**HOWARD UNIVERSITY**

**DEPARTMENT OF ECONOMICS**

**CODE NUMBER \_\_\_\_\_\_\_\_\_\_ TOTAL NUMBER OF PAGES­­­\_\_\_\_**

**DATE\_\_\_\_\_\_\_\_\_\_\_**

**COMPREHENSIVE EXAMINATION: Spring 2020 Microeconomic Theory PhD**

**EXAMINERS:**

1. **Dr. Omari H. Swinton, Chairperson**
2. **Dr. Zhun Xu**
3. **Dr. Alex Henke**
4. **The examination is scheduled between the hours: 9:30 a.m-1.00 pm**

**ALL STUDENTS ARE TO BE SEATED BY 9:15 a.m.**

1. **YOU ARE REQUIRED TO ANSWER ONLY FIVE (5) QUESTIONS.**

**Any additional questions answered over the required number from each category will NOT receive credit.**

1. **Correct answers to questions NOT asked will receive NO credit.**
2. **Be sure to write the Code Number assigned to you in the TOP LEFT HAND CORNER OF THIS SHEET AND ON EACH ANSWER SHEET. DO NOT WRITE YOUR NAME ON ANY SHEET OF THE EXAMINATION.**
3. **Begin each question on a new page. Number each page used in sequence. Write only on one side of the paper.**
4. **Write clearly and illustrate your answers with graphs whenever and wherever possible.**
5. **USE ONLY BLACK INK PENS.**
6. **At the end of the examination, please indicate the total number of pages being submitted in the space provided in the TOP RIGHT HAND CORNER of this sheet.**

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1. **Bring your pens, pencils, calculators and rulers.**
2. **No briefcases, book bags or sacks, no handbags larger than 10 x 6 of any form are to be brought into the examination room.**
3. **No books, notes or other study material are to be brought into the examination room.**
4. **During the Examination there is to be no communication between or amongst students for any purpose. All questions must be directed to and channeled through the faculty member conducting the examination.**
5. **Only the scrap paper provided by the proctor is to be used for the examination. Scrap paper should bear the code number assigned to each student, and be handed over to the proctor along with the examination.**
6. **Students are not expected to leave the examination room before completing their examination and turning it in to the proctor.**
7. **NO FOOD OR SMOKING is permitted in the examination room.**
8. **It is the student’s responsibility to remove any coffee or water containers taken into the examination room.**
9. **NO CELL PHONES ARE ALLOWED.**
10. **EXAMINATION RESULTS WILL ONLY BE GIVEN TO STUDENTS WHO ARE REGISTERED.**

**CODE NUMBER\_\_\_\_\_\_\_\_\_\_\_**

**STUDENTS: PLEASE CIRCLE ONLY THE QUESTIONS ANSWERED AND PROVIDE THE PAGE NUMBERS.**

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| **QUESTIONS** | **PAGE NUMBERS** |
| **1.** |  |
| **2.** |  |
| **3.** |  |
| **4.** |  |
| **5.** |  |
| **6.** |  |
| **7.** |  |
| **8.** |  |

**1.** Let . Find the following:

1. the Marshallian demand functions for x and y.
2. the indirect utility function.
3. the compensated (Hicksian) demand functions for x and y.
4. the expenditure function.
5. Use your answers to a and d to derive the Hicksian demand functions for x and y. Compare these to your answers to c. Explain what you are doing.
6. Use your answers to b and c to derive the Marshallian demand functions. Compare these to your answers for a. Explain what you are doing.
7. Write the Slutsky equation for good x.

**2.** A seller’s production function is , , and the competitive output price is .

1. Does the production function exhibit constant, increasing, or diminishing returns to scale?
2. For part (b) only, suppose k is fixed at and labor is variable. Find the short run cost function .

For all parts going forward, assume we are in the long run and all inputs are variable.

1. Find the long run cost function .
2. Find conditional demand for labor.
3. Find the profit-maximizing q.
4. Find unconditional demand for labor.
5. Find the profit function.
6. Suppose the production possibility frontier for an economy that produces one public good (y) and one private good (x) is given by

**x2 +100y2 =5,000**

This economy is populated by 100 identical individuals, each with a utility function of the form

**Utility = (xiy)1/2**

where xi is the individual’s share of private good production (=x/100). Notice that the public good is nonexclusive and that everyone benefits equally from its level of production.

* 1. If the market for x and y were perfectly competitive, what levels of those goods would be produced? What would the typical individual’s utility be in this situation?
  2. What are the optimal production levels for x and y? What would the typical individual’s utility level be? (Hint: The numbers in this problem do not come out evenly, and some approximations should suffice.)

1. An auctioneer holds a second-price auction for two bidders, Ann (A) and Bonnie (B), who have independent private values of the good and . If a bidder wins, her payoff is her value minus the price she pays, and if she loses, her payoff is 0. The values are independently and identically distributed, but otherwise you don’t need to know the specific distributions to solve the problem. Ann and Bonnie’s respective strategies are to bid some value , that is, bid given their privately-known value (type).

a. Explain what a second price auction is, who wins given some pair of bids and , and what the winner pays.

b. Why is a strategy where Ann bids above her own value weakly dominated by a strategy where she bids her value?

c. Why is a strategy where Ann bids below her own value weakly dominated by a strategy where she bids her value?

d. Applying the ideas from (b) and (c) to both Ann and Bonnie, what is the Weakly Dominant Strategy Equilibrium for this game?

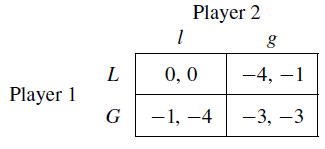
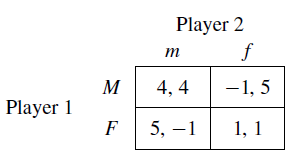
e. Suppose the good had one true value for both bidders equal to the average of and (signals that are still i.i.d.); hence, the good’s true value has a *common component*. Suppose Ann knows Bonnie is going to bid her own evaluation no matter what, but like normal, Ann doesn’t know . Explain why bidding is now a strictly dominat*ed* strategy for Ann.

1. Duopolist firms 1 and 2 compete on price with some market differentiation. Demand for firm is . Neither firm has costs.
   1. Find the best response functions for each firm in the static game.
   2. Find the unique Nash equilibrium prices in the static game.
   3. Are prices strategic complements or strategic substitutes? Briefly explain.
   4. Does Firm 1 want Firm 2 to increase or decrease ? Don’t explain.

For parts (e) and (f), modify the game as follows: Firm 1 sets , Firm 2 observes , *then* Firm 2 sets , then goods are sold and payoffs are determined as normal.

* 1. Either by using your answer from part (f) or with intuition, note whether prices will be higher or lower for Firm 1 and then for Firm 2 compared to part (b).
  2. Find the new unique subgame perfect Nash equilibrium prices.

1. Consider the following two stage games, the Prisoner’s Dilemma (PD, left) and the Revenge game (R, right). When relevant, the discount factor is , .



1. Take both games separately as static games. Solve for all pure strategy Nash equilibria (NE) for PD, and then do the same for R.
2. Suppose the players play a three-stage game in the following order: R, PD, PD. Find the two pure strategy subgame perfect Nash equilibria (SPNE).
3. Suppose the players play a two-stage game in the following order: PD, R. Find a pure strategy SPNE that supports the play of (M,m) in the first round for high enough .
4. Find the lowest that supports the SPNE you found in part (c).
5. A principal hires an agent to produce an output of value equal to . represents effort, where the agent endures a cost of effort . represents productivity, where an agent is either a “high type” and , or the agent is a “low type” and . These types occur with equal prior probability of ½. The output is observable and verifiable, but only the agent observes or individually. The principal offers a take-it-or-leave-it contract with a specified wage and output contingent upon the agent’s report of , meaning the principal will pay when the agent reports and produces , and he will pay when the agent reports and produces . The agent takes the offer or leaves it; if he leaves, his outside option is a payoff of 0. If the contract is signed, the principal’s realized payoff is , and the agent’s realized payoff is .
   1. **For part (a) only**, suppose the Principal observes all the variables, so the agent can’t lie. Explain what the IR (individual rationality) constraint is for a particular type, high or low. Use it to find the First Best contract (optimal wage and effort to maximize the principal’s profit) when and when .
   2. Suppose , and the agent wants to lie and say . Further suppose the principal sets . What *actual* effort must the lying agent exert to produce a value of given his true production is ? What is his cost of effort?
   3. Construct the incentive compatibility constraint , that is, the incentive compatibility constraint for the high type.
   4. Solve for the second best contract . Use and and ignore the other constraints.
   5. Compare each effort and wage in part (c) to part (a); is it higher, lower, or the same?
6. A monopolist has a cost function . The monopolist faces a market demand curve given by .
   1. Find marginal cost.
   2. Calculate the profit-maximizing price-quantity combination for the monopolist. Also calculate the monopolist's profits.
   3. What output level would be produced by this industry under perfect competition?
   4. Calculate the consumer surplus obtained in case (c). Show that this exceeds the sum of monopolist's profits and the consumer surplus received in case (b). What is the value of the deadweight loss from the monopolization? *Hint: The area of a triangle is 0.5 \* base \* height.*