K24N 0222

Reg. No. : ....

Name : ....

Third Semester M.Sc. Degree (C.B.S.S. – Regular) Examination, October 2023
(2022 Admission)
STATISTICS WITH DATA ANALYTICS
MST3C10 : Stochastic Processes and Time Series Analysis

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. Define processes with stationary increments.
2. What do you mean by periodicity of a Markov chain ?
3. Give an example for Poisson process.
4. Define renewal process with an example.
5. Briefly explain the relationship between time series and stochastic processes.
6. What do you mean by exponential smoothing ?
7. Discuss the important steps in exploratory time series.
8. Define auto-covariance and autocorrelation functions. **(8×2=16)**

PART – B

Answer **any four** questions. **Each** question carries **4** marks.

9. State and prove Chapman-Kolmogorov equation.
10. Let $\{X_n, n > 0\}$ be a Markov chain with three states 0, 1, 2 and with transition probability matrix

$$\begin{pmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{pmatrix}$$

and the initial distribution $P[X_0 = i] = \frac{1}{3}, i = 0, 1, 2$. Find

i) $P[X_1 = 1 | X_0 = 2]$

ii) $P[X_2 = 2, X_1 = 1 | X_0 = 2]$

P.T.O.

11. Define a Poisson process. State its postulates.
12. Explain the exponential smoothing for seasonal data.
13. Describe Box and Jenkins approach of analysis of time series data.
14. Explain the identification procedure for ARMA (p, q) models. **(4×4=16)**

PART – C

Answer **any four** questions. **Each** question carries **12** marks.

15. i) Distinguish between transient and recurrent states of a Markov chain.
    ii) State and prove the necessary and sufficient condition for a state to be recurrent.
16. i) Stating the postulates, explain pure birth processes.
    ii) Discuss Yule processes as an example of pure birth processes.
17. i) Define birth and death processes. What are its properties ?
    ii) Suppose that customers arrive at a service counter in accordance with a Poisson process with mean rate of 2 per minute (λ = 2/minute). Then the interval between any two successive arrivals follows exponential distribution with mean 0.5 minute. Find the probability that the interval between two successive arrivals is
    a) more than 1 minute
    b) 4 minutes or less
    c) between 1 and 2 minutes.
18. Write notes on :
    i) Prediction error
    ii) Linear trend process
    iii) Multiplicative seasonal model.
19. Explain AR (2) process. Obtain its mean, variance and autocorrelation function.
20. i) Explain MA (q) model and its properties.
    ii) Obtain the random shock form of ARIMA (1, 1, 1) model. **(4×12=48)**