

## M.Sc. Sem.-4 Examination

508

Statistics

April-2025

Time : 2-30 Hours]

[Max. Marks : 70

Note: Attempt all questions.

Q.1

(i) Write the equation of the multiple regression linear model for the case of 2 and k independent variables. State the assumptions of the multiple regression linear model. [7]

(ii) For the two independent variable multiple linear regression model, derive the normal equations in deviation form. [7]

OR

(i) State the null and alternative hypotheses in testing the overall significance of the regression. How is the overall significance of the regression tested? Give the formula for the explained and unexplained variance. [7]

(ii) Explain Mallow  $C_p$  statistic. [7]

Q.2

(i) What is meant by perfect multicollinearity? What is its effect? How can multicollinearity be detected? [7]

(ii) Explain, how is the presence of heteroscedasticity tested? [7]

OR

(i) What is meant by heteroscedasticity? Draw a figure showing homoscedastic disturbances and the various forms of heteroscedastic disturbances. [7]

(ii) Explain, how can heteroscedasticity be corrected? [7]

Q.3

(i) Explain, how is the presence of positive or negative first-order autocorrelation tested? [7]

(ii) Describe applications of dummy variables. [7]

OR

(i) Why is autocorrelation a problem? Explain, how can autocorrelation be corrected? [7]

(ii) Define Dummy variables and describe cautions in the use of dummy variables. [7]

Q.4

(i) When can two-stage least squares be used? What does it involve? What are the advantages of two-stage least squares with respect to indirect least squares? [7]

(ii) Explain: (a) Simultaneous equations system (ii) Reduced-form equations. [7]

OR

(i) What do you understand by Identification? When is an equation of a system exactly identified, overidentified and underidentified? [7]

(ii) When can indirect least squares be used? What does it involve? What are some of the shortcomings of using indirect least squares? [7]

(P.T.O)

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Q.5 Answer any seven:

[14]

- (i) What is meant by autocorrelation?
- (ii) In usual notations, which of the following is correct for hat matrix?  
(a)  $H = X(X'X)^{-1} X'$  (b)  $H = (X'X)^{-1} X'$  (c)  $H = X(X'X)^{-2} X'$  (d)  $H = X(X'X)^{-3} X'$
- (iii) With reference to multiple regression analysis with two independent variables, indicate the meaning of  $\hat{b}_0$ .
- (iv) Explain Variance Inflation Factor.
- (v) Define  $R^2$ .
- (vi) Heteroscedasticity does not destroy the unbiasedness and consistency properties of OLS estimators.  
(a) True (b) False
- (vii) In usual notations, which of the following relation is correct for adjusted  $R^2$  (i.e.  $\bar{R}^2$ ) and  $R^2$  ?  
(a)  $\bar{R}^2 = 1 - (1 - R^2) \frac{n-1}{n-k}$  (b)  $\bar{R}^2 = (1 - R^2) \frac{n-1}{n-k}$   
(c)  $\bar{R}^2 = 1 - (1 + R^2) \frac{n-1}{n-k}$  (d)  $\bar{R}^2 = (1 - R^2) \frac{n-k}{n-1}$
- (viii) With autocorrelation, the OLS parameter estimates are  
(a) unbiased (b) consistent (c) biased (d) both (a) and (b)
- (ix) If a qualitative variable has 'm' categories, we can introduce  
(a) only 'm - 1' dummy variables (b) only 'm' dummy variables  
(c) only 'm + 1' dummy variables (d) only 'm<sup>2</sup>' dummy variables
- (x) Define Endogenous variables.
- (xi) Indirect least squares procedure of estimation is appropriate when simultaneous equations are  
(a) over identified (b) under identified (c) exactly identified (d) identified
- (xii) Define Exogenous variables.

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