

STATE UNIVERSITY OF NEW YORK AT ALBANY

Department of Economics

Ph.D. Comprehensive Examination in Microeconomics, June 23, 2000

Answer 5 of the 7 numbered problems in Part A and two of the three numbered problems in Part B. When possible, show why your answers are correct. Write your answers to Part A in a single bluebook. On the cover of the bluebook, write A. Write answers to the two problems from Part B in separate bluebooks. Write the number of each problem from Part B on the cover next to "SECTION". On the cover of each bluebook write your EXAM number next to "NAME". DO NOT WRITE YOUR NAME on the bluebooks. The exam lasts three hours.

**Part A: Answer 5 out of 7 numbered problems.**

1. State the first fundamental theorem of welfare economics for an economy with production. Is it necessary to assume that the firms have convex production sets? Imagine an economy with private ownership of resources and of firms, and with a government that can costlessly enforce ownership rights. What conclusions can be drawn from the first fundamental welfare theorem about the allocation of resources in such an economy?
2. Suppose that gasoline is made from imported crude oil and sold in competitive markets in a small country. In this country, more expensive cars must use premium gasoline, whereas cheaper cars use regular gasoline. Each gallon of regular gasoline costs  $p+r$  to produce and each gallon of premium gasoline costs  $p+h$ , where  $p$  is the price of a gallon of crude oil and  $r$  and  $h$  are determined by the technology ( $h > r$ ). Consider the ratio equal to the quantity of premium gasoline demanded divided by the quantity of regular gasoline demanded in the country. What properties of the distribution of income and wealth and what characteristics of consumer preferences and the technology determine the way that this demand ratio changes when  $p$  rises?
3. Let  $x(p, w)$  be a  $C^1$  demand function for three goods that is homogeneous of degree 0 and satisfies Walras' Law (the budget identity). Note that  $x$  is not necessarily generated by utility maximization. Let  $S_{ij}(p, w)$  be the  $ij$  element of the  $3 \times 3$  Slutsky matrix  $S(p, w)$  of  $x$ . Show that  $S(p, w)$  is symmetric if  $S_{12}(p, w) = S_{21}(p, w)$ . Explain the economic significance of the symmetry of the matrix  $S(p, w)$ .
4. Given fixed vectors  $a = (a_1, a_2, a_3)$  and  $c = (c_1, c_2, c_3)$ , consider the demand function  $x(\cdot)$  with demand for good  $i$  ( $i = 1, 2, 3$ ) equal to  $x_i(p, w) = c_i + (a_i/p_i)(w - pc)$ , whenever the right side of this last equation is positive. Under what conditions on  $a$  and  $c$  is  $x(\cdot)$  the demand function of a locally nonsatiated competitive consumer? Find the corresponding utility function in that case. Hint: First find a utility function that generates the demand function  $z(\cdot)$  with  $z_i(p, w') = x_i(p, w' + pc) - c_i$ .
5. Can the owners of a competitive firm increase their income by reducing the wages that the firm pays its workers and at the same time offering the workers a share of the firm's profits?
6. In a competitive economy, is the price of a produced good determined by the technology and the prices of the inputs used in its production? If so, show why. If not, show why not and give conditions under which the answer is yes.
7. Will a consumer who satisfies the expected utility hypothesis buy a lottery ticket if the expected money value of the payoff from the lottery is higher than the cost of the ticket?

**Part B: Answer 2 out of 3 numbered problems.**

8. Consider an economy with three agents and one commodity. Let  $x_i$  denote agent  $i$ 's consumption of the commodity. Agents 1 and 2 each have preferences represented by the utility function  $u_i(x_i, x_3) = 2 \ln x_i + \ln x_3$ ,  $i = 1, 2$ , and each is endowed with one unit of the commodity. Agent 3 has the utility function  $u_3(x_3) = x_3$ , and initially has none of the commodity.
  - a) Determine the efficient allocations in this economy.
  - b) Suppose that agents 1 and 2 can voluntarily transfer part of their endowment to agent 3. Determine the

Nash equilibrium transfers. Is the resulting allocation efficient? Explain.

c) Next, suppose that transfers by agents are not allowed, but that the government taxes the endowments of agents 1 and 2 and transfers the proceeds to agent 3. Determine all efficient taxes.

d) Suppose, as in b), that transfers are allowed and that the government subsidizes the individual transfers by awarding agent 3  $s$  units of  $x$  for every 1 unit contributed by either agent 1 or 2 ( $s < 1$ ). The subsidy comes from outside the given economy and  $s$  is fixed exogenously. Discuss the possibility that such a subsidy scheme might generate an efficient allocation.

9. Consider an economy with a continuum of consumers each of whom demands one unit of a differentiated commodity. In principle, there is a continuum of possible varieties of the commodity parameterized along the unit interval  $[0, 1]$ . Consumer  $i$  has a most preferred type  $v_i \in [0, 1]$ . Suppose the population is such that, among all consumers,  $v_i$  is distributed uniformly over  $[0, 1]$ . Then given the varieties offered by firms, consumer  $i$  will purchase that which is closest to  $v_i$ . (In the event of a tie,  $i$  will purchase one or the other.)

a) First, suppose there are two firms, each of which must offer a single variety. Let  $l_j$  denote the variety (location) chosen by firm  $j$ ,  $j = 1, 2$ . Assume both firms wish to capture the largest market share possible, and that they would split the relevant demand equally if they chose to offer the same variety. Identify the Nash equilibrium choices of the firms. Fully explain your reasoning.

b) Suppose, now, a third firm is present. Analyze the Nash equilibria in this case. Again, explain your reasoning.

c) Returning to the case of two (incumbent) firms, suppose a third firm is considering entering but must incur a cost to do so. In order to cover the cost, it is necessary that the new firm capture at least a market share of  $1/4$ . Suppose, the incumbents, firms 1 and 2, are currently playing their Nash strategies as in part a). Would firm 3 enter? If so, what location would it choose? If not, explain why not.

d) Suppose, as in c), that firms 1 and 2 are playing their 2-player Nash strategies and that firm 3 faces an entry cost equivalent to  $1/4$  of the entire market. Now, however, assume that once a firm has selected a location, it would incur a cost of  $1/4$  of the market in order to *change* locations. Assuming that each firm wishes to maximize its *net* market share, determine a Nash equilibrium in this case.

e) Finally, suppose that the incumbent firms have the option of producing more than one variety. In particular, while firm 3 has an entry cost of  $1/4$  of the market, it would cost an incumbent firm  $c \in [0, 1/4]$  to launch a new variety, where  $c$  is again measured in terms of market share. Discuss/analyze the possibility that the incumbents might proliferate brands in order to prevent new firms from entering.

10. Half of the people in a particular city are crude (type 1) in their taste for wine and the other half are sophisticated (type 2). During a given period, no one buys more than one bottle of wine. A person of type  $\theta$  obtains utility 0 by buying no wine and obtains utility  $\theta q - p$  by buying a bottle of wine of quality  $q \geq 0$  at the price  $p$ . There is a single wine seller who incurs a cost of  $q^2$  for each bottle of wine of quality  $q$  sold. The wine seller offers a set of contracts specifying wine quality and price for a bottle. People from the city either accept a contract or do not buy. The seller is an expected profit maximizer.

a) Suppose that the wine seller can recognize a person's type and offer a contract accordingly. Describe contracts that are optimal for the seller.

b) Now, suppose that the wine seller cannot tell which type a person is. Formulate the seller's optimization problem.

c) Consider a set of optimal contracts for the seller in part b), and answer problems (c1), (c2) and (c3). (c1) Show that with these contracts, crude types get utility 0 or less. (c2) Show that a sophisticated type does not prefer any of these contracts to any other contract that offers 0 utility to a crude type. (c3) Show that when these contracts are offered, sophisticated types buy wine of quality at least as high as that bought by

the crude types.

- d) Show that when optimal contracts in part b) are offered, sophisticated types get the same wine quality that they get from the optimal contracts in part a).
- e) Find a set of optimal contracts in part b) and compare them to the optimal contracts in part a). Be sure to compare the seller's profits and the wine qualities received by different types.
- f) What conclusions can be drawn about the effect of asymmetric information?
- g) In part b) is there an incentive for anyone to invest in a signal to show the seller which type s/he is?