

Homework Assignment #2

Show all work. For those questions that require you to write R code, hand in the programs that you wrote. This assignment is due on Feb. 21st.

1.
 - (a) Using the expression $\mathbf{e} = \mathbf{y} - \mathbf{X}\hat{\boldsymbol{\beta}}$, show that the equation for the OLS regression coefficients implies $\mathbf{X}'\mathbf{e} = \mathbf{0}$ and $\mathbf{e}'\mathbf{X} = \mathbf{0}$, where \mathbf{e} is the vector containing the residuals from an OLS regression. (15 points)
 - (b) When \mathbf{X} includes a constant, prove that $\mathbf{X}'\mathbf{e} = \mathbf{0}$ in turn implies that the sum of the errors is equal to zero (Hint: Figure out the elements of $\mathbf{X}'\mathbf{e}$ when the model includes a constant so that the first column of \mathbf{X} is made up of a row of ones). (15 points)
 - (c) Show, in turn, why this implies that $\bar{y} = \bar{\mathbf{x}}'\hat{\boldsymbol{\beta}}$ (i.e., the regression line goes through the mean of the data). (15 points)
 - (d) How many restrictions does $\mathbf{X}'\mathbf{e} = \mathbf{0}$ place on the residuals and what does this have to do with the degrees of freedom correction that we use in computing s^2 ? (5 points)
2. Using `exampledata.txt` and the sample R code contained in `ols1.r` (available from the course web site), do the following:
 - (a) Write R code to compute t statistics and confidence intervals. Discuss your inferences. (10 points)
 - (b) Write R code to impose via matrix algebra the restriction that the coefficient on the first explanatory variable is equal to the coefficient on the second explanatory variable. Report and discuss the results. (20 points)
 - (c) Write R code to compute R^2 and \bar{R}^2 using matrix algebra. (20 points)