Economics 312 Spring 2005
Mid-Term Exam In-Class Questions

Instructions

1. This part of the exam is to be taken in class. It is closed-book; no outside materials may be consulted. You may write your answers wherever you wish, but if any errors or ambiguities are discovered, they will be announced only in Vollum 116.

2. Answer questions on the exam itself. If you need extra space, please use the back of the page.

3. You have until 9:50 to finish the exam. If time seems scarce, use it where its marginal product is highest. Try to get at least a sentence or two written for every question before you elaborate at length on any single answer.

4. You are responsible for making sure that you understand each question clearly. In case of any ambiguity, be sure to consult the instructor.

5. Please bring your completed exam to my office unless you are still working when I return to the room at the end.

Name:

Part A: The questions of Part A refer to a model of the demand for fresh vegetables described by:

$$\ln Q_j = \beta_0 + \beta_1 \ln P_j^v + \beta_2 \ln P_j^o + \beta_3 \ln Y_j + \beta_4 \ln N_j + u_j, \tag{1}$$

where Q_j is quantity of vegetables consumed per month by family j, P^v is an index of the price of vegetables in the family's location, P^o is an index of the prices of all other goods in that location, Y is family income, and N is the number of people in the family. You may assume for the first two questions that the Gauss-Markov conditions are satisfied for equation (1).

A-1. How would you test the null hypothesis that vegetables are an inferior good (have negative income elasticity of demand) against the alternative that they are a normal good (with positive income elasticity)? [Here and throughout the exam, be specific about how to calculate the test statistic using numbers reported from a standard regression table, what distribution it follows, and the set of test-statistic values for which you accept/reject the null hypothesis.]

H_0: H_1:	Distribution of test statistic:
Formula for test statistic:	Reject null hypothesis if:

A-2 Demand curves are supposed to depend only on *relative* prices. How would you test the null hypothesis that only the relative price of vegetables matters, in other words, that an equiproportional increase in both prices would leave quantity demanded unchanged?

H_0: H_1:	Distribution of test statistic:
Formula for test statistic:	Reject null hypothesis if:

A-3. Would you worry about heteroskedasticity in the estimation of equation (1)? How would you test for it?

A-4. If you knew that the variance of the error term in equation (1) was proportional to some variable Z_j, what would be the best, linear, unbiased estimator of the coefficients in equation (1)? In what ways would this estimator be superior to OLS?

Part B. General questions.

B-1. The dependent variable in the regression below is Reed cumulative GPA. The explanatory variables are math SAT score and its square and cube, and verbal SAT score and its square.

```
      Source |       SS       df       MS              Number of obs =    3046
-------------+------------------------------           F(  5,  3040) =   28.70
       Model |  51.3638691     5  10.2727738           Prob > F      =  0.0000
    Residual |  1088.29911  3040  .357993127           R-squared     =  0.0451
-------------+------------------------------           Adj R-squared =  0.0435
       Total |  1139.66298  3045  .374273555           Root MSE      =  .59833

------------------------------------------------------------------------------
       uggpa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        satm |   .0439658   .0165573     2.66   0.008     .0115011    .0764305
       satm2 |    -.00007   .0000264    -2.65   0.008    -.0001218   -.0000182
       satm3 |   3.75e-08   1.39e-08     2.69   0.007     1.02e-08    6.48e-08
        satv |   .0035825   .0019963     1.79   0.073    -.0003318    .0074968
       satv2 |  -1.85e-06   1.50e-06    -1.23   0.218    -4.78e-06    1.09e-06
       _cons |  -7.936155   3.413251    -2.33   0.020    -14.62867   -1.243641
------------------------------------------------------------------------------
```

Suppose that we replace satm and satv with satm/100 and satv/100 (and also replace the powers appropriately). For each entry in the table, show in the corresponding shaded box below what effect the rescaling of SAT scores would have on the entry. (Write "+10" if new entry would be old plus 10, "×10" is new entry is old times 10, "NC" if it is not changed, etc.)

Source	SS	df	MS
Model			
Residual			
Total			

Number of obs =	NC
F(5, 3040) =	
Prob > F =	
R-squared =	
Adj R-squared =	
Root MSE =	

uggpa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
satm/100						
satm/100^2						
satm/100^3						
satv/100						
satv/100^2						
_cons						

B-2. Which of the following properties are *necessarily* true of a consistent estimator $\hat{\beta}$ of a parameter β? Explain briefly.

(a) unbiasedness

(b) $\lim_{n\to\infty} E(\hat{\beta}) = \beta$

(c) asymptotic efficiency

(d) $\lim_{n\to\infty} \mathrm{var}(\hat{\beta}) = 0$

B-3. Suppose that the true regression equation is $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$, but that you estimate the equation by OLS leaving out x_2. Under what, if any, conditions will your estimate of β_1 be unbiased?

Part C: Suppose that you have data on the following variables for a sample of Reed students: *alc* = grams of alcohol consumed in beverage form per week during the last academic year; *gpa* = grade-point average for last academic year; *econ* = 1 if an economics major, 0 otherwise; *adm* = an index of the student's predicted gpa based on the quality of his or her admission file. Use linear functional forms throughout.

C-1. How would you test whether economics majors consume the same amount of alcohol as students of other majors?

<table>
<tr><td colspan="2">Regression equation:</td></tr>
<tr><td>H_0:

H_1:</td><td>Distribution of test statistic:</td></tr>
<tr><td>Formula for test statistic:</td><td>Reject null hypothesis if:</td></tr>
<tr><td colspan="2">Notes or comments:</td></tr>
</table>

C-2. How would you test whether consumption of alcohol has a greater effect on GPA performance for economics majors than for other students? (Might economics majors have higher or lower GPAs than other majors apart from any effects of alcohol? If so, keep that in mind when formulating your specification.)

<table>
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