The Open University of Sri Lanka
B.Sc./B.Ed. Degree Programme
Open Book Test (OBT) - 2010/2011
Applied Mathematics – Level 04
APU2141 –Regression Analysis I

Date: 07th April 2011 Time: 4.00pm – 5.30pm

Answer All Questions.

Non programmable calculators are permitted

01. The following information is related to a study on how the amount of time spent on studying affects the performance. Let Y denotes the examination mark and x denotes the amount of time spent (in hours). Let β_0 and β_1 be parameters. Consider the regression model $Y = f(x) + \in$, where $\in$ denotes the random error component.

i) In each case below, classify the regression function $f(x)$ as a linear regression function or not. In each case, give reasons for your answer.

(a) $f(x) = \beta_0 + \beta_1 x$

(b) $f(x) = \beta_0 + e^{\beta_1 x}$

(c) $f(x) = \beta_0 + \beta_1 x^2$

(d) $f(x) = \beta_0 x^2 + \beta_1 x^3$

(e) $f(x) = \beta_0 + \beta_1 x e^x$

ii) For each of the response functions, $f(x)$, given in Part (i), state whether the model $Y = f(x) + \varepsilon$ is a simple linear regression model or not. In each case, give reasons for your answer.

02. a) Let Y denotes the final examination mark and x denotes the continuous assessment mark of a randomly chosen student. The following summary statistics were obtained based on the marks of 20 students.

$$\sum x_i = 961; \qquad \sum y_i = 1200; \qquad \sum x_i y_i = 66333$$
$$\sum x_i^2 = 56331; \qquad \sum y_i^2 = 79760.$$

Consider fitting the model $y = \beta_0 + \beta_1 x + \varepsilon$.

i) Find the least squares estimates for β_0 and β_1.

ii) Write down the equation of the fitted regression line.

b) Let β_0 and β_1 be parameters. For a simple linear regression model fitted using the method of least squares, state whether the following statements are true or false. In each case, give reasons for your answer.

i) The random error component of an observation is the deviation of the response from the fitted value.

ii) The fitted values for any two observations that have the same response values are equal.

03. The amount of fertilizer added to the plot (in grams), x, and the yield obtained (in kilograms), y, from 20 plots are given in the accompanying table.

x	5	5	6	8	8	8	10	12	14	14
y	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.8	3.0

x	14.0	16.0	16.0	16.0	18.0	18.0	20.0	22	24.0	24
y	3.2	3.4	3.2	2.8	2.6	2.5	2.2	2.0	2.1	2.0

i) Compute the Pearson Correlation Coefficient, r. In relation to this study, what does it measure?

ii) Based on the value of r, a student stated that there is no relationship between the amount of fertilizer added and the yield. Do you agree with the statement of the student? Give reasons for your answer.

iii) State whether the following statement is true or false. Give reasons for your answer.
If there is a positive linear association between the response and the predictor variable, an increase in the predictor variable will cause an increase in the response variable.