Econ 371
Exam #2

Multiple Choice (5 points each): For each of the following, select the single most appropriate option to complete the statement.

1) The slope estimator, β_1, has a smaller standard error, other things equal, if
   a) there is more variation in the explanatory variable, X.
   b) there is a large variance of the error term, u.
   c) the sample size is smaller.
   d) the intercept, β_0, is small.

2) To decide whether or not the slope coefficient is large or small,
   a) you should analyze the economic importance of a given increase in X.
   b) the slope coefficient must be larger than one.
   c) the slope coefficient must be statistically significant.
   d) you should change the scale of the X variable if the coefficient appears to be too small.

3) The t-statistic is calculated by dividing
   a) the OLS estimator by its standard error.
   b) the slope by the standard deviation of the explanatory variable.
   c) the estimator minus its hypothesized value by the standard error of the estimator.
   d) the slope by 1.96.

4) Under the least squares assumptions (zero conditional mean for the error term, X_i and Y_i being i.i.d., and X_i and ui having finite fourth moments), the OLS estimator for the slope and intercept
   a) has an exact normal distribution for n > 15.
   b) is BLUE.
   c) has a normal distribution even in small samples.
   d) is unbiased.

5) When there are omitted variables in the regression, which are determinants of the dependent variable, then
   a) you cannot measure the effect of the omitted variable, but the estimator of your included variable(s) is (are) unaffected.
   b) this has no effect on the estimator of your included variable because the other variable is not included.
   c) this will always bias the OLS estimator of the included variable.
   d) the OLS estimator is biased if the omitted variable is correlated with the included variable.

6) You have to worry about perfect multicollinearity in the multiple regression model because
   a) many economic variables are perfectly correlated.
   b) the OLS estimator is no longer BLUE.
   c) the OLS estimator cannot be computed in this situation.
   d) in real life, economic variables change together all the time.

7) The overall regression F-statistic tests the null hypothesis that
   a) all slope coefficients are zero.
   b) all slope coefficients and the intercept are zero.
   c) the intercept in the regression and at least one, but not all, of the slope coefficients is zero.
   d) the slope coefficient of the variable of interest is zero, but that the other slope coefficients are not.

8) If the estimates of the coefficients of interest change substantially across specifications,
   a) then this can be expected from sample variation.
   b) then you should change the scale of the variables to make the changes appear to be smaller.
   c) then this often provides evidence that the original specification had omitted variable bias.
   d) then choose the specification for which your coefficient of interest is most significant.

Problems: Provide the requested information for each of the following questions. Be sure to show your work

9) Sir Francis Galton, a cousin of James Darwin, examined the relationship between the height of children and their parents towards the end of the 19th century. It is from this study that the name "regression" originated. You decide to update his findings by collecting data from 110 college students, and estimate the following relationship:

$$\widehat{Studenth} = 19.6 + 0.73 \times Midparh, \; R^2 = 0.45, \; SER = 2.0$$
$$\qquad\qquad\quad (7.2) \quad (0.10)$$

   where *Studenth* is the height of students in inches, and *Midparh* is the average of the parental heights. Values in parentheses are heteroskedasticity robust standard errors. (Following Galton's methodology, both variables were adjusted so that the average female height was equal to the average male height.)

   a) What is the prediction for the height of a child whose parents have an average height of 70.06 inches?

b) Test for the statistical significance of the slope coefficient.

c) If children, on average, were expected to be of the same height as their parents, then this would imply two hypotheses, one for the slope and one for the intercept.
   i) What should the null hypothesis be for the intercept? Calculate the relevant t-statistic and carry out the hypothesis test at the 1% level.

   ii) What should the null hypothesis be for the slope? Calculate the relevant t-statistic and carry out the hypothesis test at the 5% level.

10) The cost of attending your college has once again gone up. Although you have been told that education is investment in human capital, which carries a return of roughly 10% a year, you (and your parents) are not pleased. One of the administrators at your university/college does not make the situation better by telling you that you pay more because the reputation of your institution is better than that of others. To investigate this hypothesis, you collect data randomly for 100 national universities and liberal arts colleges from the 2000-2001 *U.S. News and World Report* annual rankings. Next you perform the following regression

$$\widehat{Cost} = \underset{(2{,}058.63)}{7{,}311.17} + \underset{(664.58)}{3{,}985.20}\times Reputation - \underset{(0.13)}{0.20}\times Size$$

$$+ \underset{(2{,}154.85)}{8{,}406.79}\times Dpriv - \underset{(1{,}121.92)}{416.38}\times Dlibart - \underset{(1{,}007.86)}{2{,}376.51}\times Dreligion$$

R^2=0.72, *SER* = 3,773.35

where *Cost* is Tuition, Fees, Room and Board in dollars, *Reputation* is the index used in *U.S. News and World Report* (based on a survey of university presidents and chief academic officers), which ranges from 1 (“marginal”) to 5 (“distinguished”), *Size* is the number of undergraduate students, and *Dpriv*, *Dlibart*, and *Dreligion* are binary variables indicating whether the institution is private, a liberal arts college, and has a religious affiliation. The numbers in parentheses are heteroskedasticity-robust standard errors.

a) What is the forecasted cost for a liberal arts college, which has no religious affiliation, a size of 1,500 students and a reputation level of 4.5? (All liberal arts colleges are private.)

b) To save money, you are willing to switch from a private university to a public university, which has a ranking of 0.5 less and 10,000 more students. What is the effect on your cost? Is it substantial?

c) You want to test simultaneously the hypotheses that $\beta_{size} = 0$ and $\beta_{Dlibart} = 0$. Your regression package returns the F-statistic of 1.23. Can you reject the null hypothesis?

d) Eliminating the Size and Dlibart variables from your regression, the estimation regression becomes

$$\widehat{Cost} = 5{,}450.35 + 3{,}538.84 \times Reputation + 10{,}935.70 \times Dpriv - 2{,}783.31 \times Dreligion;$$
$$(1{,}772.35) \quad (590.49) \qquad\qquad (875.51) \qquad (1{,}180.57)$$

R^2=0.72, SER = 3,792.68

Why do you think that the effect of attending a private institution has increased now?

e) Indicate whether or not the coefficients are individually significantly different from zero.