

where C is a constant, is non-stationary. Also show that the series of first differences $\{Y_t\}$ defined by $Y_t = X_t - X_{t-1}$ is a first-order MA process. Find the autocorrelation function of $\{Y_t\}$. (9,6)

6. (a) Show that the autocorrelation function of the m th order MA process given by

$$X_t = \frac{1}{m+1} \sum_{k=0}^m \epsilon_{t-k}$$

is

$$\rho(k) = \begin{cases} 1 - \frac{k}{m+1}, & k = 0, 1, \dots, m \\ 0 & k > m \end{cases}$$

- (b) Explain the Exponential Smoothing procedure for the purpose of forecasting in a time series. (9,6)

7. Write notes on any **two** of the following :

- (a) Box-Jenkins forecasting procedure
 (b) Merits and limitations of trend fitting by the principle of least-squares.
 (c) Fitting of Logistic curve by the method of three selected points. (7½, 7½)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7967

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Unique Paper Code : 32377905

Name of the Paper : Time Series Analysis

Name of the Course : **B.Sc. (Hons.) Statistics : DSE-1**

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions.
 1. (a) Stating clearly the reasons, identify with which component of a time series would you mainly associate each of the following:
 - (i) General decline in the infant mortality rate in India since independence.
 - (ii) Strike in a production facility, delaying production for 7 days.

P.T.O.

(iii) Heavy sales on the occasion of Christmas.

(iv) Sales of grocery stores during the peak hours.

(b) Explain giving one example each of the following in the context of time series :

(i) Secular trend

(ii) Seasonal component and

(iii) Random component (8,7)

2. (a) In the usual notations, prove that

$$\frac{1}{m_1 m_2 \dots m_r} [m_1][m_2] \dots [m_r] y_0 = y_0 + \frac{m_1^2 + m_2^2 + \dots + m_r^2 - r}{24} \delta^2 y_0$$

where $\frac{1}{m}[m]$ stands for the simple arithmetic mean of 'm' terms.

(b) Explain the method of 'partial sums' for fitting the modified exponential curve to a given time-series data. (9,6)

3. (a) What is meant by seasonal fluctuations of a time series? Describe the method of 'Ratio-to-Moving Averages' for measuring the seasonal variations, stating clearly the assumptions made.

(b) Given that a time series is composed of the trend, the oscillatory and the random components. Discuss the effect of elimination of trend on other components of the time series. (7,8)

4. (a) Explain variate-difference method for trend analysis. How is the appropriate order of differencing determined?

(b) Explain the terms (i) weak stationary, (ii) autocorrelation function and (iii) correlogram, with reference to a time series. (9,6)

5. (a) Show that the AR(2) process $X_t = X_{t-1} + cX_{t-2} + \epsilon_t$ is stationary provided $-1 < c < 0$. Find the autocorrelation function when $c = -3/16$.

(b) Show that the infinite-order MA process $\{X_t\}$ defined by

$$X_t = \epsilon_t + C(\epsilon_{t-1} + \epsilon_{t-2} + \dots)$$