ECO 5350 Prof. Tom Fomby
Introductory Econometrics Spring 2011

TOPICS TO CONSIDER
FOR MID-TERM

The Mid-term in this class is scheduled for Thursday, March 24, 2011 at the regular class time. Don't spend a whole lot of time memorizing formulas. For the exam I will make available to you the formulas on the front and back covers of your Hill, et. al. textbook and any normal, t, and F tables that you might need. Given that we will not have access to a computer during the test you should review up on how to determine critical values for hypothesis tests directly from statistical tables like the Z, t, and F tables. You should commit to memory the ANOVA table I presented in class.

1. The test will cover the material in Chapters 1 – 6 in your Principles of Econometrics textbook. (This roughly corresponds to the same chapters in the 3^{rd} edition.) Also, roughly, this covers the material in the Lecture Notes 1 – 12, 13 (testing a linear restriction), 14 (testing multiple linear restrictions), and 18 (prediction in using linear regression) posted on the course website. Of course you should review the QQs and Exercise Keys posted on the class website. (Keys to Exercises 4 and 5 will be posted after class on Tuesday, March 22.)
2. You should be able to list and understand the 6 Assumptions of the Simple Linear Regression model. See the front cover of your textbook.
3. What does the term **homoskedasticity** mean? Draw a population regression function $(E(y \mid x))$ and several conditional density functions at various values of x while at the same time demonstrating the phenomenon of homoskedasticity. Do the same except draw a population regression and several conditional density functions at various values of x that demonstrate the phenomenon of **heteroskedasticity**. In looking at a data scatter of observations of y and x, how would you determine whether the population regression function is subject to homoskedasticity or heteroskedasticity? Is it OK to use OLS when you have heteroskedasticity in the errors of your regression model?
4. The **Ordinary Least Squares** estimators of the coefficients β_1 and β_2 in the simple linear regression model are derived by using the calculus. What function do you minimize in order to get the OLS estimators? The nice thing about the least squares criterion is that it gives rise to **analytic solutions** for the coefficient estimators $\hat{\beta}_1$ and $\hat{\beta}_2$.
5. Define the term **Population Regression Function (PRF)**. What is a **Sample Regression Function (SRF)** and how does it compare to the population regression (conditional mean) function? What is meant by the "**repeated sampling view**" of statistical hypothesis testing? In words, explain what is meant by "the **sampling distribution** of $\hat{\beta}_2$?" What is meant when we say "$\hat{\beta}_2$ is an **unbiased estimator** of β_2?"
6. What is the meaning of the term "perfect collinearity?"
7. What are the **properties of the Ordinary Least Squares estimator** $\hat{\beta}_2$? What are the properties of the Ordinary Least Squares estimator $\hat{\beta}_2$? What does it mean for these estimators to be **BLUE**? In other words, what does the **Gauss-Markov theorem** state? Can you give me a drawing that

represents the Gauss-Markov Theorem? What is the **Extreme Value estimator**? (More about the EV estimator during the Tuesday, March 22 lecture.) How do you use it to estimate the intercept β_1 and the slope β_2 of the conditional mean function (E(y|x)? Is the Extreme Value estimator unbiased? How does its sampling variance compare to the corresponding Ordinary Least Squares estimators? What does this have to say about the Gauss- Markov Theorem?

8. Hypothesis Testing. What additional assumption on the error term e allows us to conduct small sample inference in the simple linear regression model? (See SR6.)
9. How do you display an estimated regression function when presenting it to someone else for his/her inspection? (I.e. reporting coefficient estimates, standard errors and the like).
10. How do you construct a **95% confidence interval for** β_2 using $\hat{\beta}_2$ and se($\hat{\beta}_2$)? How do you use such a confidence interval to test the null hypothesis that $H_0 : \beta_2 = 0$ versus the alternative hypothesis $H_1 : \beta_2 \neq 0$? How do you construct a t-test of the above hypothesis?
14. What is the difference between testing **a two-sided alternative** and testing **a one-sided alternative**? In a "word problem" would you be able to distinguish between when you would use a two-side test versus using a one-sided test? Can you get the p-value of an observed t-statistic for a two-sided alternative? A one-sided alternative?
11. In the **sum of squares decomposition**, TSS = SSM + SSE, what is TSS, SSM, and SSE? What are their mathematical formulas?
12. What is the **coefficient of determination** (R^2)? How do you interpret $R^2 = 0.90$?
13. What is the test for **Overall Significance** of the Regression equation? How does this relate to the **ANOVA table**?
14. A **Test of a Single Linear Hypothesis**. See Lecture notes 13 and the examples I demonstrated in class (i.e. fair4.wf1 and the equal and opposite effects of growth versus inflation in the vote equation, beer.wf1 and the test of homogeneity of demand in all prices and income, and cobb_zurich.wf1 and the test of constant returns to scale.)
15. **Tests of Multiple Linear Hypotheses in Linear Regression**. See Lecture notes 14.
16. **Prediction in regression**. There are three types of prediction problems: (1) Prediction of the mean of Y given a certain setting of X = X_0, (2) Prediction of the next value of Y given a certain setting of X = X_0, and (3) Prediction of the next value of Y given an uncertain setting of X around $X = X_0$. See Lecture Notes 18 and Exercise 5. Recall the "trick" of re-centering the explanatory variables at the prediction point of interest and the fact that the least squares estimate of the intercept in this case is the prediction that we are trying to get.