Small Project 3 (Due 5/21 Midnight)

Description: The goal of Small Projects is "learning by doing" rather than evaluating your knowledge. So, this project will be graded based on your *efforts* than its correctness. In other words, you will receive a full score as long as you answer all questions enough. Don't copy and paste others' answers.

Instructions: Use R to estimate the model and answer the questions. Please work on the problem set and submit it in a PDF format along with your R script file via Blackboard Assignment by the end of May 21st (Friday).

1. The following model can be used to study whether campaign expenditures affect election outcomes:

$$voteA = \beta_0 + \beta_1 \log(expendA) + \beta_2 \log(expendB) + \beta_3 prtystrA + u,$$

where *voteA* is the percentage of the vote received by Candidate A, *expendA* and *expendB* are campaign expenditures by Candidates A and b, and *prtystrA* is a measure of party strength for Candidate A (the percentage of the most recent presidential vote that went to A's party).

(i) What is the interpretation of β_1?

(ii) In terms of the parameters, state the null hypothesis that a 1% increase in A's expenditures is offset by a 1% increase in b's expenditures.

(iii) Estimate the given model using the data in VOTE1 and report the results in usual form. Do A's expenditures affect the outcome? What about b's expenditures? Can you use these results to test the hypothesis in part (ii)?

(iv) Estimate a model that directly gives the *t* statistic for testing the hypothesis in part (ii). What do you conclude? (Use a two-sided alternative.)

2. Consider a model where the return to education depends upon the amount of work experience (and vice versa):

$$\log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 educ \cdot exper + u$$

(i) Show that the return to another year of education (in decimal form), holding *exper* fixed, is $\beta_1 + \beta_3 exper$.

(ii) State the null hypothesis that the return to education does not depend on the level of *exper*. What do you think is the appropriate alternative?

(iii) Use the data in WAGE2 to test the null hypothesis in (ii) against your stated alternative.

(iv) Let θ_1 denote the return to education (in decimal form), when *exper* =10: $\theta_1 = \beta_1 + 10\beta_3$. Obtain θ_1 and a 95% confidence interval for θ_1. (*Hint*: Write $\beta_1 = \theta_1 - 10\beta_3$ and plug this into the equation; then rearrange. This gives the regression for obtaining the confidence interval for θ_1.)

3. Use the data in WAGE2 for this exercise.
(i) Estimate the model

$$\log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 tenure + \beta_4 married + \beta_5 black + \beta_6 south + \beta_7 urban + u$$

and report the results in the usual form. Holding other factors fixed, what is the approximate difference in monthly salary between blacks and nonblacks? Is this difference statistically significant?

(ii) Add the variables $exper^2$ and $tenure^2$ to the equation and show that they are jointly insignificant at even the 20% level.

(iii) Extend the original model to allow the return to education to depend on race and test whether the return to education does depend on race.

(iv) Again, start with the original model, but now allow wages to differ across four groups of people: married and black, married and nonblack, single and black, and single and nonblack. What is the estimated wage differential between married blacks and married nonblacks?