THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(CBCSS-PG)

(Regular/Supplementary/Improvement)

CC19P ST3 E02 - TIME SERIES ANALYSIS

(Statistics)

(2019 Admission onwards)

Time: Three Hours   Maximum: 30 Weightage

PART A

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

1. Define autocorrelation function (acf). Find the acf of a random walk model,

   $X_t = X_{t-1} + \epsilon_t$ where $\{\epsilon_t\}$ are independent and identically distributed (i.i.d)

   $(0, \sigma^2)$ random variables.

2. Define spectral density and state its important properties.

3. Define an autoregressive process of order p (AR(p). Show that an AR(1) process is Markovian.

4. Explain the need of autoregressive integrated moving average models (ARIMA).

5. Describe any one test used in the residual analysis in time series.

6. Explain periodogram and state its association with spectral density.

7. What do you mean by non-linear time series models? Give one example.

(4 × 2 = 8 Weightage)

PART B

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

8. Describe (i) Single exponential smoothing method and (ii) Moving average method.

9. Distinguish between weak and strong stationarity. Check the stationarity of $\{Z_t\}$

   defined as $Z_t = Z_{t-1} + \epsilon_t + \theta \epsilon_{t-1} \ for \ t = 1, 2, \ldots$ where $\{\epsilon_t\}$ are i.i.d $(0, \sigma^2)$.

10. When do you say that a time series process is invertible? Obtain the conditions for invertibility of autoregressive moving average process (ARMA) of order (1,1).

11. What do you mean by forecasting in time series? Explain the l-step ahead forecasting procedure in an AR(p) process.

12. Explain the least square estimation method in AR(1) and MA(1) models.

13. Find the spectral density of an AR(1) process and a White Noise process.

14. Define ARCH(p) and GARCH (p,q) models. Explain their uses in time series analysis.

(4 × 3 = 12 Weightage)

PART C

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

15. Describe (a) Holt method and (b) Holt Winter method of smoothing.

16. Define ARMA(p,q) process and obtain the acf of ARMA(1,1) process.

17. (i) Describe the steps in Box-Jenkins method of time series analysis.

 (ii) Obtain the maximum likelihood estimates of the parameters of AR(1) model.

18. (i) State and prove Herglotz theorem.

 (ii) Show that the marginal distribution of GARCH (p, q) has kurtosis larger than that of Normal distribution.

(2 × 5 = 10 Weightage)

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