SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641 035

DEPARTMENT OF MATHEMATICS

23MAT203-PROBABILITY AND RANDOM PROCESSES

Unit III

1. The probability distribution of the process $\{X(t)\}$ is given by $P(X(t)=n)=\begin{cases}\frac{(at)^{n-1}}{(1+at)^{n-1}}, n=1,2,\ldots\\ \frac{at}{1+at} \quad , n=0\end{cases}$
   Show that {X(t)}is not stationary.
2. Verify whether the random process $X(t)=Acos(w_0 t+\theta)$ where A and $w_0$are constants , $\theta$is uniformly distributed random variable $(0,2\pi)$ is wide sense stationary.

3. Show that the random process $X(t)=Acos\lambda t+Bsin\lambda t$, where λ is a constant, A and B are uncorrelated random variables with 0 mean and equal variance, is a WSS.

4. Consider a random process {X(t)} defined by $X(t)=Acost+Bsint$ when A and B are independent random variables each of which assumes the values -2 and 1 with probabilities $\frac{1}{3}$ and $\frac{2}{3}$ respectively. Show that {X(t)}is wide sense stationary and not strict sense stationary.

5. Define random telegraph process. Prove that it is stationary in the wide sense.

6. Three boys A, B, C are throwing a ball to each other. A always throw a ball to B, B always throw a ball to C, but C

is just as likely to throw the ball to B as to A. Find TPM and classify the states.

7. A housewife buys three kinds of cereals A,B,C. She never buys the same cereal in successive weeks. If she buys cereal A, the next week she buys cereal B. However if she buys either B or C, the next week she is three times as likely to buy A as the other cereal. How often she buys each of the 3 cereals?

8. Define TPM.
Let $P = \begin{bmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$. Classify the states of the markov chain.

9. The one step T.P.M of a Markov chain (X_n;n=0,1,2,…) having state space $S = (1,2,3)$ is $\begin{bmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}$ and the initial distribution $\pi_0 = (0.7,0.2,0.1)$. Find
1. $P(X_2 = 3/X_0 = 1)$
2. $P(X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$
3. $P(X_2 = 3)$

10. The t.p.m of a Markov chain with three states 0,1,2 is $P = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{bmatrix}$ and the initial state distribution of the chain is $P(X_0 = i) = \frac{1}{3}\ , i = 0,1,2.$ Find $(i) P[X_2] = 2$ $(ii) P[X_3 = 1\ , X_2 = 2, X_1 = 1, X_0 = 2]$ (iii) $P[X_2 = 1, X_0 = 0]$