[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1213 **E** **Your Roll No.....**

Unique Paper Code : 237603

Name of the Course : **B.Sc. (H) Statistics**

Name of the Paper : Econometrics (STH–603)

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions, selecting **two** from each section.
3. Use of simple calculators is allowed.
4. Attempt all parts of a question in continuation.

SECTION A

1. (a) Stating the assumptions of a general linear model, obtain an estimate $\hat{\beta}$ of the vector of unknown coefficients β. Show that, under given assumptions $\hat{\beta}$ is MLE also.

   (b) Define the coefficient of multiple determination R^2 and obtain an expression for it. Why do we need to use $\bar{R}^2$ instead of R^2. Obtain an expression of $\bar{R}^2$ in terms of R^2. (7½,5)

2. (a) What is an econometric model ? Justify the insertion of the stochastic error term in an econometric model.

(b) Consider the following regression :

$$SPI_t = -17.8 + 33.2\ Gini_t$$

$$se = \quad (4.9) \quad (11.8); \qquad r^2 = 0.16$$

SPI = index of socio-political instability, average for 1960-80

Gini = Gini coefficient for 1975 ($0 \leq Gini \leq 1$). Higher *Gini* means higher income instability.

The sample consists of 40 countries.

(i) Interpret the equation.

(ii) Suppose *Gini* increases from 0.25 to 0.55, by how much does SPI go up ? What does it mean in practice ?

(iii) Is the estimated slope coefficient significant at 5%? (t40 = 2.021).

(iv) What does it mean if *Gini* is 0 ? (7½,5)

3. (a) Why do we need to select "a" best regression equation. Describe the process of selecting "a" best regression equation using R^2 criterion.

(b) In a three variable model $Y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t$, an estimate b_2 of β_2 is known with certainty. Use this information to obtain an estimate of β_3. (7½,5)

SECTION B

4. What is multicollinearity ? For the model $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + u_t$; t = 1,2,---, n, discuss in details the consequences of multicollinearity on least square estimation. Also describe a test for detecting multicollinearity. (12½)

5. What do you understand by autocorrelation ? For a two variable model $Y_t = \alpha + \beta X_t + u_t$, show that in the presence of autocorrelation the ordinary least square estimators are still linear unbiased but they are no longer efficient. Also discuss in detail the Cochran-Orcutt iterative method of estimation for regression parameters. (12½)

6. (a) Explain in details the remedial measures to tackle the problem of multicollinearity.

(b) (i) Consider the following correlation matrix

$$\begin{pmatrix} 1 & r_{23} & \cdots & r_{2k} \\ r_{32} & 1 & \cdots & r_{3k} \\ \cdots & \cdots & & \cdots \\ r_{k2} & r_{k3} & \cdots & 1 \end{pmatrix}$$

How can you use the matrix to find if the some or all X variables are (1) uncorrelated (2) less than perfectly correlated (3) perfectly correlated ?

(ii) State true or false

(1) The exclusion of an important value may give a significant d value.

(2) High pairwise correlation coefficients mean high multicollinearity.

(7½,5)

SECTION C

7. (a) Describe the Aitken's estimators and find its mean and variance. Show that it has least variance in the class of all unbiased linear estimators.

(b) Answer the following :

(i) In applying the Durbin-Watson test, the disturbance term u_t follows _____ autoregressive scheme.

(ii) With the violation of the assumption of homoscedasticity, the estimators of the regression function will still be unbiased. (true/ false).

(iii) Which of these tests require re-ordering of the observations with respect to the X variables :

(1) Goldfield - Quandt test

(2) Glejser test

(3) Spearman's rank correlation test

(4) All of the above.

(iv) For a constant demand process, what is the relationship between the variance σ_u^2 of the forecast error and the variance of demand σ_ε^2 ?

(v) GLSE is the OLSE on the transformed variables that satisfies the standard least squares assumptions. (true/ false)

(7½,5)

8. Consider the linear trend model $X_t = b_1 + b_2 t + \varepsilon_t$, where ε_t is the random error having mean zero and variance σ^2. Show that

$$E\left(S_T^{[2]}\right) = E\left(S_T\right) - \frac{1-\alpha}{\alpha} b_2$$

Also prove that $\hat{b}_2(T) = \frac{\alpha}{\beta}\left(S_T - S_T^{[2]}\right)$; $\beta = 1-\alpha$

where S_T and $S_T^{[2]}$ are first order and second order smoothing statistics respectively. (12½)

9. (a) For the simple linear model $Y_i = \beta_1 + \beta_2 X_i + u_i$; i = 1,2..., n with $E(u_i) = 0$; $V(u_i) = \frac{\sigma^2}{\lambda_1}$, obtain the variances of GLSE and OLSE of β_2. Comment on the result.

(b) Explain Goldfield- Quandt test, stating all the assumptions under which the test is valid. (7½,5)

(500)