Ph.D. MICROECONOMICS CORE EXAM August 2011

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. Each question has four parts. 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

A1: Charlie and the Expenditure Function

Consider Charlie's the expenditure function E($\boldsymbol{p}$,u) where $u > 0$ is a utility level, $\boldsymbol{p}$ is a vector of n strictly positive prices p_i of n quantities of goods x_i ($i = 1, 2, 3, ..., n$) consumed by Charlie and the a_i are n nonzero constants:

$$E(\mathbf{p}, u) = u \sum_{i=1}^{n} \frac{p_i}{a_i}$$

a) Assuming Charlie is rational, verify that E($\boldsymbol{p}$,u) is an appropriate expenditure function under suitable restrictions on the n constants a_i (i.e., state the properties of the expenditure function and the restrictions required for the properties to hold).

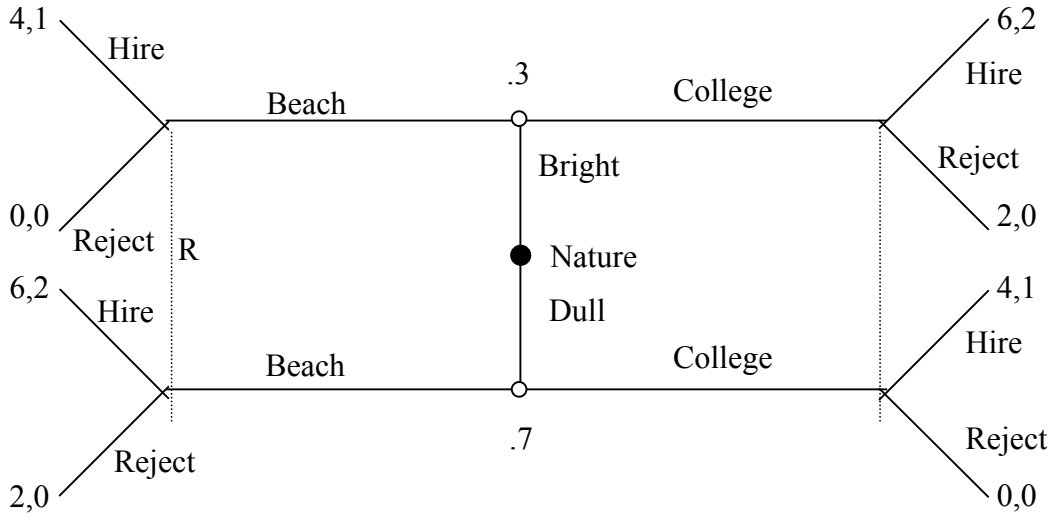
b) Find Charlie's Hicksian and Marshallian Demand functions, and state the condition(s) under which any Hicksian or Marshallian demand will be zero versus positive (if any).

c) Is the Slutsky Equation satisfied? Interpret the terms in the Slutsky equation.

d) Find Charlie's utility function under the restriction $i \neq j$. Explain this result and draw a picture of the resultant indifference curve (in two dimensions).

A2: College or the Beach?

Consider the following dynamic game of incomplete information. In this game there is a potential employee (signaler) who faces two choices: (1) to go to the beach, or (2) to go to college. After the signaler makes his message choice, the employer (receiver) has the option to either: (1) hire the sender, or (2) reject the sender. Note, if offered a job, senders will always accept and a *homogeneous* wage will be paid regardless of the message decision. In this game the sender has private information concerning her aptitude. She has two potential types: (1) bright or (2) dull, and her type is unobserved to the receiver. The way we model this is that, in the first move of the game, the sender's type is determined by nature, and this action is unobserved by the receiver. The payoffs for the game are listed below.



a) First, use your economic intuition. Do the payoffs for this game make sense? If so tell a story for why they do make sense. If not explain why they do not and describe how you could change the payoffs to make the game more realistic.

b) With the original payoffs (not using your updated payoffs), list all pure-strategy Bayesian Nash equilibria for this game. Make sure to describe your notation.

c) Assume that the payoffs for this game are reasonable. Again using your economic intuition, are all of the Bayesian Nash equilibria reasonable predictions for the outcome of this game? Why or why not? If not describe additional criteria (refinements) you could include in the equilibrium concept that would make the predicted outcomes more reasonable.

d) List all pure-strategy Perfect Bayesian Equilibrium for this game.

PART B: CHOICE QUESTIONS

Answer all parts of *either* B1 or B2. If you answer both, *only* B1 will be considered.

B1: Monopoly, Anyone?

Assume a monopoly supplier of a good makes sales to customers located in different regions of the country. The demand functions for the good in each region are

$$q_1 = 1 - p_1$$

and

$$q_2 = \tfrac{1}{2} - p_2 .$$

Assume production and transportation costs are zero.

a) Assuming that a monopolist must charge a uniform price across the two regions, calculate the profit maximizing uniform price.

b) Assume that the monopolist can engage in 3rd degree price discrimination. Calculate the profit-maximizing price for each region.

c) For this does 3rd degree price discrimination increase or decrease welfare, as measured as the sum of consumers' plus producers' surplus (i.e., b) compared to a))? Is this a general result when one compares uniform monopoly prices with 3rd degree price discrimination?

d) Assume the monopolist is selling an intermediate product, and that the demand functions above are the derived demands for the intermediate product of two downstream industries. If 3rd degree price discrimination is not possible, discuss how the monopolist may achieve the same result by entering the downstream market as an industrial producer. Using economic theory and logic, which one will the monopolist integrate into, and why?

B2: It's Electrifying

Consider a community in the western US. Electricity to the community is currently provided by XYZ, Inc. - a large merchant company. Given the age of the grid that brings electricity into the community, the unreliability of service provided by XYZ, and the escalating cost of delivery, the community is considering building a distributed electricity generation system that could deliver up to 3,000 megawatt hours (MWH) of electricity per year (there are some assumptions made concerning the annual delivery of electricity and of the peak capacity of the generator.) and would replace XYZ. (Define a distributed system as one that serves a localized area and is not connected to a larger grid.) Here are a few factors about the community. There are 200 identical homes in the community and because of a building moratorium, there will be no additional homes built. Each home has an identical annual demand for electricity, described by

$$q = 475 - .9P + .12I \ ,$$

where q is annual quantity of electricity demanded (in MWH), P is the price per MWH (in \$'s), and I is the income of the household (in \$1,000). The current household income is \$50 per year. The marginal cost to provide electricity from the distributed system is \$500 per MWH.

a) The community is considering having a for-profit firm build and run the system. What price per MWH (commodity charge) would the firm charge for the electricity

b) Suppose in addition to the commodity charge you found in a), the community had to pay an annual fixed charge over the life of the generator to pay for the capital costs. Assuming a zero discount rate, what is the largest fixed cost per year a household would be willing to pay?

c) If the community chose to build and run this project themselves as a non-profit, what price would be charged for electricity? Of this price, what is attributable to the marginal cost of capacity?

d) Under a) find the elasticity of income and explain the impact on the consumer's demand for electricity of a change in income.

PART C: CHOICE QUESTIONS

Answer all parts of *either* C1 or C2. If you answer both *only* C1 will be considered.

C1: Decisions, Decisions

Suppose an individual has a mutually exclusive investment choice to make now: she can choose asset A or B. If she chooses to invest in A, her income will be 5, with certainty. If she chooses B, she may end up earning 400, but there is only a 1% chance of this event. Otherwise, given that she chooses B, she will earn 2. Suppose her value of whatever income actually occurs from her investment choice is given by

$$U = 1 - \frac{1}{m}$$

where m represents the income from the chosen asset.

a) What are her risk preferences?

b) Given the above information, what is the rational choice, asset A or B? Explain.

c) Suppose prior to making her asset choice, she can hire a financial analyst that guarantees to be able to forecast the outcome of B with certainty. What is the expected utility of perfect information?

d) The financial analyst charges 2 for his forecast. Should our investor pay 2 in order to gain this information? Why or why not?

C2: Murray and the Airplanes

Murray manufactures toy airplanes. Murray's production function is $Q = 5KL$ where Q is in airplanes, L is labor in person hours, and K is capital in machine hours. Murray's labor costs are $25 per hour (inclusive) and per unit capital costs are $100 per hour (an implicit rental charge). Murray currently pays $80,000 per month in labor and capital costs.

a) Given the above information, determine Murray's optimal capital/labor ratio.

b) What is Murray's optimal level of labor and capital inputs, given the constraints of the problem? What is the firm's optimal output?

c) At the output from b), what is the minimum price necessary for Murray to breakeven – assuming no fixed costs.

d) Suppose a per unit output tax of $0.10 were levied. What is Murray's optimal output now, and how does the tax affect the minimum price for Murray to breakeven?