Ph.D. Core Examination

MICROECONOMICS

Wednesday, July 8, 2015

WRITE in **black ink** and write only on **one side** of each page.

DO NOT WRITE in the margins.

Be sure the "random number" stamped on your paper is the correct number (the number you were given by the department office). Be sure to put your **random number** in the upper left hand corner of **every page** you write on.

On the **first page** of your examination write:

- the name of the examination
- the date of the examination

Put the **page number** in the upper right hand corner of **every page** of your examination.

When you have completed your examination, write the **total number** of pages on the **back** of the last page.

Put your examination in the envelope to be turned in.

Results of the examination will be posted by your random number outside the Office of Graduate Student Affairs and sent to you by letter.

TIME: THREE HOURS

1. **You must answer ALL questions and justify ALL answers.**

2. **The exam is out of 180 points. Parts I and IV are each worth 60 points. Parts II and III are each worth 30 points.**

Note: The envelope you will be given will contain a colored writing pad to be used for notes and a white writing pad with your random number to be used for writing your final answers.

I. BASIC PRICE THEORY QUESTIONS (60 points; 10 points each)

Answer each of the following six questions as TRUE, FALSE, or UNCERTAIN, and justify your answer in a half of a page or less. Your grade will depend entirely on your justification.

1) The fact that physicians charge less to poor patients is good evidence that physicians have market power.

2) The long-run supply of capital cannot slope down versus the capital rental rate.

3) The demand for assembled toys is less price elastic than the demand for toys that customers have to assemble.

4) A durable goods market adjusts more rapidly to changes in demand when the durable good has a high depreciation rate.

5) The individual-level and market-wide price elasticity of demand for Microsoft Excel are essentially the same because market demand is the sum of individual demands.

6) Reductions in the quantity index for the consumption of cigarette products indicate that the population is smoking less over time.

II. GENERAL EQUILIBRIUM AND CHOICE THEORY (30 points)

(a) (15 points) Consider an economy with production in which there are n goods and in which each consumer's utility function is strongly increasing.

(i) (5 points) Suppose that the price vectors $\mathbf{p}, \mathbf{p}' \in \mathbb{R}^n_{++}$ are Walrasian equilibria and that neither is proportional to the other. Using the fact that excess demand is homogeneous of degree zero, prove that there is a Walrasian equilibrium price vector $\mathbf{p}'' \geq \mathbf{p}$ in $\mathbb{R}^n_{++}$ such that $\mathbf{p}'' \neq \mathbf{p}$ and $p''_k = p_k$ for at least one good k.

(ii) (10 points) Suppose that this economy's excess demand function, $z : \mathbb{R}^n_+ \to \mathbb{R}$, is differentiable and satisfies the following gross substitutes condition.

$$\frac{\partial z_k(\mathbf{p})}{\partial p_l} > 0, \text{ for all distinct } l \text{ and } k.$$

Using the result that you just proved in (i), prove that this economy can have at most one Walrasian equilibrium in which $p_1 = 1$. (You can receive up to 5 points out of 10 if you consider the special case of two goods.)

(b) (15 points)

(i) (10 points) Define a social choice function and state the Gibbard-Satterthwaite Theorem (you need **not** define the other terms used in the statement of the theorem).

(ii) (5 points) Show that the conclusion of the Gibbard-Satterthwaite theorem need not hold when there are just two alternatives. (Hint: You may assume an odd number of individuals if this is helpful.)

III. Game Theory (30 points)

In the extensive form game below, find

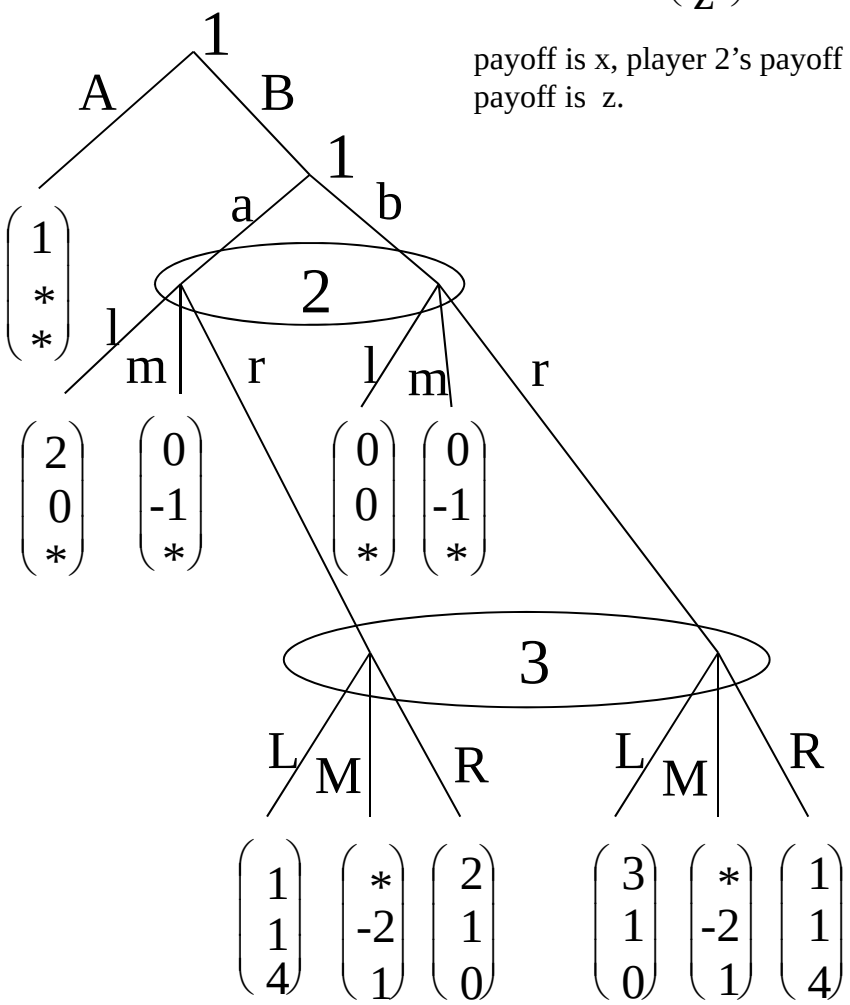
(a) (10 points) A pure strategy Nash equilibrium that is not subgame perfect. Why is it not subgame perfect?

(b) (10 points) A pure strategy subgame perfect equilibrium that is not sequential. Why is it not sequential?

(c) (10 points) A sequential equilibrium.

An asterisk in the figure below indicates that the particular payoff in that entry is not relevant.

The notation $\begin{pmatrix} x \\ y \\ z \end{pmatrix}$ indicates that player 1's payoff is x, player 2's payoff is y and player 3's payoff is z.



IV. INFORMATION ECONOMICS (60 points)

Consider the following variation of the standard labor-market signaling model. Suppose that a worker can be one of two equally likely types, $t \in \{1, 2\}$. If a worker of type t receives education $e \in [0, \infty)$ and wage w, her payoff is $w - (e^2/t)$. In contrast to the standard model, education affects productivity. The productivity of a type t worker who receives education e is $t + 2\alpha e$, where $\alpha \in (0, 1)$. Except as noted below in part (a), the game played by the worker and the firms as well as the equilibrium concept are the same as in the standard signaling model.

(a) (5 points) Characterize the levels of education of both types of workers as a function of α if the firms *can* observe the worker's type.

For the next three parts, assume that the firms *cannot* observe the worker's type, i.e., that the worker's type is private information.

(b) (5 points) Characterize the level of education of a type-1 worker as a function of α in any separating equilibrium.

(c) (25 points) What are the lowest and highest possible education levels that a type-2 worker can receive in any separating equilibrium?

(d) (25 points) What are the lowest and highest possible education levels that a worker receives in any pooling equilibrium?