Turn off any connection with the outside world: cell phones, beepers, text messaging devices. Close out any Internet connections.

Do all five questions. (There is an extra credit question as well.) Provide explanations!

1. (20 pts) Professor Dutkowsky estimates the velocity of money by calculating an OLS regression of GDP against money stock in the US (T=22):

\[ Y_i = 13.8 + 6.2M_i \]

(\text{1.87}) \quad (t-\text{statistic})

where both GDP and money stock are measured in billions of dollars.

Where the population slope is \( \beta \), test the hypothesis \( H_0: \beta = 0 \) against the alternative \( H_1: \beta > 0 \) at the .05 level of significance. Is this a Type I error? Is this a Type II error?

2. (20 pts) Professors Horrace and Brown both estimate a simple regression of hot chocolate consumption as a function of temperature. They use the same individuals as observation points. But:

1. They differ in how they measure consumption: Horrace has \( Y \) in gallons per week; Brown has \( Y^* \) in pints per week. So \( Y^* = 8 \cdot Y \).
2. They also differ in how they code temperature: For Horrace, the explanatory variable \( X \) is temperature in Centigrade. For Brown, the explanatory variable \( X^* \) is temperature in Fahrenheit, so \( X^* = 32 + (9/5)X \). Professor Horrace’s estimate is

\[ Y_i = 1.95 + .8X_i \]

(\text{1.44}) \quad (t-\text{statistic})

a. What will be Professor Brown’s estimate of the slope?
b. What will be Professor Brown’s estimate of the intercept?
c. How will Professor Brown’s errors compare with Professor Horrace’s?
d. How will Professor Brown’s \( R^2 \) compare with Professor Horrace’s?
c. What will be Professor Brown’s \( t \)-statistic?
[Don't just give new numbers; \textbf{argue} as carefully as you can why your answer must be correct.]

3. (20 points) Professor Smeeding has been hired by the Syracuse Ballet Company to estimate annual demand for ballet tickets. He determines (where the t-ratios are given in parentheses) from a sample of \( T = 20 \) months:

\[ D_t = 103.6 - 3.21 \text{ PrT}_t + 6.77 \text{ PrBB}_t + 12.03 \ln t - 7.23 S_t + e_t \]

(\text{–2.95}) \quad (1.97) \quad (2.43) \quad (–1.60) \quad (t-\text{statistics})
where $D_i$ is dollars spent on tickets, $Pr_T$ is the price of tickets, $Pr_{BB}$ is the price of SU basketball tickets, $ln_i$ is annual county income, and $S_i$ is annual snowfall.

(a) For which variables would you reject $H_0: \beta = 0$ at the 0 level of significance?

(b) For which variables would you reject $H_0: \beta = 0$ at the .01 level of significance?

(c) For which variables would you reject $H_0: \beta = 0$ at the .025 level of significance?

(d) For which variables would you reject $H_0: \beta = 0$ at the .05 level of significance?

[In each case, assume a one-tail alternative hypothesis.]

EXPLAIN

4. (20 points) To estimate money demand, LINEST is run on data to get

$$m_i = 0.271 + 0.193 y_i + 0.717 m_{i-1} - 0.019 r_i$$

where $m_i$ is measured in billions, $GDP (y_i)$ is measured in billions, and the interest rate $(r_i)$ is measured as a percentage.

A. Suppose money holdings are now expressed in millions instead of billions (on both sides of the equation). What happens to the estimated coefficients? To the t-statistics? To the p-values? To $R^2$?

B. Suppose interest rates are now expressed as negative numbers - all the values of the interest rate variable are multiplied by $-1$. What happens to the estimated coefficients? To the t-statistics? To the p-values? To $R^2$?

5. (20 points.) Is it possible to have an even number of observations (no two X values being the same) such that a simple OLS regression line yields errors that alternate in sign: $+, -, +, -, +, ..., +, -$ as you go from smallest to largest values of X? [Defend your claim carefully.]

6. [General culture extra credit question] Name either the current world record holder in the men’s marathon or the current world record holder in the women’s marathon.