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THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. /B.Ed. Degree Programme, Continuing Education Programme

APPLIED MATHEMATICS-LEVEL 05

ADU5301– Regression Analysis I

Open Book Test (OBT) 2017/2018

Date: - 02.01.2019 **Time: 4.15pm – 5.15pm**

Instructions

- This examination is of **one hour** duration.
- Answer **all** questions.
- Each of the two questions is allocated fifty marks. **In the first question, each part is given 25 marks equally distributed among the subparts. In the second question, marks are allocated as indicated.**

1. i) State whether each of the following statements is true or false. **If the statement is false, explain why it is false.**

   a) In the simple linear regression model $y = \beta_0 + \beta_1 x + \epsilon$, the term ϵ represents how an individual observation deviates from the fitted regression line.

   b) In the simple linear regression model $y = \beta_0 + \beta_1 x + \epsilon$, if a point (x, y) lies below the fitted line, the term ϵ will be negative.

   c) In the simple linear regression model $y = \beta_0 + \beta_1 x + \epsilon$, the parameter β_1 represents the change in the response associated with one unit of change in the predictor variable.

   d) In fitting a simple linear regression model, the variable that has less random variation is selected as the response variable.

   e) Simple linear regression model assumes that the means of the response at different levels of the predictor variable lie on a straight line.

(5x5 = 25 marks)

ii) State whether each of the following is suitable as the regression function $f(\underline{x}, \underline{\beta})$ for a simple linear regression model or not. **In each case, give reasons for your answer.**

a) $f(\underline{x}, \underline{\beta}) = \beta_0 + \beta_1 x^2$, where $\underline{\beta} = (\beta_0, \beta_1)^T$.

b) $f(\underline{x}, \underline{\beta}) = \beta_0 + \frac{\beta_1}{x}$, where $\underline{\beta} = (\beta_0, \beta_1)^T$.

c) $f(\underline{x}, \underline{\beta}) = \beta_0 + \beta_1 x + \beta_2 x^2$, where $\underline{\beta} = (\beta_0, \beta_1, \beta_2)^T$.

d) $f(\underline{x}, \underline{\beta}) = \beta_1 x$, where $\underline{\beta} = (\beta_0, \beta_1)^T$.

e) $f\left(\underline{x}, \underline{\beta}\right) = \beta_0 + \beta_1 \log x$, where $\underline{\beta} = (\beta_0, \beta_1)^T$.

(5x5 = 25 marks)

2. i) State whether each of the following statements is true or false. **If the statement is false, explain why it is false.**

a) Pearson correlation coefficient measures the strength of linear association between variables.

b) When extreme observations are present, Pearson correlation coefficient can be close to zero, even when there is a linear association between the two variables.

c) If the Pearson correlation coefficient is negative, increase in the predictor variable will be associated with a decrease in the response variable.

d) Pearson correlation coefficient lies between 0 and 1.

e) Pearson correlation coefficient close to zero is an indication that there is no relationship between the two variables.

(5x5 = 25 marks)

ii) The following summary statistics were obtained from the data collected on the amount of catalyst added, x (mg), and the yield measured, y (mg) of a chemical reaction on 24 chemical samples.

$$\sum x_i = 50.4;\ \sum y_i = 137.1;\ \sum x_i^2 = 114.06;\ \sum y_i^2 = 825.65;\ \sum x_i y_i = 270.3.$$

a) Calculate the Pearson correlation coefficient.

(15 marks)

b) Assume that there are no unusual observations in the data. Clearly explain what you conclude about the variables based on the measure calculated in part (a).

(10 marks)