

2021

STATISTICS — HONOURS

Paper : DSE-A-2

(Econometrics)

Full Marks : 50

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.*

Group - A

Answer *any five* questions.

2×5

1. What is coefficient of determination?
2. What problem will arise if intercept parameter is not included in a regression equation?
3. Write the regression model when autocorrelated error exists.
4. What is exact multicollinearity?
5. Exemplify dummy variable regression.
6. What is Ridge Regression to get rid off Multicollinearity?
7. Write the variance covariance matrix in case of existence of first order autocorrelation in error.
8. Given three regressors which exhibit multicollinearity, how will you decide which variable(s) to drop to get rid of the problem?

Group - B

Answer *any two* questions.

5×2

9. An equation for the natural log of the price of a digital camera, $\ln(P)$ is written as :
 $\ln(P_i) = \alpha + \beta_1 MP_i + \beta_2 Zoom_i + \beta_3 (Zoom_i \times Dum_i) + e_i$, where MP = number of megapixels (ranges from 10 to 30); Dum = 1 if MP > 20, 0 otherwise; Zoom = 1 if optical zoom > 10.
Interpret the coefficients in the equation above.
10. Explain mathematically the near exact multicollinearity problem.
11. Show that OLSE of parameters in a regression equation is not unbiased in presence of measurement error in variables.

Please Turn Over

Group - C

Answer **any three** questions.

10×3

12. Suppose you are given the following Data Sampling Process (DSP) : $C_t = \beta_0 + \beta_1 Y_t + \varepsilon$ where C_t is aggregated consumption expenditure in India, Y_t is disposable income. Suppose you have data from 1935 to 2018. Suppose you believe that the post-independence consumption function (from 1947-2018) is likely to be different from the pre-independent period (1935-1947). Answer the following questions :
- (a) Describe and specify a model that allows you to test whether the intercept only is affected by the post-independence time period.
- (b) Assume that both the intercept and the slope parameters are affected differently in the pre-vis- \hat{a} -vis post-independence period, specify a model for this assumption.
- (c) What test statistic would you use in case of testing the assumption in (b)? Also, specify the hypothesis for this test statistic. 3+3+4
13. Define instrument variables. Show that instrument variable estimator is unbiased and consistent. Show that $V(\hat{\beta}_{OLS}) \leq V(\hat{\beta}_{IV})$ when there is no measurement error in variables. 2+4+4
14. (a) Write the variance covariance matrix for the following three situation :
- (i) Individuals are from heterogeneous community but they are independent.
- (ii) Individuals are from heterogeneous community and they are correlated.
- (iii) Individuals are from homogeneous community and dependence among individuals is decreasing as distance(time/space/cross-sectional) between two individuals increases.
- (b) Find $\hat{\beta}_{GLS}$ and show that it is BLUE in presence of heteroscedasticity in data where β is the regression parameter. (1+2+2)+5
15. (a) Consider the model
- $$y_t = \beta_0 + \beta_1 X_t + u_t$$
- $$u_t = \rho u_{t-1} + \varepsilon_t$$
- Find $E(u)$ and error dispersion matrix $D(u)$.
- (b) Explain the Durbin-Watson test for existence of autocorrelation in error in multiple regression equation. 5+5
16. (a) Consider a Data Sampling process (DSP) : $y = \beta_0 + \beta_1 X + u$, where; $E(u | X) = 0$, $E(u^2 | X) = \sigma^2 X$. Prove that the above DSP violates the unbiasedness property of the Gauss-Markov Theorem.
- (b) Consider a saving function : $sav = \beta_0 + \beta_1 inc + u$ and $u = \sqrt{inc} * e$; where e is a random variable with $E(e) = 0$ and $var(e) = \sigma_e^2$. Assume that e is independent of income. What assumptions of CLRM are violated? “sav” and “inc” stand for savings and income respectively. 5+5