WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 5th Semester Examination, 2020, held in 2021

STSACOR11T-STATISTICS (CC11)

STOCHASTIC PROCESS AND TIME SERIES

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

Answer any *four* questions from question numbers 1-6 and any *two* questions from question numbers 7-10

GROUP-A

Answer any *four* questions from the following 5×4 = 20

1. Explain Slutsky-Yule effect. 5

2. Describe the exponential smoothing technique for forecasting. 5

3. Estimate the parameters of an AR(2) process using the Yule-Walker equations. 5

4. For the Markov Scheme $u_t = \rho u_{t-1} + e_t$, show that under appropriate assumptions, $\rho_k = \rho^k$ where the notations have their usual significance. 5

5. Discuss the ratio to trend method to measure the seasonal fluctuations. 5

6. Describe the moving average method of trend fitting. What would be the effect on the moving average series if the original series undergo a base and scale change? 5

GROUP-B

Answer any *two* questions from the following 10×2 = 20

7. (a) Define stochastic process with an example. 2

   (b) When a stochastic process is said to be stationary? 2

   (c) When a stochastic process is called a Markov chain? 2

(d) Suppose that the probability of a dry day (state 0) following a rainy day (state 1) is 1/3 and that the probability of a rainy day following a dry day is $1/2$. Find the probability that May 3 is a dry day given that May 1 is a dry day and also find the probability that May 5 is a dry day given that May 1 is a dry day. 4

8. (a) What do you mean by the 'trend component' of a time series data? 2

(b) How one can determine trend by fitting a polynomial of appropriate degree? 4

(c) Discuss the variate difference method for determining the order of the polynomial to be fitted. 4

9. (a) Let $\{Z_t\}$ be a discrete, purely random process such that $E(Z_t)=0,\ V(Z_t)=\sigma_z^2$. Find the values of the constants λ_1 and λ_2 such that the second order autoregressive process defined by $X_t=\lambda_1 X_{t-1}+\lambda_2 X_{t-2}+Z_t$ is stationary. 5

(b) For the problem in (a) if $\lambda_1=1/3$ and $\lambda_2=2/3$, show that the autocorrelation function of X_t is given by 5

$$P(k)=\frac{16}{21}\left(\frac{2}{3}\right)^{|k|}+\frac{5}{21}\left(-\frac{1}{3}\right)^{|k|},\quad k=0,\ \pm 1,\ \pm 2,\ \ldots\ldots$$

10.(a) Write down a moving average process of order 2(MA(2)). Is this process stationary? 1+3

(b) Define autocorrelation function. Derive the autocorrelation function of a MA(2) process. 1+2

(c) What is a correlogram? Discuss how the correlogram of a MA(2) process would look like. 1+2

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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