625.661 Statistical Models and Regression

Module 1 Discussion Questions

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Please discuss all the following questions.

1. A typical simple linear regression model is $y = \beta_0 + \beta_1 x + \varepsilon$, where y is a response variable (also often called dependent variable), x is an independent variable (also often called regressor), and ε is a random error with mean (also called expectation) zero. Thus y and ε are random variables. The regressor x is either a random variable or a non-random (also often called fixed) variable.

   a) The regressor x is non-random. What is the meaning of the expectation of y, denoted by $E(y)$? What is the meaning of the expectation of y given (or conditional on) x, denoted by $E(y \mid x)$? What are the differences between the two expectations?

   b) The regressor x is random. Discuss the questions in a) above.

2. Under a typical simple linear regression model as given in Problem 1 above, if the value of x increases by Δ units, how much does the value of y change? Is the change an increase or decrease?

3. The simple linear regression model given in Problem 1 above represents a straight-line relationship between y and x. If the values of β_0 and β_1 are given, a straight line can be drawn. Do all the values of y given x values fall exactly on the straight line? If yes, why? If not, why not?