The Open University of Sri Lanka

B.Sc. / B.Ed. DEGREE, CONTINUING EDUCATION PROGRAMME

Open Book Test (OBT) 2015/2016

Level 04 - Applied Mathematics

APU2141/APE4141 – Regression Analysis I

Date: - 15.10.2016	Time: - 10.30 am - 11.30 am

Instructions

- This examination is of **One hour** duration.
- Answer **All** questions.
- Each of the two questions is allocated fifty marks.
- Non programmable calculators are permitted.

1. A researcher is interested in finding out whether the mean life time of an electric circuit is affected by the room temperature of its use. He recorded the life times (in years), y, of 20 more or less similar electric circuits and the room temperatures, (^{0}C) of their use. The following is a summary of the data collected.

$$\sum x_i = 314.0, \sum y_i = 73.5, \sum x_i y_i = 1009.32, \sum x_i^2 = 6492.0, \sum y_i^2 = 287.11.$$

   i) Compute the Pearson correlation coefficient and clearly explain what it measures in relation to this study.

   ii) State whether each of the following statements is true or false. In each case, give reasons for your answer.

      a. Based on the findings in Part (i), one can conclude that increase in the room temperature reduces the life time of the said electric circuits.

      b. If the value of the Pearson correlation coefficient is close to zero, a simple linear regression model cannot provide a good fit to the observed data.

      c. Residuals obtained from simple linear regression models always provide good estimates for the random errors in the responses.

2. A researcher is interested in finding out the effect of artificially added sugar on the preservation time of a soft drink. He recorded the preservation times (in days) of 40 samples of the soft drink with 1, 2, 3, 4 and 5 grams of sugar added per litre of the soft drink using 8 replicates at each sugar amount. Suppose the researcher seeks your advice to fit a simple linear regression model with additive errors.

   i)   Which variable would you choose as the predictor variable? Give reasons for your answer.

   ii) Let x denote the predictor variable, β_0 and β_1 denote unknown parameters and ε denote the random error. State whether each of the following is a regression function suitable for a simple linear regression model fit or not. In each case, give reasons for your answer.

   a) $f(x, \beta_1) = \beta_1 x$

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

   c) $f(x, \beta_0, \beta_1, \beta_2) = \beta_0 + \beta_1 x + \beta_2 x^2$

   d) $f(x, \beta_0, \beta_1) = \beta_0 + \beta_1 x + \varepsilon$

   iii) Based on a plot of the data, suppose the researcher decides to fit a simple linear regression model for the response variable y with an intercept term using x as the only predictor variable. Write down the model equation in the usual notation.

   iv) In relation to this study, clearly explain all the parameters in the model including any nuisance parameters.