Ph.D. Core Examination
MICROECONOMICS
Wednesday July 5, 2017

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). 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 answers **ONLY** in the envelope to be turned in.

You will be notified of the results by Random Number in the following weeks.

TIME: THREE HOURS

1. You must answer ALL questions and justify ALL answers.
2. The exam is out of 180 points. Part I is worth a total of 60 points. Each of Parts II, III, IV, and V are 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*)

Answer each of the following as TRUE, FALSE or UNCERTAIN and justify your answer. Your grade will depend entirely on the quality of your justification. Evaluate the correctness of the conclusions presented in each of the statements whether you are answering TRUE, FALSE or UNCERTAIN.

1) A subsidy to the production of ethanol from corn would likely benefit corn farmers by more than the amount of the subsidy even though some of the benefits from the subsidy will go to ethanol consumers.
2) An anticipated subsidy to future housing construction will raise housing rental rates in the near-term even though it will reduce housing prices and housing rental rates in the long term.
3) Higher costs for labor will reduce measured profits for an industry with constant returns to scale if there are adjustment costs to capital.
4) Stricter enforcement of drug trafficking laws will reduce the profits of drug suppliers and induce suppliers to exit the industry.
5) A finding that the use of bus travel declines in response to an exogenous increase in wage rates (holding all goods prices fixed) generated by a randomized experiment, i.e. that an experiment increases the wages for a random group from a sample of workers without affecting the wages (or use of bus travel) for the control group, would be good evidence that bus travel is an inferior good for this group of individuals.
6) Individual level labor supply elasticities are likely to exceed the corresponding macro level responses because there is less substitution possibilities in the aggregate.

II. GENERAL EQUILIBRIUM THEORY QUESTION (*30 points*)

Consider a two-consumer two-good exchange economy in which consumers 1 and 2 respectively have utility functions $u^1(x_1,x_2) = 2x_1+x_2$ and $u^2(x_1,x_2) = x_1+2x_2$ for consumption bundles (x_1,x_2) in the consumption set $\mathbb{R}_+^2$, and have initial endowments $\mathbf{e}^1$ and $\mathbf{e}^2$ in $\mathbb{R}_+^2$ such that $\mathbf{e}^1+\mathbf{e}^2 = (10,10)$.

(a) Identify the set of Pareto efficient allocations for this economy.

(b) For each Pareto-efficient allocation, identify the set of price vectors that would form a Walrasian equilibrium if this efficient allocation were the consumers' initial endowment. You may use the normalization $p_1=1$. (*Hint:* If you have difficulty, you may start with an efficient allocation in which consumer 1 gets strictly greater utility than consumer 2.)

(c) Show (by formulas or by labelling different regions on an Edgeworth box diagram) what the Walrasian equilibrium prices and Walrasian equilibrium allocations would be for each initial endowment such that $\mathbf{e}^1\geq(0,0)$, $\mathbf{e}^2\geq(0,0)$ and $\mathbf{e}^1+\mathbf{e}^2 = (10,10)$.

III. GAME THEORY QUESTION (*30 points*)

Consider a game where player 1 must choose T or B, player 2 must choose L or M or R, and their utility payoffs (u_1,u_2) depend on their choices as follows:

Player 1 \ Player 2:	L	M	R
T	0, 0	6, 5	4, x
B	1, 9	9, 5	3, 3

The payoff $x = u_2(T,R)$ has been left unspecified in the above table, so that we can consider several different assumptions about it in (a)-(c) below.

(a) For what range of x is the action M strictly dominated for player 2 by some randomized strategy? (*Hint:* You can start by showing how M could be dominated if x were very high.)

(b) Suppose that x=6. With randomization, how many Nash equilibria does this game have? Show all the equilibria, and compute the expected payoff for each player in each equilibrium.

(c) Now suppose that x is drawn from a Uniform distribution on the interval from 5 to 6. When they play the game, player 2 privately knows the value of x, but player 1 only knows that it has been drawn from this Uniform [5,6] distribution. So x now may be considered player 2's type. Find a Bayesian equilibrium in which player 1 would randomize, using each of his possible actions with a strictly positive probability. (You do not need to show expected payoffs here.)

IV. OPTIMAL AUCTION PROBLEM (*30 points*)

Consider the standard Independent Private Value auction model with n bidders. Assume that the distribution of valuation of each bidder is given by the CDF F supported on the interval [1, 2]. (There is a pdf f on the interval [1,2) corresponding to the CDF F.) In addition, the virtual valuation of each bidder is a weakly increasing function.

Consider the following allocation:
(i) if the valuation of each bidder is strictly smaller than two, the seller keeps the object with probability one half and, with the remaining probability, the object is randomly assigned to a bidder with equal probabilities.
(ii) if there is at least one bidder whose valuation is two then the object is randomly assigned to one of those bidders whose valuation is two with equal probabilities.

a. Argue that this allocation can be implemented.

b. Suppose that a revenue-maximizing seller implements this allocation. What can one conclude about the CDF F?

V. MORAL HAZARD PROBLEM (*30 points*)

Consider the following moral hazard problem. There is a firm and a single worker who can either exert effort ($e = 1$) or shirk ($e = 0$). If the worker exerts effort, the output, π, is 10. If the worker shirks then the output, π, is 10 with probability p and $L(\geq 0)$ with probability 1-p such that $p10 + (1-p)L = 5$. The distribution of output conditional on the worker's effort choice is common knowledge. First, the owner of the firm offers a wage schedule $\{w(\pi)\}_\pi$ such that $w(\pi) \geq 0$ for all π. Then the worker decides whether to exert effort or to shirk. If the realized output is π, the owner's payoff is $\pi - w(\pi)$ and the worker's payoff is $w(\pi)-3e$. Both the owner and the worker are expected payoff maximizers.

a. Show that if the owner wants to implement $e = 1$, the worker's incentive constraint binds.

b. Show that $w(L)=0$.

c. For what values of (p, L) does the owner want to implement $e = 1$?

d. Suppose that prior to interacting with the owner, the worker can choose any pair (p, L) as long as $p10+(1-p)L = 5$. This choice is observed by the owner before he determines the wage schedule. What is the equilibrium choice of the worker?