

Take-home Graded Practice Opportunity 4

Due date: November 8, 2011, 5:00 p.m.

1. Are the Gauss-Markov assumptions required to perform a  $t$ -test that determines whether an estimated OLS coefficient is significantly different than zero? Why or why not?
2. Suppose that you estimate an OLS regression of  $\mathbf{Y}$  on  $\mathbf{X}$  and retrieve the associated residuals,  $\hat{\boldsymbol{\varepsilon}}$ . What is the  $R^2$  of an OLS regression of the residuals  $\hat{\boldsymbol{\varepsilon}}$  on  $\mathbf{X}$ ? Prove and explain the intuition.
3. True or false: if an estimated coefficient is significant at the 10% level, then it is also significant at the 5% level. Explain.
4. Suppose that you have data on middle schoolers' age, weight, and parents' income (in thousands).

Age	Weight	Income
14	110	45
12	95	28
13	105	40
12	100	40
14	105	42

Consider the model:  $Weight = f(Age, Income) + \varepsilon$ . Compute the following by hand:

- (a) The estimated coefficient vector  $\hat{\boldsymbol{\beta}}$ , predicted weights vector, the residuals vector.
- (b) The vector of standard errors. Using just the standard errors, determine whether each estimated coefficient is statistically different from zero and explain how you are reaching your conclusion.
- (c) The adjusted  $R^2$ , AIC, and BIC.
- (d) If the true model  $Weight = f(Age, Income, Parents\_Education\_Level) + \varepsilon$ , do you think the estimated coefficient associated with the income variable is upward or downward biased? Explain the economic intuition behind your answer.

5. Suppose that the random variable  $Y$  has the following pdf:  $f_Y(y_i) = \theta e^{-\theta y_i}$ , for  $y_i > 0$ . Perform the following:
- Solve for the maximum likelihood estimator (MLE). That is, set up the likelihood and log-likelihood function, and determine the parameter  $\hat{\theta}$  that maximizes this function.
  - Suppose you have a sample for  $Y : y_i = \{1, 0.8, 1.3, 1.6, 2\}$ . What is the MLE estimator given this sample?
6. You have just been hired (to a hypothetical but very high paying consulting position). Your first project is to analyze the economic impacts of pet ownership policies on property values. In the city of Bozeman, if households wish to own more than two dogs, they must purchase a kennel license and abide by the regulations of those licenses. Suppose that the city's mayor (a pet lover) is considering removing this requirement. In a paragraph, explain your strategy for setting up an empirical evaluation of this policy. In completing this task:
- Discuss potential dependent variables and explain why they may be good choices.
  - Outline the potential explanatory variables and why you would want to include them in the model.
  - For each explanatory variable, hypothesize the effect that the variable could have on the dependent variable.
  - Explain using economic intuition what the economic effects of the law removal may have on property values.