14.03 Midterm
Spring 1997

DO NOT OPEN THE EXAM UNTIL TIME IS ANNOUCED!!!

Please box your answers when possible, so that they are easy to find.

There are 90 total points on this exam, and you have 2 hours to complete the exam. The points can be used as a guideline for how many minutes to spend on each problem, leaving time at the end to come back to problems you found difficult.

There are three parts to the exam. Parts I and II are TRUE-FALSE-UNCERTAIN AND WHY, and you are required to defend your answers (even if you answer true) with one or two sentences and/or graphs. The first set is relatively easy (6 problems at 5 points each, for a total of 30 points), while the second set is a little more difficult (3 problems at 10 points each, for a total of 30 points).

Part III is short answer, with 2 problems of varying difficulty and points (total of 30 points).

Pace yourselves carefully, making sure you leave adequate time for the short answer questions.

Note: When we refer to "well-behaved" indifference curves or utility functions, we mean utility functions which have the following properties: monotonicity, diminishing marginal utility, diminishing MRS, plus differentiability.

Part I

True-False-Uncertain, and Why:

5 pts. each -- 30 points total.

Instructions: YOU MUST defend your answer with one or two sentences and/or graphs. The choice of True-False-Uncertain counts zero points without justification. However, your answers should be CONCISE!

1. For some levels of income, it might be that all goods are inferior goods.
2. A consumer with convex, well-behaved indifference curves who is indifferent between the bundles (1,4) and (9,2) will like the bundle (5,3) better than either of the first two bundles.
3. Suppose that a grocery store sells milk by the quart, and records how many quarts are sold at different prices. An economist measures the price elasticity of demand for quarts of milk to be -2 when milk sells for $1/quart. Then the milk company asks the economist to determine the price elasticity of demand for *gallons* of milk (there are four quarts to the gallon), when milk sells for $4/gallon. The economist should report an elasticity of −8.
4. Let Carla be the typical consumer in the economy. Phelps believes that the optimal tax on alcohol should be set in order to equate the loss in Carla's consumer surplus with the expected benefit to Carla from the decreased chance that she will die in a car crash. [Your answer should include a sentence as to why this is or isn't a sensible way to set the tax, according to Phelps.]
5. The new goods bias is unlikely to be an important element of the bias in the CPI, since very few consumers purchase new goods at the initially high prices at which they are offered. [Your answer should define the new goods bias and be specific about why this statement is or isn't a valid evaluation of why it is important!]
6. Suppose that a state government makes an unexpected announcement that it will publicly fund abortions for women who cannot afford them, effective immediately. Seven months later, we measure the change in the birth rate for teenage women in that state. A finding that the birth rate has decreased seven months after the announcement would be consistent with Kane and Staiger's analysis.

Part II

True-False-Uncertain, and Why:

10 points each. Total points = 30.

Instructions: YOU MUST defend your answer with a short paragraph and/or graphs. The choice of True-False-Uncertain counts zero points without justification.

1. Julie was maximizing her utility subject to her budget constraint. Then prices changed, but her income stayed fixed. After the price change, she chose a new bundle, and she found herself better off. Therefore the new bundle costs more at the old prices than the old bundle did.

2. A group of MIT students develop an electric car and take it around the country on tour, starting at home in Boston and then going to New York, Washington DC, Atlanta, New Orleans, Dallas, Los Angeles, and San Francisco (where the students decide to bail out of the tour and stay). Since they have no income of their own, they are sponsored by a local technology company, which is aware that hotel prices and restaurant prices vary by city. Since the company isn't sure how the cost will change from city to city, it proposes the following rule. In New York, the company will give the students funds equal to the cost (in New York prices) of the bundle they purchased in Boston. In Washington, they will provide funds to the students equal to the cost of the bundle (in Washington prices) that they purchased in New York, and so on. The students spend all of their income in each city.

   Over the course of the tour, the students' utility will sometimes increase and sometimes decrease when the go from city A to city B. We can tell whether it will increase or decrease according to whether the Laspeyres price index (taking the city A as "period 0" and the city B as "period 1") goes up or down.

   [Justify your answer carefully, giving the logic behind your answer about how the students' utility will change from city A to city B according to the rule.]

3. A dean wants to measure the effect of the campus alcohol policy on drinking behavior. The campus policy is very strict: no alcohol in the dorms. Dorms are offered as an option for all students. An <u>anonymous</u> survey is conducted of two groups of students (assume they answer honestly): those who live on campus and those who live off-campus, where there is effectively no policy. The dean computes the average number of beers consumed per week over the course of the year in each group, finding that the on-campus students consume an average of 3 beers a week, while the off-campus students consume an average of 10 beers a week.

   This constitutes a "natural experiment," and so we can conclude that on average, students reduce their beer consumption by 7 beers a week when an alcohol policy is in place on campus, relative to a situation where MIT had no alcohol policy.

   [Your answer should include a definition of "natural experiment" and *be specific* about why this does or doesn't fit the definition, as well as how meeting or not meeting the definition affects the conclusions which can be drawn. You should consider prices, weather, and other environmental factors to be constant in the relevant time period.]

Part III

Short Answer

(Total points = 30)

1. (16 pts.) (a) State the Slutsky equation which gives the effect of changing the price of good Y on the uncompensated demand for good X, and provide an interpretation of each term.

   (b) Draw two diagrams, one of which illustrates "gross complements" and one of which illustrates "gross substitutes." Label your diagram with the terms from the Slutsky equation.

   (c) Suppose that you were looking for an example of "gross complements." Name two criteria you would look for, and justify your answer with respect to the Slutsky equation.

   (d) Prove that $\frac{\partial}{\partial P_X} h_Y(P_X, P_Y, \bar{u}) = \frac{\partial}{\partial P_Y} h_X(P_X, P_Y, \bar{u})$. Justify your use of any theorems you invoke.

2. (14 pts.) A consumer has the following indirect utility function:

$$V(P_X, P_Y, I) = -\frac{P_X + 2\sqrt{P_X \cdot P_Y}}{I} - \frac{P_Y + \frac{1}{2}\sqrt{P_X \cdot P_Y}}{I}$$

   (a) Compute the consumer's expenditure function.

   (b) Suppose that income is fixed at I=100. Suppose that prices were P_X=4 and P_Y=9. Suppose that the government puts in a tax of $5 on good X, but rebates enough to the consumer so that the consumer is as well off as he was before the tax. What is the deadweight loss of taxation in this example (that is, what is the difference between the revenue collected by the government and the amount of the rebate)?

   (c) Illustrate your answer to part (b) in a graph, carefully labeled.

   (d) How would your answer to (b) change if the government also taxed good Y by $11.25, keeping the tax on X at $5? [Hint: think before you start calculating.]