

M.Sc. (Sem.-IV) Examination

508

Statistics

April-2017

Time : 3 Hours]

[Max. Marks : 70

- Instructions: 1. All questions carry equal marks.
2. Scientific calculator can be used.

Total Marks: 70

1. (a) For GLM $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + U_t$, $t = 1, 2, \dots, n$ Obtain OLSE for the parameters involved in the model. Discuss the test procedure for testing (i) $\beta_1 + \beta_2 = c$, c is a known real constant. (ii) $\underline{\beta} = 0$.

OR

- (a) What will happen if the basic assumptions of GLM are violated in turn? – Discuss fully.
(b) Define heteroscedasticity. Describe Glejser test for detecting heteroscedasticity. What are the difficulties in using Glejser test? How do you overcome these difficulties.

OR

- (b) Discuss the consequences of heteroscedasticity under bivariate model.

2. (a) What is multicollinearity? How do you detect its presence in GLM?

OR

- (a) Discuss the implications of multicollinearity (i) for prediction of the dependent variable and (ii) for the estimation of regression coefficient.

- (b) Discuss Silve's eigen value approach to solve the problem of multicollinearity.

OR

- (b) Discuss Ridge regression. Show that ridge regression estimator can not only resolve the deadlock of multicollinearity but it can also give an efficient estimator even though it is a biased estimator.

3. (a) What is dummy variable? Discuss with illustrations.

OR

- (a) Discuss how dummy variable technique is used in depersonalize the time series data?

- (b) What is auto correlation? Explain the method to estimate the parameters of a linear model in the presence of auto correlation.

OR

- (b) What are the consequences of auto correlation? Discuss how the Durbin-Watson test is used to detect the presence of auto correlation.

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4. (a) What is simultaneous equations system? Show that OLS estimation to simultaneous equations system leads to biased and inconsistent estimator.

OR

- (a) Define the term: exogenous variable, endogenous variable. What is identification problem in linear model? Discuss with illustration rank and order condition for identification of the given equation in the simultaneous equations system.
- (b) Discuss indirect least square method of estimation for simultaneous equations system. Show that this method is equivalent to the method of 2-SLS.

OR

- (b) Describe 2-SLS method to estimate the parameters in the simultaneous equations system. State the properties of the estimator obtained by this method.
5. (a) Answer the following questions.

- (i) In GLM if rank of $X = r < k$ then ----- will arise.
- (ii) State your conclusion if adjusted R^2 comes out negative.
- (iii) In GLM $\underline{Y} = X\underline{\beta} + \underline{U}$ the matrix $M = I_n - X(X'X)^{-1}X'$ is
 (a) Symmetric (b) idempotent (c) (a) and (b) both (d) neither (a) nor (b)
- (iv) In GLM $\underline{Y} = X\underline{\beta} + \underline{U}$ the distribution of $\frac{\underline{e}'\underline{e}}{\sigma^2}$ is-----.
- (v) State the relationship between MLE of σ^2 and OLSE of σ^2 .
- (vi) State the test statistic to test $H: \beta_j = \beta_{j0}$, when σ^2 is unknown.
- (vii) In GLM state the distribution of $\frac{(\hat{\beta} - \beta)'(X'X)(\hat{\beta} - \beta)}{\sigma^2}$.
- (viii) $R^2 =$ -----
 (a) Explained variance/total variance (b) residual variance/explained variance
 (c) Residual variance/total variance (d) none of the above

- (b) Answer in two-three lines (Any three):

- (i) State the distribution of dependent variable Y in general linear when disturbance terms has normal distribution with mean 0 and variance σ^2 . State its mean and variance
- (ii) Explain the use of VIF?
- (iii) What is reduced form equation?
- (iv) State Theil - Nagar formula for estimating auto correlation. If the number of observations are very large what will be the effect on the formula.

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Q-1(a) Explain 'Input-Output Analysis'. Discuss Leontief's Inter Industry Closed System Model and state its important properties.

OR

(a) Discuss limitations of Input-Output Analysis.

(b) Discuss Leontief's Open-sector model for Input-Output Analysis.

OR

(b) Discuss Mahalanobis two Sector Model.

Q-2(a) In usual notations define Marginal propensity to consume (MPC) and Marginal propensity to save (MPS). Derive relation between MPC and MPS.

OR

(a) Discuss Samuelson-Hicks model of multiplier accelerator.

(b) Define time series using appropriate illustrations. What are the objectives of time series? Describe the importance of time series analysis.

OR

(b) A series is to be fitted for the curve which best approximate to sets of seven points. What are the weights of the moving average if a cubic provides a satisfactory approximation? Make your comments if quadratic is fitted instead of cubic; state your general conclusion on it.

Q-3 (a) Discuss Variate Difference method and show how (i) the trend component of a time series can be estimated and (ii) the variance of the random component is estimated using this method. State clearly the assumptions underlying this method and explain with illustration when the method fails.

OR

(a) Define stationary time series. Distinguish between the Ordinary and stationary time series. How do you test the stationary of the given time series.

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

OR

(b) 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.

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Q-4 (a) Distinguish between:

- (i) Correlation and Autocorrelation
- (ii) RWM with drift and without drift
- (iii) Trend stationary and Difference stationary stochastic process.

OR

(a) 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.

(b) Obtain the correlogram of the harmonic series.

OR

(b) Write a brief note on periodogram analysis.

Q-5 (a) Choose the appropriate answer.

1. The Variate Differenc method fails when
 - (A) Seasonal component is present in the given time series.
 - (B) Cyclical component is present in the given time series.
 - (C) Random component is present in the given time series.
 - (D) None of the above.
2. A stochastic process is said to be Stationary if
 - (A) its mean is constant over time
 - (B) its variance is constant over time
 - (C) its covariance depends only on the lag value
 - (D) all of above
3. 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) Stationary.
 - (B) Non-Stationary
 - (C) Oscillatory
 - (D) Harmonic
4. Which of the following time series is stationary?

(A) $\Delta y_t = \beta_1 + u_t$

(B) $y_t = \beta_1 + y_{t-1} + u_t$

(C) $y_t = \beta_1 + \beta_2 t + u_t$

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$$(D) y_t = y_{t-1} + u_t$$

5. 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 stationary , then it is said to be integrated of order 'd'.
- (C) If a time series is stationary , then it is said to unit root stochastic process.
- (D) If a time series is non- stationary , then it is said to be integrated of order zero.

6. Which of the following statement is false?

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

7. 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.

8. 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.

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9. 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 $\mu \neq \lambda$, the intensity function takes high values, otherwise the value is very small.
- (D) If by trial sometimes we get $\mu = \lambda$, the intensity function takes high values, otherwise the value is very small.

10. Which of the following statement is false?

- (A) The objective of periodogram analysis is to estimate the periodicities λ_i ($i=1,2,\dots,k$).
- (B) The objective of periodogram analysis is to estimate the periodicities λ_i and to find out the constants a_i 's and b_i 's ($i=1,2,\dots,k$)
- (C) The objective of periodogram analysis is to find out trial period μ_i for which $\lambda_i = \mu_i$ ($i=1,2,\dots,k$).
- (D) The objective of periodogram analysis is to check whether the given time series consisting cyclical component.

(b) Answer the following questions.

1. When intensity function takes high value?
2. What is Difference stationary process?
3. What is detrending?
4. What is Buys-Ballot Table?

