

Your name _____

Your Id No. (NOT Soc. Sec. no.) _____

Make sure that all pages (1 through 4) are there. The maximum number of points for the exam is 80. Read the questions carefully and make sure that you do not misunderstand them. If there is any ambiguity ask for clarification. Don't provide the answer to one part somewhere else. You won't get credit for it.

I. (10 points)

Consider the simple regression model $CATCH_t = \alpha + \beta BOATS_t + u_t$, where CATCH = the total fish catch in thousands of pounds and BOATS = the number of BOATS that went fishing on day t. If $BOATS = 0$, then CATCH should be zero also, indicating that the true value of α is zero. Thus the true model is $CATCH_t = \beta BOATS_t + v_t$. Suppose, however, you kept the constant term in the model and estimated a constant term and a slope term.

What is the nature of the misspecification you are making here; is it adding an irrelevant variable or omitting a relevant variable?

Are the estimates biased?

Are they consistent?

Are they efficient?

Are the hypothesis tests valid?

II. (10 points)

"When it comes to the properties of unbiasedness, consistency, and efficiency of the OLS estimators of parameters, adding an irrelevant variable (that is, one that has a truly zero coefficient) to a model has the same effect as high multicollinearity." Carefully explain in the next page whether this statement is valid. If it is only partly valid, indicate which parts they are.

III.

Consider the following model relating the gain in salary due to a MBA degree to a number of its determinants (for simplicity, the t subscript is omitted):

$$\text{SLRYGAIN} = \beta_1 + \beta_2 \text{TUITION} + \beta_3 \text{Z1} + \beta_4 \text{Z2} + \beta_5 \text{Z3} + \beta_6 \text{Z4} + \beta_7 \text{Z5} + u$$

Z1 = MBA skills graded by recruiters in being analysts (1-4, 1 is best)

Z2 = MBA skills graded by recruiters in being team players (1-4, 1 is best)

Z3 = MBA skills graded by recruiters in having a global view (1-4, 1 is best)

Z4 = Teaching evaluation by MBAs (1-4, 1 is best)

Z5 = Curriculum evaluation by MBAs (1-4, 1 is best)

Using data for 25 top business schools gathered by Business Week, the coefficients were estimated as follows:

	Coefficient	Standard error	Test Statistic	Retain or Omit
$\hat{\beta}_1$	60.899	22.513	Skip this	Skip this
$\hat{\beta}_2$	0.314	0.750		
$\hat{\beta}_3$	- 3.948	2.756		
$\hat{\beta}_4$	- 2.016	2.165		
$\hat{\beta}_5$	- 2.402	2.948		
$\hat{\beta}_6$	- 0.613	3.062		
$\hat{\beta}_7$	- 5.325	3.773		

$$R^2 = 0.461 \quad \bar{R}^2 = 0.282 \quad \text{ESS} = 1288.214$$

III.1

To carry out a test for the null hypothesis $\beta_i = 0$ ($i = 2, 3, \dots, 7$) against a two-sided alternative, write down in the table above the numerical values of the test statistic for each of the above coefficients, excluding the constant term (6 points).

State the statistical distribution of the test statistics, including the degrees of freedom, and the critical value (or range) for a 10 percent test (4 points).

In each case, write down (in the table) whether the variable is a candidate for omission or retention (6 points).

III.2

Test the model for overall significance at the 10 percent level by carrying out the following steps.

State the null and alternative hypotheses (3 points).

Write down an expression for the test statistic and compute its value (2 + 2 points).

State its distribution under the null including the d.f. (2 points).

State the criterion for rejection of the null (at the 10 percent level) and apply it (3 points).

What is your conclusion about the overall goodness of fit (3 points)?

Is there a conflict between your conclusion here and that in question III.1? (2 points). If yes, can you suggest possible explanation(s) (3 points)?

III.3

Another model was estimated after omitting some variables. The estimated model is the following with p-values in parentheses.

$$\widehat{\text{SLRYGAIN}} = 62.438 - 6.398 Z1 - 5.516 Z5 \\ (\lt 0.01) \quad (0.006) \quad (0.052)$$

Error sum of squares = 1494.512 $\bar{R}^2 = 0.318$

Using the first model as the unrestricted model and the second model as the restricted model, test a relevant joint hypothesis at the 10 percent level by carrying out the following steps.

State the null and alternative hypotheses (3 points).

Write down an expression for the test statistic and compute its value (3 + 2 points).

State its distribution under the null including the d.f. (3 points).

State the criterion for rejection of the null (at the 10 percent level) and apply it (3 points).

Does your test here confirm the individual tests done in III.1 or does it contradict it? (2 points)?

III.4

In the two models, do the signs of the regression coefficients agree with your intuition or do you think that some of the signs are wrong? If the latter, which ones? (3 points)

III.5

Considering the goodness of fit, the tests you have done, the conclusions you have drawn from them, and the significance of the regression coefficients, evaluate the adequacy of the model specification (5 points).