ZA-105

April-2014

M.Sc., Sem.-IV

STA-507 : Statistics (Time Series Analysis & Applications)

Time : 3 Hours]   **[Max. Marks : 70**

Instruction :   **All** questions carry equal marks.

1. (a) Suppose that five successive terms of the time series are given. Find trend using weighted moving average for $u_t = a_0 + a_1 t + a_2 t^2$. Make your comments if cubic is fitted instead of quadratic; state your general conclusion on it.

   OR

   Define stationary time series. How do you test the stationary of the given time series ?

   (b) Distinguish between :
   (i) Ordinary and stationary time series
   (ii) RWM with drift and without drift
   (iii) Trend stationary and difference stationary stochastic process. Why random walk is said to have an infinite memory ?

   OR

   Explain the concept of "Unit Root Stochastic Process". Write different particular cases of the time series $y_t = \beta_1 + \beta_2 t + \beta_3 y_{t-1} + u_t$ where u_t is a white noise error term and t is time.

2. (a) Define periodic time series. What is periodogram ? Establish a relation between periodogram and the correlogram.

   OR

   In usual notations define auto covariance and auto correlation matrix. For n = 3, show that

   $$\rho_i \leq 1,\ i = 1, 2 \text{ and } -1 \leq \frac{\rho_2 - \rho_1^2}{1 - \rho_1^2} \leq 1.$$

   (b) Let $X_t = y \cos \theta t + z \sin \theta t$, where y and z are two uncorrelated random variables each with mean zero and variance unity and $\theta \in (-\pi, \pi)$. In usual notations obtain γ_k and ρ_k.

   OR

Explain the concept of ARIMA (p, d, q). Write the estimation procedure of the ARIMA model.

3. (a) Explain the concepts of Multiplier and Accelerator in Economic models. Discuss Harrod-Domar growth model (periodic & derivative form) which make use of these concepts.

OR

Discuss Mahalanobis Two Sector Model.

(b) Explain 'Input-Output Analysis'. Discuss Leontief's inter industry closed system model and state its important properties.

OR

Discuss Samuelson-Hicks model of multiplier accelerator.

4. (a) For the 2nd order autoregressive series $u_{t+2} + a\, u_{t+1} + b\, u_t = \varepsilon_{t+2}$, $|b| < 1$ obtain correlogram r_k.

OR

For the series determined by $u_{t+2} = a\, u_t + \varepsilon_{t+1}$, $|a| < 1$

where ε has zero mean, find the correlogram if (i) successive values of ε are independent and (ii) if ε itself obeys a relation of the form.

$\varepsilon_{t+1} = b\, \varepsilon_t + \eta_{t+1}$, $|b| < 1$, where successive values of η are independent.

(b) Let $X_t = y_t + Ay_{t-1}$, where $y_{t's}$ are independently and identically distributed with mean '0' and variance σ^2. Show that X_t is weakly stationary time series.

OR

In usual notations for the harmonic series $u_t = A \sin \theta t + \varepsilon_t$ show that

$r_k = (A^2/2) \cos \theta k \, (\sigma^2 + (A^2/2))^{-1}$, $k > 0$.

5. (a) Choose the appropriate answer :
   (i) The variate difference method fails when
       (A) Cyclical component is present in the given time series.
       (B) Seasonal component is present in the given time series.
       (C) Random component is present in the given time series.
       (D) None of the above

(ii) In testing the stationarity of the given time series using DF-test if the null hypothesis $H : \delta = 0$ is accepted then the time series is

(A) Non-stationary

(B) Stationary

(C) Oscillatory

(D) Harmonic

(iii) Which of the following statement is true ?

(A) If a time series is stationary, then it is said to be integrated of order zero.

(B) If a time series is non-stationary, then it is said to be integrated of order zero.

(C) If a time series is stationary, then it is said to be integrated of order 'd'.

(D) If a time series is stationary, then it is said to unit root stochastic process.

(iv) Which of the following statement is false ?

(A) In testing the stationarity of the given time series using DF-test if the null hypothesis $H : \delta = 0$ is rejected then the time series is stationary.

(B) In testing the stationarity of the given time series using DF-test if the null hypothesis $H : \delta = 0$ is accepted then the time series is non-stationary.

(C) In testing the stationarity of the given time series using DF-test if $\rho = 1$ then the time series is non stationary.

(D) In testing the stationarity of the given time series using DF-test if $\rho < 1$ then the time series is not stationary.

(v) Which of the following statement is true ?

(A) In the method of '2m' yearly moving average, two terms at the beginning and two terms at the end of the series would not be determined.

(B) In the method of '2m' yearly moving average; 'm' terms at the beginning and 'm' terms at the end of the series would not be determined.

(C) In the method of '2m + 1' yearly moving average; 'm' terms at the beginning and 'm +1' terms at the end of the series would not be determined.

(D) In the method of '2m + 1' yearly moving average; 'm + 1' terms at the beginning and 'm + 1' terms at the end of the series would not be determined.

3

(vi) Which of the following statement is false ?
- (A) The method of moving average has no effect on the Oscillatory component.
- (B) The series obtained after elimination of trend will not be free of oscillations.
- (C) In the method of moving average most of the primary oscillation in the original time series will be eliminated as trend.
- (D) Using correlogram analysis we can know that cause of oscillation in the given time series.

(vii) Which of the following statement is true ?
- (A) If by trial sometimes we get $\mu = \lambda$, the intensity function takes high values, otherwise the value is very small.
- (B) If by trial sometimes we get $\mu < \lambda$, the intensity function takes high values, otherwise the value is very small.
- (C) If by trial sometimes we get $\mu > \lambda$, the intensity function takes high values, otherwise the value is very small.
- (D) If by trial sometimes we get $\mu \neq \lambda$, the intensity function takes high values, otherwise the value is very small.

(b) Answer the following questions :
- (i) Define periodic time series.
- (ii) Define integrated stochastic process of order d.
- (iii) Define Intensity function.
- (iv) Define ARIMA (1,1,1).
- (v) What is Buys-Ballot Table ?
- (vi) What is Detrending ?
- (vii) Define Correllogram

_____