write any two applications of Poisson process.
6. Provide any two examples for renewal process.
7. Define a super martingale.
8. Define discrete time branching process.
9. Write a note on stationary process.
10. Write different types of stochastic processes.

**Section – B**

**Answer any five questions: 5 x 8 = 40 marks**

1. Explain (i) martingale (ii) point process
2. Explain one-dimensional random walk.
3. (a) Show that a state i is recurrent if and only if iin = .



1. If i j and if i is recurrent show that j is recurrent. (4+4)



1. Derive Pn(t) for the Yule process with X(0) = 1.
2. Derive the mean for a birth and death process if λn = nλ + a and μn = nμ with λ > 0 , μ >0 and a>0.
3. Explain (i) renewal function (ii) excess life (iii) current life (iv) mean total life
4. Explain Markov branching process with three examples.
5. Write a note about (i) stationary process on the circle (ii) stationary Markov chains.

**Section – C**

**Answer any two questions: 2 x 20 = 40 marks**

1. (a) Show that state 0 is recurrent for a two dimensional random walk.

(b) Derive the basic limit theorem of Markov chains. (5+15)

20. For the gambler’s ruin on (n+1) states with P(Xn+1 = i+1 | Xn = i ) = p ,

P(Xn+1 = i-1 | Xn = i ) = q and 0 and n are absorbing states , calculate ui  = i (C0 ) and v i ( Cn) .



21. (a) Derive the differential equations for pure birth process.

(b) Derive Pn(t) for Yule process with X(0) = N. (10 + 10)

22. (a) State and prove the basic renewal theorem.

(b) Derive mean and variance of branching process. (10 + 10)

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