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0204N17

Candidate's Seat No :_____

M.Sc Semester-4 Examination

507

Statistics

April-2024

Time : 2-30 Hours] **[Max. Marks : 70**

Instructions:

1. All the questions are compulsory.
2. Figures on the right indicate the marks.

Q - 1 (a) Define time series. Suppose that five successive terms of the time series are given. Find trend using weighted moving average for $u_t = a_0 + a_1 t + a_2 t^2$. **[07]**

Q - 1 (b) Make your comments in above (a) if cubic is fitted instead of quadratic. State your general conclusion on it. **[07]**

OR

Q - 1 (a) Discuss Variate Difference method and show how the variance of random component is estimated using this method. **[07]**

Q - 1 (b) Write a brief note on Periodogram analysis. **[07]**

Q - 2 (a) 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 a white noise error term and t is time. **[07]**

Q - 2 (b) Discuss Variate Difference method to show how the trend component of a time series can be estimated. **[07]**

OR

Q - 2 (a) Define trend stationary and Difference stationary stochastic process. Why random walk is said to have an infinite memory? **[07]**

Q - 2 (b) explain the concept of RWM with drift and without drift. **[07]**

Q - 3 (a) How do you test the stationarity of the given time series using DF test. **[07]**

Q - 3 (b) Explain the following terms in usual notation with appropriate examples: **[07]**

(a) AR (p) (b) MA (q)

(c) ARMA(p, q) (d) ARIMA (p, d, q)

OR

Q - 3 (a) Define stationary time series. Distinguish between the ordinary and stationary time series. **[07]**

Q - 3 (b) Explain Box Jenkins methodology. Write its limitations and importance. **[07]**

Q - 4 (a) In usual notations define auto covariance and auto correlation matrix. For n=3 Show that $\rho_i \leq 1, for\ i = 1.2..$ and $-1 \leq \frac{\rho_2 - {\rho_1}^2}{1-{\rho_1}^2} \leq 1$ **[07]**

Q - 4 (b) Let $X_t = ycos\theta_t + zsin\theta_t$, where y and z are two uncorrelated random variables each with mean zero , variance unity and $\theta \in (-\pi, \pi)$. Obtain γ_k and ρ_k in usual notations. **[07]**

OR

Q - 4 (a) Explain the effect of elimination of trend on Oscillatory component and Random component of the given time series. **[07]**

Q - 4 (b) Explain the various component of time series. **[07]**

Q - 5 Attempt any seven **[14]**

(i) Which of the following is an example of time series problem?

P.T.O

(1) Estimating number of hotel rooms booking in next 6 months.
(2) Estimating the total sales in next 3 years of an insurance company.
(3) Estimating the number of calls for the next one week.
(A) 1 and 2 (B) 2 and 3 (C) 1 and 3 (D) 1, 2 and 3

(ii) 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

(iii) 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

(iv) Which of the following time series is stationary ?
(A) $y_t = y_{t-1} + u_t$ (B) $y_t = \beta_1 + y_{t-1} + u_t$
(C) $y_t = \beta_1 + \beta_2 t + u_t$ (D) $\Delta y_t = \beta_1 + u_t$

(v) Suppose that monthly death rates in India are given for the last one year (April, 2019 to April, 2020). We can observe an exponential increase in death rate in last few months due to Covid-19 epidemic in the world. We can interpret increase in death rate in India as
(A) Trend component (B) Seasonal component
(C) Cyclical component (D) Irregular component

(vi) Which of the following statement is false?
(A) In AR (p) case the ACF declines geometrically
(B) In AR (p) case the PACF cuts off after a certain number of lags.
(C) In MA(q) case the ACF declines exponentially
(D) In $MA_{(q)}$ cases the PACF spikes through certain lags.

(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.

(viii) Box Jenkins is an iterative procedure which contains the following four steps.

(i) Forecasting (ii) Diagnostic checking
(iii) Identification of the model (iv) Parameter estimation of the chosen model

Chose the right order of the above four steps.
(A) [(i), (ii), (iii), (iv)] (B) [(ii), (iii), (i), (iv)]
(C) [(ii), (iii), (iv), (i)] (D) [(iii), (iv) , (ii), (i)]

(ix) Which of the following statement is true?
(A) In the method of '2m' yearly moving average, two terms at beginning and two terms at the end of the series would not be determined.
(B) In the method of '2m' yearly moving average, two terms at beginning and two terms at the end of the series would not be determined.
(C) In the method of '2m+1' yearly moving average, 'm' terms at 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 beginning and 'm+1' terms at the end of the series would not be determined.

(x) 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 the cause of Oscillation in the given time series.

(xi) 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.

(xii) Write any two uses of time series.

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