Ph.D. MICROECONOMICS CORE EXAM
August 2012

This exam is designed to test your broad knowledge of microeconomics. There are three sections: one required and two choice sections. You must complete both problems in the required section and one choice problem in each of the two choice sections, giving you a total of four problems to complete during the allotted time. The required problems are in section A and the choice problems are in sections B and C. If you should answer more than one choice question in a section, only the first will be considered.

IMPORTANT. You are expected to adhere to the following guidelines in completing the exam for your answer to be considered complete. Incomplete answers will be evaluated accordingly.

- Write legibly. **Number all pages and organize your answers to questions in the same order as they were given to you in the exam. Begin your answer to each question on a new page and identify the question number.**
- Provide clear, concise discussion to your answers.
- Explicitly state all assumptions you make in a problem. Graders will not take unstated assumptions for granted. Do not make so many assumptions as to trivialize or assume the problem away.
- Define any notation you use in a problem and label all graphs completely.
- Explain your steps in any mathematical derivations. Simplify your final answers completely.
- When you turn in your exam answers double check to make sure you have all the pages to each question number, in order, and included. The pages you submit as your answer are the only ones that will be considered.

PART A: REQUIRED QUESTIONS

Both problems in Part A (A1 and A2) are required. Answer all parts of all questions.

QUESTION A1

1. You have been hired by a price-taking firm (in both inputs and outputs) that produces "zygotes," using three inputs: *zy (z)*, *go (g)*, and *te (t)*. The firm believes their production of zygotes can best be described by a Cobb-Douglas function:

$$f(z,g,t)=z^{0.3}g^{0.3}t^{0.3}$$

The current input prices are: $4 per *zy*, $3 per *go*, and $5 per *te*. The market price for a zygote is $10. The firm currently produces and sells 25 zygotes per period. The only fixed input to the firm is *te*, where the quantity is fixed at 8. Due to unrest in the world, the firm believes their cost for *zy* will increase to $6 per *zy*.

a) What is the best production strategy for this profit-maximizing firm in the short run with the forecast price change? Your strategy should include the optimal level of inputs, output and profits.

b) What will be the anticipated change in profits for the firm before and after the price change?

c) What is the indirect profit function associated with this problem?

d) What is the long-run demand function for zy's (let the per unit price of *zy*'s be *l,* the per unit price of *go* be *m,* and the per unit price of *te* be *n*.

QUESTION A2

Consider a t period, n firm, Cournot game where each firms' objective is to maximize profit, and the industry has an inverse demand curve equal to $P(Q)=a-Q$ (where of course $Q=q_1+....+q_n$). Each firm has a cost function equal to $C(q_i)=c_iq_i$ (where $c_i<a$, for all i), and a discount rate equal to δ .

a) First, assume $t=n=1$. What quantity will the firm produce and what will the market price be? What is the consumer surplus, and what is the deadweight loss compared to a perfectly competitive industry?

b) Next, assume that $t=1, n=2$, and $c_1=2c_2$. Describe the Nash equilibria for this game. How much profit will each firm make? (solve for profit in terms of a and c_2).

c) Now assume that this is an infinitely repeated game with n firms, and each firm has an identical cost structure ($c_i=c$ for all i). What is the lowest value of δ such that firms can use trigger strategies to sustain the monopoly output level in a subgame-perfect Nash equilibrium? Be sure to state the strategies that each firm plays and describe your notation.

d) Explain what a subgame is and provide a definition of a subgame perfect Nash Equilibria. Why do subgame perfect Nash equilibria sometimes provide more reasonable predictions to game-theoretic problems? Give an example of an unreasonable Nash equilibrium for the previous part (part c) that is not a subgame perfect Nash equilibrium.

PART B: CHOICE QUESTIONS

Answer all parts of either question B1 or B2. If you complete more than one problem, only B1 will be considered.

QUESTION B1

2. Suppose the estimated ordinary demand function for local bus service (for which there is no substitute transportation) is given by:

$$r = 50\text{-}10P$$

where *r* is the number of rides per day and *P* is the price per ride. The price per ride (set many years ago, for no reason anyone remembers) is $1.00. The typical (average) rider spends 0.5% of his or her income on bus service per year and his or her income elasticity of demand for bus service is 0.2.

a) Find the compensated elasticity of demand at the current price for the average rider.

b) The bus service is run by the local municipality (whose objective is to maximize societal welfare, and the evaluating the price per ride). Suppose there are 100 identical riders and suppose the marginal cost per rider is $2.00. What is the optimal price and how many rides will taken?

c) The municipality is also considering selling the bus service to a for profit firm. What is the optimal price the firm will set and how many rides will be taken?

d) Under (c), what is the total amount of compensation that would need to be given to the average rider to make them as well of as they were under the original condition of $1.00 per ride?

QUESTION B2

Suppose an individual's utility function is $U(x, y) = x^{0.5} + y^{0.5}$. Assume income and prices are strictly positive.

a. Find the Marshallian demand.

b. Use a Hessian for the objective function to explain what the utility function and related indifference curves look like. Give an example of two goods for which an individual might have these types of preferences.

c. What typical assumption does this utility function violate?

d. Find the Hicksian demand. Compare and contrast the Hicksian demand with the Marshallian demand.

PART C: CHOICE QUESTIONS

Answer all parts of either question C1 or C2. If you complete more than one problem, only C1 will be considered.

QUESTION C1

True, False, Uncertain: For each of the following statements, indicate if it is true, false, or uncertain. Provide a detailed explanation of your answer.

a. The profit maximizing output level of a monopolist with constant marginal cost c will never increase in c.

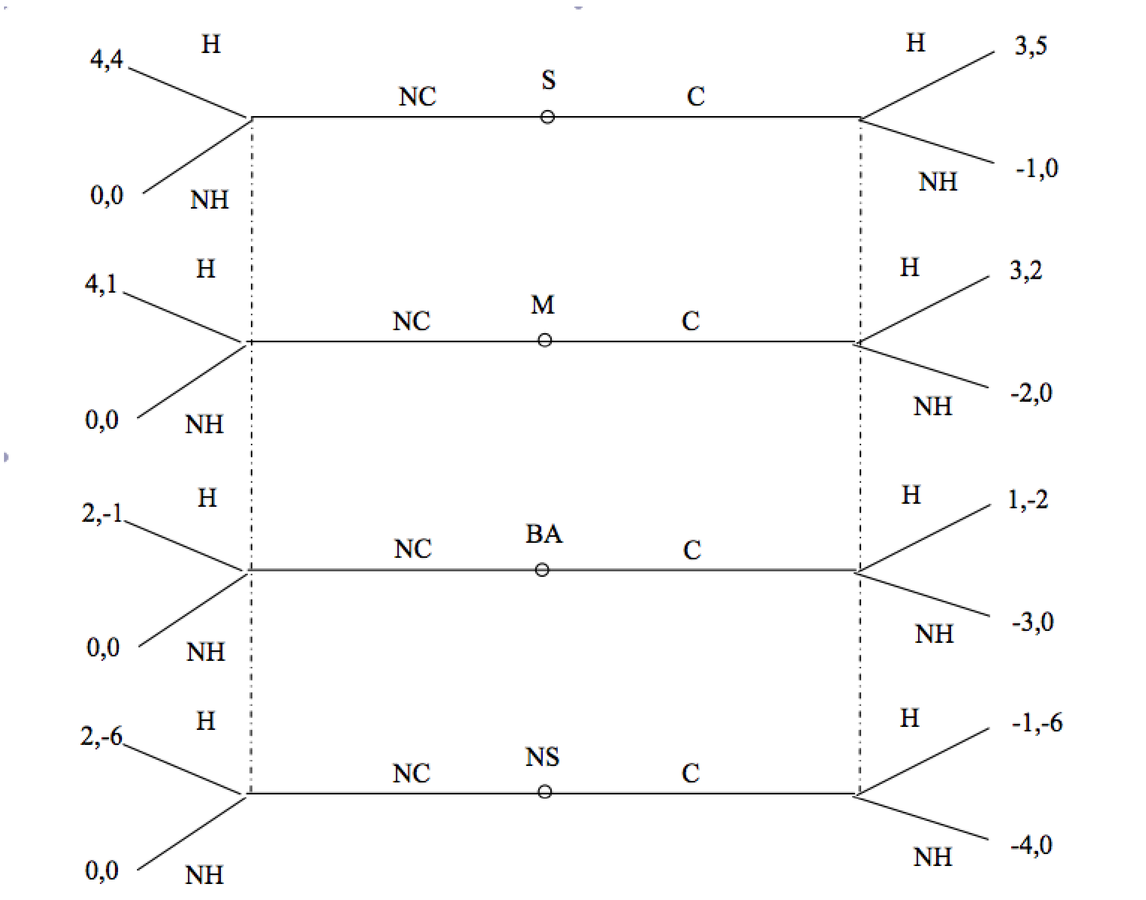
b. The equilibrium price in an oligopoly market must decrease as the number of firms in the market increases.

c. Hicksian demand is homogenous of degree one in utility.

d. On his first visit to the farmer's market, Julio bought 10 nectarines at $.50 each and 2 pounds of grapes at $2/pound. On his next visit to the farmer's market, Julio bought 20 nectarines at $1 each and 4 pounds of grapes at $1/pound. Julio's behavior is consistent with WARP.

QUESTION C2

Consider the following signaling game. The sender can be one of four potential types: smart (S), moderate (M), below average (BA), and not smart (NS) which is determined by nature and observed by the sender, but not the receiver. After observing her type the sender chooses a message M={NC,C} to send the receiver. Once the receiver observes this message and she chooses to either hire (H) or not hire (NH) the sender. The game is represented below. **<u>In all parts make sure to describe your notation</u>.**



a) First assume that p(S)=.5, p(D)=.5 and p(M) = p(BA) =0. What are the pure strategy NE for this game? Using your economic intuition discuss the equilibria.

b) Now assume that p(S)=.15, p(M)=0, p(BA) =.55 and p(D)=.3. What are the pure strategy NE for this game? Discuss.

c) Now assume that p(S)=.3, p(M)= .55 p(BA) =0 and p(D)=.3. What are the pure strategy NE for this game? Discuss.

d) Think of the results of part b and c in the context of affirmative action. Assume that the above model represents a signaling game for a minority group. As a policy maker or social planner, what did you learn from these two different games? Given what you learned from b and c what policies might you consider implementing (or have been implemented) to improve (or which have improved) racial inequality in the United States?