Name : ……………………………………………………………

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Invigilator's Signature : ……………………………………

CS/MMA/SEM-2/MMA-208/2011

2011

STATISTICAL AND ECONOMETRIC METHODS – II

Time Allotted : 3 Hours   Full Marks : 70

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

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

   i)   Which of the following statements are true ?

   a)   Regression analysis necessarily implies causation of Y variables by X variables.

   b)   Regression analysis implies dependence of Y variable on other X variables.

   c)   Regression analysis implies interdependence of Y and X variables.

   d)   Regression analysis gives the correlation between Y and X variables.

ii) A bivariate regression analysis is one with

a) two X variables

b) only one X variable

c) number of X variables do not matter

d) depicts quadratic relationship between Y and X variables.

iii) In the simple linear regression model, the regression slope

a) indicates by how many per cent Y Increases

b) when multiplied with the explanatory variable will give you the predicted Y

c) indicates by how many units Y increases, given a one unit increase in X

d) represents the elasticity of Y on X.

iv) The fitted regression equation is given by $Y = -12 + 0.5 X$. What is the value of the residual at the point $X = 50$, $Y = 70$?

a) 57   b) -57

c) 0   d) None of these.

v) Which one of the following is not a part of classical assumptions ?

    a) Values taken by regressand is fixed in repeated sampling

    b) Regression model is linear in parameters

    c) Error term has mean zero

    d) Error term has a constant variance.

vi) By autocorrelation we mean

    a) that the residuals of a regression model are not independent.

    b) that the residuals of a regression model are related with one or more of the regressors.

    c) that the squared residuals of a regression model are not equally spread

    d) that the variance of the residuals of a regression model is not constant for all observations.

vii) Estimation using OLS on autocorrelated data results in the parameters being estimated to be

    a) biased

    b) inconsistent

    c) asymptotically normally distributed

    d) inefficient.

viii) Heteroscedasticity means that

   a) all X variables cannot be assumed to be homogeneous

   b) the variance of the error term is not constant

   c) the observed units have no relation

   d) the X and Y are not correlated.

ix) With the violation of the assumption of homoscedasticity, the estimates of the regression function will not be

   a) unbiased   b) consistent

   c) Blue d)   none of these.

x) Which of the following tests requires reordering the observations with respect to the X variables ?

   a) Gold field Quandt test b) Godfrey test

   c) White's test   d) All of these.

xi) Estimation of regression coefficients in presence of high but not perfect multicollinearity may result in all of these *except*

   a) high confidence intervals for the estimates

   b) almost all the estimates are statistically significant

   c) a high R-square

   d) estimates are all BLUE.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. State important properties of maximum likelihood estimator.

3. Explain the logistic regression model with appropriate applications.

4. What is the problem of multicollinearity in multiple regression ? How does one detect it ?

5. What are the important conditions for the use of Durbin-Watson test ?

6. What are the different sources of heteroscedasticity for a data set ?

7. On what condition does the power of Goldfield-Quandt test depend ?

GROUP – C

(**Long Answer Type Questions**)

Answer any *three* of the following. $3 \times 15 = 45$

8.   The following are data on Y = quit rate per 100 employees in manufacturing sector and X = unemployment rate :

Year	Y	X
1960	1.3	6.2
1961	1.2	7.8
1962	1.4	5.8
1963	1.4	5.7
1964	1.5	5
1965	1.9	4
1966	2.6	3.2
1967	2.3	3.6
1968	2.5	3.3
1969	2.7	3.3
1970	2.1	5.6
1971	1.8	6.8
1972	2.2	5.6

a)   Find the regression equation of Y on X.

b)   Construct a 95% confidence interval for β.

c)   Test the hypothesis $\beta = 0$ against $\beta \neq 0$ at 5% level of significance.   7 + 4 + 4
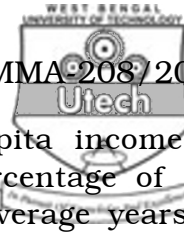
9. The table below gives the real per capita income in thousands of U.S. dollars Y with the percentage of the labour force in agriculture X1 and the average years of schoolling of the population over 25 years of age X2 for 15 developed countries in 1981 :

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Y	6	8	8	7	7	12	9	8	9	10	10	11	9	10	11
$X1$	9	10	8	7	10	4	5	5	6	8	7	4	9	5	8
$X2$	8	13	11	10	12	16	10	10	12	14	12	16	14	10	12

   a) Find the least square regression equation of Y on $X1$ and $X2$.

   b) Interpret the results of part (a).   10 + 5

10. The table below gives the hypothetical quantity demanded for a commodidty, Y, its price. $X1$ and consumers's income, $X2$, from 1985 to 1999 :

Year	Y	X1	X2
1985	40	9	400
1986	45	8	500
1987	50	9	600
1988	55	8	700
1989	60	7	800
1990	70	6	900
1991	65	6	1000
1992	65	8	1100
1993	75	5	1200
1994	75	5	1300
1995	80	5	1400
1996	100	3	1500
1997	90	4	1600
1998	95	3	1700
1999	85	4	1800

   a) Fit an OLS regression to these observations.

   b) Test at the 5% level for the statistical significance of the slope parameters.   10 + 5

11. A company manufacture and sales two products A and B. The sales of the products and corresponding profits for the last six months are given below :

Month	Product A ('000 units)	Product B ('000 units)	Profit (Thousand rupees)
1	45	172	9·6
2	23	76	9·8
3	48	196	10·7
4	31	107	6.2
5	42	168	7·5
6	47	174	8·1

   i) Find out the fixed cost of the company.

   ii) Find the contribution per unit for each of the products.

   iii) Estimate the profit for the 7th month, if the sales figures are 61,000 and 179,000 units respectively.

                                           4 + 6 + 5

12. From the following data on advertisement expenses (x) and sales (y), fit a linear regression of y on x. Test the significance of β_0 and β_1 and find 99% confidence interval for β_0 and β_1 in the regression equation $y_i = \beta_0 + \beta_1 x_i + e_i$ $i = 1, 2, \ldots, n$, with e_i's are independently normally distributed with mean zero and variance σ^2. Also obtain 99% confidence interval for predicted value of sales when adjustment expenditure is Rs. 25 lakhs.

x (Lakh Rs) :   12   25   17   23   37   43   29   40   18   34

y (lakh Rs.) :   127   267   184   172   348   490   317   431   193   367

13. Consider the bivariate regression equation

$$y_i = \beta_0 + \beta_1 x_i + e_i \ , \ i = 1, 2, \ldots, n,$$ with e_i's are independently and normally distributed random variables with mean zero and variance σ^2.

   a) Estimate the parameters β_0, β_1 and σ^2 by the maximum likelihood method.

   b) Estimate β_0 and β_1 by the least square method without the assumption of normality of errors distribution. 8 + 7