2021

ECONOMICS — HONOURS

Seventh Paper

(Group - A)

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.*

Section - A

(Marks : 20)

1. Answer *any five* questions :

   (a) Define Type-I and Type-II error. Can you reduce both the errors simultaneously?   4

   (b) Are the following linear regression models? Give reasons.   4

       (i) $Y_i = \alpha + \sqrt{\beta} X_i + u_i$

       (ii) $Y_i = \alpha X_i^{\beta} e^{u_i}$

   (c) Show that if a regression line is fitted through origin, the sum of the residuals may not equal to zero.   4

   (d) A random sample $x_1, x_2, \ldots \ldots \ldots, x_n$ is drawn from an infinite population with variance σ^2 and $\bar{x}$ is the sample mean. Derive an unbiased estimator of σ^2.   4

   (e) A sample of size 25 drawn from a normal population with variance 81, produced a mean of 81.2. Find a 0.95 level of confidence interval for the population mean.

       (Given that $\dfrac{1}{\sqrt{2\pi}} \displaystyle\int_{1.96}^{\infty} e^{-z^2/2} \, dz = 0.025$).   4

   (f) Show that the square of Student's t–statistic with n degrees of freedom has an F-distribution with $(1, n)$ degrees of freedom.   4

   (g) Discuss the method of least squares for computing trend in time series analysis.   4

   (h) $Y_i = \hat{\alpha} + \hat{\beta} X_i + u_i$ where $n = 10,$

       $\sum X_i = 70, \ \sum Y_i = 80, \ \sum X_i^2 = 600, \ \sum Y_i^2 = 734, \ \sum X_i Y_i = 480$

       Obtain the estimated value of α and β.   2+2

Please Turn Over

Section - B

(Marks : 30)

Answer *any five* questions.

2. Let x and y be two continuous random variables having joint probability density function :

$$f(x,y) = \begin{cases} 1 - \dfrac{x}{3} - \dfrac{y}{3}, & 0 \le x < 2, 0 \le y \le 1 \\ 0 & , \quad \text{otherwise.} \end{cases}$$

Obtain the marginal densities of x and y.   3+3

3. (a) What do you mean by a Minimum Variance Unbiased Estimator (MVUE)?

   (b) Let T_1 and T_2 be statistics with expectations $E(T_1) = 2\theta_1 + 3\theta_2$ and $E(T_2) = \theta_1 + \theta_2$. Find unbiased estimators of θ_1 and θ_2.   3+3

4. Find the standard error of sample proportion in both SRSWR and SRSWOR.   3+3

5. (a) A simple random sample of size 5 is drawn without replacement from a finite population consisting of 41 units. If the population standard deviation is 6.25, what is the standard error of sample mean?

   (b) If $X_1, X_2, \dots \dots \dots, X_n$, be '$n$' normally distributed variables having identical variances σ^2 with mean 0, what form will the distribution of $X_1^2 + X_2^2 + \dots\dots\dots + X_n^2 / \sigma^2$ take? Justify your answer.

          4+2

6. Show that the least squares estimator of β in the model $Y_i = \alpha + \beta X_i + u_i$ is linear and unbiased. Derive the variance of the estimator of β.   3+3

7. Find the maximum likelihood estimator of the mean of a Poisson population from a random sample of size n and show that it is unbiased.   4+2

8. What assumptions are made regarding the error term in a Classical Linear Regression Model? What happens to the OLS estimators if homoscedasticity assumption is violated?   3+3

9. Fit a straight line trend to the following data and obtain the trend value for 2004 :   4+2

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Average Monthly Profit (Million ₹)	6.3	7.4	9.3	7.4	8.3	10.6	9.0	8.7	7.9