University of Ruhuna
Department of Mathematics

Bachelor of Science (Special) Degree (Level II)

Mathematics

MST 4053: Statistics Laboratory

Assignment No: 09 **Semester I, 2010**

23/04/2010

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1. To study how bone density changes as children grow, researchers at Citrus Hill Plus Calcium compiled data for five prominent research journals. They found these percents of peak bone density for different-aged children.

Age	2	4	6	8	10	12	14	16	18
Percent	43	49	51	56	63	71	82	91	95

a) What are the least squares estimates of β_0 and β_1 for the model $y = \beta_0 + \beta_1 x + \epsilon$?

b) Graph the regression equation on the scatter plot. Does it fit the data?

c) What is the standard error about regression line?

d) Is it reasonable to extrapolate the percent of peak bone density to age 20?

e) Plot the residuals against the predicted values and comment on the model.

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2. Consider the following table,

x	11	6	11	15	14	15	8	16
y	8	5	10	12	12	9	5	11

a) What is the standard error about the regression line?

b) What is the regression equation?

c) Verify that the t-ratio to test the hypothesis that $\beta_0 = 0$ is $b_1/SE(b_1)$.

d) Compute the t-ratio to test the hypothesis that $\beta_1 = 0$. Be sure to give the p-value and state your conclusion.

e) Based on the computer output, is there evidence to reject the hypothesis $H_0 : \beta_1 = 0$? Does this mean that the regression line should go through the origin (0,0)?

f) Complete a residual analysis of the model. Is it clear that the simple linear regression model is inappropriate?

3. These data are IQ and GPA scores for a random sample of 12 students.

IQ(x)	115	132	125	120	119	132	105	114	106	139	127	118
GPA(y)	2.2	3.3	3.0	2.6	2.9	3.5	2.2	2.7	3.7	1.8	3.7	2.4

a) Examine the scatter plot for any unusual behavior. Are there any bivariate outliers? Will they have an adverse effect on the least square regression line?

b) Find the least squares estimates of β_0 and β_1 in the model $y = \beta_0 + \beta_1 x + \epsilon$.

c) What is the value of the R^2? What does it tell you about the proposed model?

d) What is the p-value associated with the t-ratio? What does this signify?

e) Should we use this model to predict GPA from one's IQ?

f) Complete a residual analysis of the model.

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4. To investigate the relationship between the numbers books read during the term by third-graders and their final spelling scores, an educator collected the following data on the 17 randomly selected students.

No of books read	27	11	32	5	17	0	8	15	24	6	4	23	41	7	2	13
Final spelling score	85	81	98	61	92	36	59	84	90	70	72	95	99	78	58	80

Conduct a simple linear regression analysis of the data. Examine a scatter plot. Construct a residual plot analysis based on the simple linear regression equation.

a) Does a scatter plot show a straight line pattern?

b) Is the regression coefficient significantly different from 0? What is the p-value associated with the t-test? What is your conclusion?

c) Calculate R^2. How much of the variability in the response variable is explained by the predictor variable?

d) Does the residual plot show a random pattern or do you think that the model should be revised? If so, what revision do you recommend?

e) Complete a residual analysis of the model.

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