

19P363

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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2020

(CBCSS-PG)

CC19P ST3 E02 - TIME SERIES ANALYSIS

(Statistics)

(2019 Admission Regular)

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer any *four* questions. Each question carries 2 weightage.

1. What is a time series? Describe the seasonal and cyclic components of a time series.
2. Define spectral density $f(\lambda)$ of a time series. Find the spectral density of a first order moving average (MA(1)) model.
3. Define auto-covariance function and auto-correlation function of a time series. Prove that the auto-correlation lies between -1 and +1.
4. Write down the general form of an ARMA(p,q) and ARIMA(p ,d ,q) model. Identify the constants (p,d,q) of the model $Y_t = 2 Y_{t-1} - Y_{t-2} + \epsilon_t$.
5. Describe the role of autocorrelation and partial autocorrelation in determining a time series model.
6. Derive the Yule-walker equations for an autoregressive process of order 1 (AR(1)) model.
7. Explain a non-linear time series model with an illustrative example.

(4 x 2 = 8 Weightage)

Part B

Answer any *four* questions. Each question carries 3 weightage.

8. Describe the moving average method and exponential smoothing method in time series.
9. Establish the duality between AR (1) and MA model.
10. Derive the autocorrelation of $\{Y_t\}$, where $Y_t = \epsilon_t - 0.2 \epsilon_{t-1} + 0.3 \epsilon_{t-2}$ assuming $\{\epsilon_t\}$ as a white noise process.
11. Obtain the Yule Walker equations in an AR(p) model.
12. Explain the forecasting method in an autoregressive moving average (1, 1) (ARMA (1,1)) process.
13. Describe the maximum likelihood estimation of ARMA (1, 1) model.
14. Explain the structure of correlogram of a (i) Stationary series (ii) Non stationary series and (iii) a series with seasonal fluctuations.

(4 x 3 = 12 Weightage)

Part C

Answer any *two* questions. Each question carries 5 weightage.

15. Explain the Holt method and Holt winter method (additive and multiplicative cases) of smoothing techniques in time series.
16. (a) Let $\{e_t\}$ be a zero mean white noise process. If $Y_t = e_t + \theta e_{t-1}$, find the autocorrelation function for $\{Y_t\}$ both when $\theta = 4$ and when $\theta = \frac{1}{4}$.

(b) Comment on the uses of Portmanteau test and Ljung Box test in time series, clearly explaining the statistics in both cases.
17. (a) Discuss the stationarity and invertibility of ARMA(1,1) process.

(b) Describe the ordinary least square estimation method in ARMA(p,q) model.
18. (a) State and prove Herglotz theorem.

(b) Define a GARCH (1, 1) model and state its important properties.

(2 x 5 = 10 Weightage)
