The Open University of Sri Lanka

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

No Book Test (NBT) 2019/2020

Level 05 - Applied Mathematics

ADU5301– Regression Analysis I

Date: 15.08.2020   **1.00pm to 2.00pm**

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. The following summary statistics given in the usual notation were computed from the reaction times (in minutes) measured on 30 samples, y maintained at known temperatures ($^\circ$C), x. The researcher had studied 5 temperature levels 20°C, 25°C, 30°C, 35°C and 40°C and had used 6 replicates at each temperature level.

$$\bar{x} = 30.0, \ \bar{y} = 4.66, \sum x_i y_i = 4409.0, \sum x_i^2 = 28500.0, \sum y_i^2 = 683.6.$$

The researcher wants to fit a simple linear regression model to the reaction times using the method of least squares, with temperature as the predictor variable.

   i) Clearly describe the assumptions needed to obtain the least squares estimates for the model parameters.   (15 Marks)

   ii) Obtain least squares estimates for the slope and intercept of the population regression line.   (30 Marks)

   iii) Write down the equation of the fitted line based on the method of least squares.

   (15 Marks)

   iv) Calculate the fitted value for 30°C and clearly explain what it measures in relation to this study.   (25 Marks)

1

v) The researcher stated that the estimate for the intercept parameter gives an estimate for the expected reaction time for a sample at 0°C. Comment on the statement of the researcher.
(15 Marks)

2. The following plot was constructed from the residuals obtained by fitting a simple linear regression model to the body weights (grams) of 39 fish using length of fish (cm) as the predictor variable.
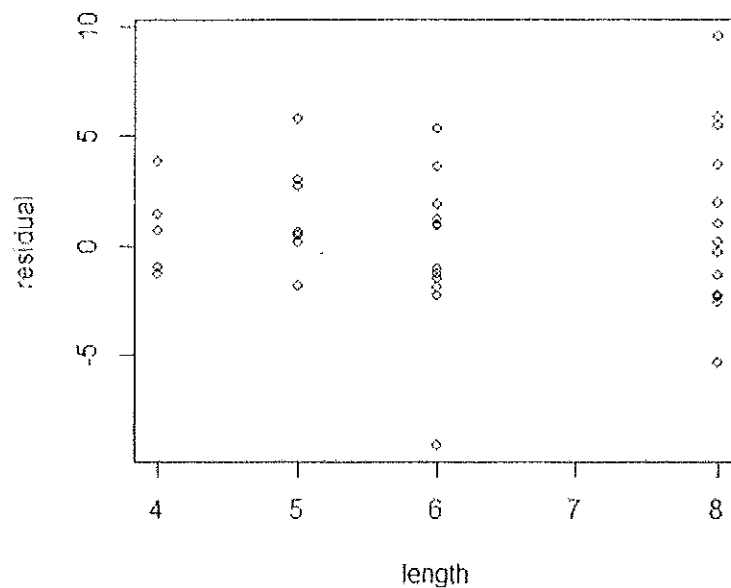
Using the information conveyed by the residual plot, state whether you agree with each of the following statements or not. Give reasons for your answer.

i) The plot indicates violation of model assumptions. (20 Marks)

ii) A plot of fitted values against the length of fish will have the same pattern. (20 Marks)

iii) The model fits better for fish with smaller length compared to the longer fish.
(20 Marks)

iv) Assuming that the model fits reasonably well, one can conclude that there is a fish in the sample whose body weight is underestimated by the fitted model. (20 Marks)

v) After fitting the model, the researcher found out that, due to an error in the scale, the weights of fish had been recorded incorrectly and 2mg had to be added to each weight. If the data were corrected and the model was re-fitted, the resulting residuals will be smaller in magnitude than the residuals plotted here. (20 Marks)