Economics Department 2003 Honors General Exam

You must answer ONLY TWO of the four micro questions. If you try to answer more than two micro questions, you will not get any credit for any work done on questions beyond the first two you try to answer.
You must answer ALL TWO macro questions.
You must answer ONLY ONE of the two econometrics questions. If you try to answer both econometric questions, you will not get any credit for any work done on the last question you try to answer.

You must use a SEPARATE blue book for each question, so you will hand in five (5) bluebooks.

Calculators are NOT permitted.

Make sure your name and the question number (Micro 3, Macro 1, etc.) is on the outside of each of the five bluebooks! The number should refer to the actual question number on the exam.

Micro Question 1

Stephanie is trying to decide how much labor to supply in a given day at wage rate w_1.

Assume initially that she has no non-labor income.

a. With a composite good (G) on the vertical axis, and leisure hours (L) on the horizontal axis, graph her budget constraint, clearly indicating the end points and slope. Assume the composite good costs $p per unit.

b. Write an equation for her budget constraint.

Assume Stephanie's optimal (utility maximizing) combination of leisure and the composite good, given wage w_1, is at (L_1, G_1). Assume also that, for Stephanie, both leisure and the composite good are normal, and subject to diminishing marginal utility.

c. Write out the complete algebraic condition implied by (L_1, G_1) being utility maximizing.

Now assume the wage rate goes up to w_2, where $w_2 > w_1$, and Stephanie's optimal point is now (L_2, G_2), where $L_2 < L_1$, $G_2 > G_1$.

d. Draw a new graph showing the changes and graphically decompose the income and substitution effects, clearly showing each, involved in the move from (L_1, G_1) to (L_2, G_2).

Assume now that Stephanie has a fund of savings of $E, independent of any labor income she receives.

e. Draw a new graph showing her budget constraint at wage rate w_1, carefully labeling all relevant points.

f. Assume the same wage change to w_2 as above ($w_2 > w_1$). On the graph you drew for (e), draw her new budget constraint.

g. Given the budget constraints you drew for (e) and (f), on two separate graphs clearly illustrate the compensating variation (CV) and the equivalent variation (EV).

h. Interpret CV and EV in words in this context.

Micro Question 2 **(New Blue Book)**

Assume Nila and Raja are the only two consumers in Intermedland. The country produces, and Nila and Raja consume, only two goods—equations (E) and graphs (G), both of which are subject to diminishing marginal utility for both consumers. Despite common assumptions to the contrary, E and G are available only in fixed supply.

a. Draw a consumption Edgeworth Box Diagram for Intermedland, if equations are fixed at E_0 and graphs are fixed at G_0. Define and show clearly the contract curve, and indicate how it is derived.

Currently, Nila has 12 equations and 2 graphs. Raja has 6 equations and 6 graphs.
Their preferences can be described by the following utility functions:

$U_{Nila} = E^{2/3}\ G^{1/3}$, which implies that $MRS_{Nila} = E/(2G)$
$U_{Raja} = E^{1/2}\ G^{1/2}$, which implies that $MRS_{Raja} = E/G$

b. Is the initial allocation of equations and graphs Pareto efficient? Illustrate your answer in the Edgeworth Box you drew for (a).

Equations and graphs are produced with two inputs—Cleverness (C) and Nerdiness (N), the supply of both of which is fixed. Assume that the relevant production functions are:

$E = C^{1/2}\ N^{1/2}$ which implies that $MP^E_C = ½\ C^{-1/2}\ N^{1/2}$ and $MP^E_N = ½\ C^{1/2}\ N^{-1/2}$ and
$G = C^{1/3}N^{2/3}$ which implies that $MP^G_C = 1/3\ C^{-2/3}\ N^{2/3}$ and $MP^G_N = 2/3\ C^{1/3}\ N^{-1/3}$

c. Derive the condition for efficiency in production, given these production functions.

d. Explain and illustrate how the consumption Edgeworth Box and the production possibilities frontier (PPF) can be used to derive the "grand" utility possibilities frontier (GUPF, or the envelope of all the individual utility possibility frontiers, UPFs).

Micro Question 3 **(New Blue Book)**

Consider a market with one seller and two buyers. The seller's type is his private information. We denote the seller type by t, and assume that the seller's value for the object is $r(t)=0.8\,t$. Assume that all buyers value the *object* at t (thus, for any value of t, the seller's value for the object is lower or equal to that of the buyers). The buyers do not observe t. The buyers believe that t is uniformly distributed on the interval [0,2]. This information is common knowledge (as well as the structure of the game). Both buyers simultaneously announce the prices that they are willing to pay for the object. The seller observes the prices and decides if he wants to keep the object, or to sell it to one of the buyers. The payoff of the seller is $r(t)$ if he keeps the object, and p if he sells it. The payoff of a buyer is zero if he does not buy the object, and $t-p$ if he buys it.

(a) Would you describe this market as an example of moral hazard or/and adverse selection? What is the equilibrium price offered by the buyers?

(b) Now suppose that before the buyers make their offers, the seller has an opportunity to take a free test that truthfully reveals his type t to the buyers. The seller does not have to take the test. What is the range of types of sellers such that the seller chooses to take the test?

(c) Now let us consider a slightly more complicated game. Suppose that before the buyers make their offers the seller has an opportunity to take a test that costs $c=0.02$, and truthfully reveals his type t to the buyers. The seller does not have to take the test. What is the range of types of the seller such that the seller chooses to take the test?

Micro Question 4 **(New Blue Book)**

(a) John is not credit constrained: he is free to borrow or lend money at the market rate of interest of 10%. (The market interest rate is not expected to change in the future; it is at 10% per year for a loan of any duration.) John works for Sly corporation. Sly corporation used to give John a $1500 bonus at the end of the year. This year they introduce an innovation. Instead of a bonus they offer John a subsidized zero interest loan of $10 000. John must repay the loan in two installments, $5 000 after the first year, and the remaining $5 000 after the second year. Is this loan more or less valuable than the $1500 bonus?

(b) Ann is a very unusual lady. There are only three things she can possibly need: ice cream, caviar and lard. To make your computations easy, Ann settled in a country where all three of her favorite things have the same price, $1 per unit. Ann's von Neuman-Morgenstern utility function is $(xy)^{0.5}+z^{0.5}$, where x denotes Ann's consumption of ice cream, y is her consumption of caviar, and z is her consumption of lard. Ann's income is denoted by w. Peter has a von Neuman-Morgenstern utility function that is just like that of Ann, but multiplied by a constant. Can we say that preferences of Ann and Peter are identical? Is there a sense in which Ann and Peter have different preferences? Lisa has a von Neuman-Morgenstern utility function that is the square of Ann's utility, i.e. Lisa's utility function is $[(xy)^{0.5}+z^{0.5}]^2$. Can we say that preferences of Ann and Lisa are identical in some sense? Is there a sense in which Ann and Lisa have different preferences?

(c) Do you have enough information to derive Ann's utility of money? Explain. If possible, derive Ann's utility of money.

(d) Is Ann risk loving for some range of incomes? Is Ann locally risk neutral for some range of incomes? Is Lisa risk loving for some range of incomes?

(e) Compute Ann's relative measure of risk aversion. (If you do not know how to find Ann's utility of money you can find the coefficient of relative risk aversion for the utility function ln(w)).

(f) What is the definition of a normal good? What is a definition of an inferior good? For the range of income $w<1$, is lard a normal good for Ann?

Macro Question 1 **(New Blue Book)**

1) Use the IS-LM model (including the behavioral relations from which the model is derived) to analyze the consequences of the following events on output, employment, consumption, investment, and real interest rates. Focus on the *short-run* effects (i.e. with constant prices).

a. A tax cut that increases all consumers' disposable income.
b. An increase in expected future productivity.
c. An investment subsidy, for example a tax cut to corporations that invest (indirectly this is one of the features of President Bush's tax cut proposal).
d. President Bush's tax-cut proposal contains elements of both (a) and (c), and much of the debate about the advisability of the tax cut hinges on how much investment will increase or decline. What does the answer depend on, in terms of the slopes of various curves? What is the economic interpretation of these slopes?
e. So far we have implicitly assumed that consumers do not conform to the predictions of Ricardian Equivalence (which states that consumers do not experience tax cuts as increases in wealth). How would your answers to (a)-(d) change if consumers behaved as predicted by Ricardian equivalence?
f. So far we have assumed that the economy is closed. How would your answers to (a)-(d) change if it was a small open economy with flexible exchange rates?
g. What about a large open economy with flexible exchange rates?

Macro Question 2 **(New Blue Book)**

2) Consider an economy described by the following assumptions. The aggregate production function is $Y=K^{a}(EL)^{1-a}$, the saving rate is s, the depreciation rate is d, the rate of growth of E is 0, and the rate of growth of L is n.

a. Express steady state income per worker as a function of the exogenous parameters.
b. What is consumption per worker in this steady state?
c. Suppose that the economy has been in steady state for a while. Now suppose that suddenly there is a one-time large increase in the efficiency level E (some people think this may describe what will happen in Iraq now). *On the day of the change in E*, what happens to the *levels* of output per worker?
d. In the years following the change in E, as the economy moves to its new steady state, what happens to income per worker? Illustrate your answer with a graph that has time on the horizontal axis [on the vertical axis you can put income per worker, the growth rate of income per worker, or the log of income per worker, whatever is easier. Be very explicit about which it is, though.]
e. Suppose now that on the same day that E increases, a large fraction of the capital stock is destroyed. How does this change your answers to (c) and (d)?

Econometrics Question 1 **(New Blue Book – answer EITHER this question or the Econometrics Question 2)**

This question was inspired by Janet Currie and Aaron Yelowitz's "Are Public Housing Projects Good for Kids?," which appeared in the Journal of Public Economics in 2000. Currie and Yelowitz examined numerous possible adverse consequences of living in public housing, including whether children who live in public housing projects are more likely to be left back in school. This question adapts that analysis to make it more tractable, but retains its flavor.

The sample is 340,081 children aged 7 to 17, all of whom have exactly one sibling. 4.75% of the children (16,154 children in all) live in public housing projects. The basic model is a linear probability model; assume that for so large a sample, the specification is plausible and the law of large numbers and central limit theorem apply.

The specification states that

E(dummy variable = 1 if left back and = 0 otherwise) =

$\beta_0 + \beta_1(PROJECT_i) +$

$$\sum_{j=2}^{12} \beta_j \left(dummy\ for\ child's\ age_{ji} \right)$$

$+ \beta_{13}\ (income\ of\ household\ head_i) + \beta_{14}\ (income\ of\ head_i)^2$

$+ \beta_{15}(head's\ age_i) + \beta_{16}(head's\ age_i)^2 + \beta_{17}(head\ female_i) + \beta_{18}(head\ black_i)$

$+ \beta_{19}(head's\ education\ 9\text{-}11)_i + \beta_{20}(head's\ ed\ 12)_i + \beta_{21}(head's\ ed\ 13\text{-}15)_i + \beta_{22}(head's\ ed\ 16)_i.$

Project is a dummy variable equal to 1 if the child lives in a public housing project and equal to 0 otherwise. Household head's income and head's age, and their squares, are measured continuously. All the other variables are dummy variables. Assume throughout that the explanators are not perfectly collinear and that at least some coefficients are non-zero.

i) Ordinary least squares (OLS) yields an estimated coefficient on PROJECT of -0.0374 with an estimated standard error of 0.037. Assume, in this part, that the model is properly specified and that the Gauss-Markov assumptions are met.

a) Offer an intuitive interpretation of the coefficient estimate for β_1. (3 minutes)

b) Explain succinctly how you would test the hypothesis that $\beta_1 = 0$ at the 5% significance level. (This is about the mechanics, not the concepts. Be terse. Use appropriate numbers where possible.) (4 minutes)

c) According to this model, what is the rate of change of the probability of being left behind with respect to the head's age? (2 minutes)

ii) a) Which Gauss-Markov assumption must be violated by the linear probability model. Explain briefly. (4 minutes)

b) In the light of (iia), how would you propose altering the test of the hypothesis that $\beta_1 = 0$ that you offered in (ib)? Still base your test upon the OLS estimator of β_1. You need not provide any formulae. (3 minutes)

iii) Assume you had in hand the data for conducting the OLS regression in (i). Explain all the steps you would take to test the hypothesis that the age of the head of household does not matter at all for the probability that a child is left behind. (This is about the mechanics, not the concepts. Be terse) (5 minutes)

iv) "There is good reason to believe that the OLS estimates will be biased by selection. Whether or not a family lives in a project reflects choices made by both households and program administrators. Many unobserved factors such as whether the family can double-up with friends and relatives, or has recently been homeless, are likely to affect both participation and the (educational) outcomes (of the children). Our expectation is that failure to control for this source of endogeneity would bias the estimated effects of living in projects downward, since families in projects may be more likely to live in substandard housing in any case, and their children may be more likely to experience negative outcomes." (Currie and Yelowitz, p.104.)

Show that the endogeneity of PROJECT can undermine the consistency of OLS estimation of (β_1). [If you wish, you may ignore any or all of the other explanators for purposes of your demonstration.] (5 minutes)

v) Currie and Yelowitz noted that public housing rules treat families with one boy and one girl differently than families with two children, both of the same sex. The former families are given three bedroom apartments, while the latter are given two bedroom apartments. Because rent depends only on income, families with one boy and one girl get a larger subsidy than families with two children, both of the same sex. Currie and Yelowitz observe that families with one boy and one girl are 24% more likely to be in housing projects than are families with two children, both of the same sex. They propose using as an instrumental variable for PROJECT a dummy variable, DIFFER, equal to 1 if the two children are a boy and a girl, and equal to zero otherwise.

a) What must be true of the dummy variable DIFFER if it is to serve as a valid instrument? (3 minutes)

b) Consider the model

$$Y_i = \beta_1(\text{PROJECT}_i) + \beta_2(\text{DIFFER}_i) + \varepsilon_i.$$

Suppose DIFFER is mistakenly omitted from the equation. Demonstrate the inconsistency of instrumental variables estimation of β_1 if the instrument used is the mistakenly omitted variable, DIFFER. Notice the model has no intercept term. (5 minutes)

c) Currie and Yelowitz establish that Differ is not itself an omitted variable. Assume they are correct in this. They also worry, however, that another dummy variable, OTHER, that indicates participation in a subsidized housing program besides public housing, might be wrongly omitted from their model. Adapt your analysis in (vb) to determine what must be true about DIFFER if it is to be a valid instrument when OTHER is wrongly omitted from the model, but DIFFER is properly omitted. (8 minutes)

vi) The IV estimate of β_1 is -0.113 with an estimated standard error of 0.069. Is this effect significant at the .10 level of significance? (3 minutes)

vii) If Currie and Yelowitz implemented the IV estimation by using two stage least squares, what specific steps would they have followed to arrive at their coefficient estimates? (5 minutes)

Econometrics Question 2 **(New Blue Book – answer EITHER this question or the Econometrics Question 1)**

Consider a panel data set with observations over time on a cross-section of individuals. The dependent variable only takes on the values 0 and 1. There is a small number of explanatory variables; some of them are constant over time, only varying across the individuals. There is a large number of individuals and only a few time periods.

(a) Consider three models: standard probit, pooling all the observations; fixed-effects probit; and random-effects probit. Write down the likelihood function for each of these models.
(b) What are the relative advantages and disadvantages of the three models, when estimated by maximum likelihood?
(c) Consider using the random-effects estimates to generate a probability that the dependent variable equals 1, for various interesting values of the explanatory variables. This can be done by setting the random effect equal to its mean, or by averaging over the distribution of the random effect. Explain how to implement these two approaches and why they can give very different answers.