

625.661 Statistical Models and Regression

Module 3-4 Assignment

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Please complete all the following problems.

Make sure that you state the assumptions for your analyses or proof/derivation steps. If applicable, you can use math/stat software to produce statistical results.

1. In a typical multiple linear regression model where x_1 and x_2 are two regressors. The expected value of the response variable y given x_1 and x_2 is denoted by $E(y | x_1, x_2)$.
 - a) As the value of x_1 increases, the magnitude of change in the value of $E(y | x_1, x_2)$ will not depend on the value of x_2 . Write down the multiple linear regression model with assumptions for this scenario.
 - b) As the value of x_1 increases, the magnitude of change in the value of $E(y | x_1, x_2)$ will depend on the value of x_2 . Write down the multiple linear regression model with assumptions for this scenario.
2. Do Problem 3.24, page 126 of Textbook
3. Do Problem 3.27, page 127 of Textbook
4. Do Problem 3.38, page 128 of Textbook
5. In a multiple linear regression model, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$, where y is a response variable, x_1 and x_2 are non-random regressors, and ε is a random error, the parameter β_2 is **nonzero**. Suppose that n subjects give data on (y, x_1, x_2) to generate the ordinary least-squares (OLS) estimators of all

three β parameters in this model. We then fit the same data to the simple linear regression model $y = \beta_0 + \beta_1 x_1 + \varepsilon$.

- a) Create a hypothetical data set and perform regression analysis to compare the OLS estimate of β_1 in the regression model including x_2 with the OLS estimate of β_1 in the regression model excluding x_2 . What have you learned?
 - b) Discuss with mathematical arguments whether the OLS estimators of β_1 from the two model fittings are equal. If not, discuss with mathematical arguments the condition(s) under which the two OLS estimators of β_1 are equal (Note: β_2 is **nonzero**).
6. Use any math/stat software (e.g., www.numbergenerator.org/randomnumbergenerator) of your choice to find a random number generator to randomly select 22 rows of Table B.3 (page 556) used in Problem 3.5 (page 122) of Textbook and then do (a), (b), (c), (d), (e), (f), (g).