

Name \_\_\_\_\_ Surname \_\_\_\_\_ Student ID. \_\_\_\_\_

DUE DATE : Thursday 22<sup>th</sup>, September 2016.

## Assignment 2: (40 marks)

I pledge to the Honor Code and to obey all rules for taking and performing homework assignments as specified by the course instructor.

Student Signature: \_\_\_\_\_

1. (10 marks) Determine whether the following models are linear in the parameters, or the variables, or both. Which of these models are linear regression models?

1.1 Reciprocal

$$Y_i = \beta_1 + \beta_2 \left( \frac{1}{X_i} \right) + u_i$$

1.2 Semilogarithmic

$$Y_i = \beta_1 + \beta_2 \ln X_i + u_i$$

1.3 Inverse semilogarithmic

$$\ln Y_i = \beta_1 + \beta_2 X_i + u_i$$

#### 1.4 Logarithmic or double logarithmic

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$$

#### 1.5 Logarithmic reciprocal

$$\ln Y_i = \beta_1 - \beta_2 \left( \frac{1}{X_i} \right) + u_i$$

2. (10 marks) Consider the following non-stochastic models (i.e., model without the stochastic error term). Are they linear regression models? If not, is it possible, by suitable algebraic manipulations, to convert them into linear models?

2.1

$$Y_i = \frac{1}{\beta_1 + \beta_2 X_i}$$

2.2

$$Y_i = \frac{X_i}{\beta_1 + \beta_2 X_i}$$

2.3

$$Y_i = \frac{1}{1 + \exp(-\beta_1 - \beta_2 X_i)}$$

3. (10 marks)(Mid-term Exam 1/2015) Show that  $\sum x_i^2 = \sum X_i^2 - n\bar{X}^2$  and that  $\sum x_i y_i = \sum x_i Y_i$ . In other words, show that:

$$\hat{\beta}_2 = \frac{\sum x_i y_i}{\sum x_i^2} = \frac{\sum x_i Y_i}{\sum X_i^2 - n\bar{X}^2}$$

4.(10 marks) In the Table 1  $X_i$  is total microeconomics exam point (total points are 100) and  $Y_i$  is GPA of each student.

**Table 1.**  $X_i$  is total microeconomics exam point (total points are 100) and  $Y_i$  is GPA of each student.

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<b>X</b>	<b>Y</b>
63	2.7
72	3.4
78	3.1
81	3.5
87	3.6
75	3
75	2.8
90	3.8

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4.1 Now consider the two-variable model :

$$Y_i = \beta_1 + \beta_2 X_i + u_i$$

Based on Table 2, use the OLS to find the estimator of  $\beta_1$  and  $\beta_2$ . Interpret the regression.

4.2 Show that  $\sum \hat{u}_i = 0$