EC201 Intermediate Microeconomics

Boston University Summer Term 2

Final Exam

August 10th, 2016

Start time:	1:00PM
Duration:	2 hours
Total Points:	120 (1 point = 1 minute)
Permitted materials:	Non-programmable calculator

- Please write only your BU ID on the blue books (not your name).
- If using multiple blue books, please write which questions are in each blue book on the front.

Question 1 – (12 Points)

The following parts (i), (ii) and (iii) of this question are *unrelated*. Consider each separately.

(i) **(4 Points)** John says he strictly prefers $(x_1, x_2) = (2,3)$ to $(x_1, x_2) = (1,3)$. John also says he strictly prefers $(x_1, x_2) = (1,3)$ to $(x_1, x_2) = (3,1)$. Using this, come up with a preference relation between two bundles such that John would violate transitivity. Explain why.

(ii) **(4 Points)** Mary says she strictly prefers $(x_1, x_2) = (1,2)$ to $(x_1, x_2) = (100,1)$. Do Mary's preferences violate monotonicity? Why/why not?

(iii) **(4 Points)** Sarah says she is indifferent between the bundles $(x_1, x_2) = (1,9)$ and $(x_1, x_2) = (9,1)$. Using this, come up with a preference relation between two bundles such that Sarah would violate convexity. Explain why.

Question 2 – (15 Points)

Your utility function for goods 1 and 2 is:

$$u(x_1, x_2) = x_1^{\frac{1}{2}} + \frac{1}{2}x_2$$

- **(7 Points)** If the prices of goods 1 and 2 are $p_1 = 1$ and $p_2 = 2$ and you have \$10 to spend, how much will you buy of each good?
- **(3 Points)** Is good 1 normal, inferior, or neither?
- **(5 Points)** What is the own-price elasticity of demand for good 1? For this you will need to find the demand function $x_1(p_1, p_2, m)$. Is it inelastic, elastic or unit elastic?

Question 3 – (9 Points)

A firm cuts down enormous trees and sells the wood. To cut down a tree it needs 2 sawyers (workers who saw down trees for a living) and a giant two-person saw. One sawyer is not able to use a saw on their own, as the saws are very big. If there are 3 sawyers with only 1 saw, the third sawyer will be idle (they can't help as the saw can only be used be two people).

(i) **(5 Points)** Call the sawyers x_1 and the giant saws x_2. Given the information provided, what is the production function $f(x_1, x_2)$ for cutting down trees?

(ii) **(4 Points)** Sketch an isoquant for this production function.

Question 4 – (18 Points)

The cost function for a firm in a perfectly competitive industry is given by:

$$c(q) = q^2 + 1$$

All firms have the same cost function. The market demand function for the good sold in this industry is:

$$D(p) = 100 - 10p$$

(i) **(2 Points)** What is each firm's average cost function?

(ii) **(2 Points)** What is each firm's marginal cost function?

(iii) **(7 Points)** There are 30 firms in the industry in the short run. What is the industry supply curve? What is the equilibrium market price? How much will each individual firm produce? What will each firm's profits/losses be?

(iv) **(7 Points)** How many firms will be in this industry in the long run?

Question 5 – (15 Points)

You are considering developing a new piece of software currently unavailable in the world. If you develop it, you will patent it and then you will have monopoly rights to sell that software. You have \$200 sitting in your bank account and the development of the software will cost \$100. Your friend, who is a marketing expert, tells you that the demand for your software will be:

$$D(p) = 50 - \frac{1}{2}p,$$

where p is the price per download of the software. Each additional unit of software sold will incur you no cost.

However, you are concerned that the government will regulate the sale of your software. Your friend in the government gives you the following information.

- There is a $\frac{1}{3}$ probability that the government will not regulate you at all, and you will be free to choose any price you wish.
- There is a $\frac{1}{3}$ probability that the government will force you to charge at marginal cost.
- There is a $\frac{1}{3}$ probability that the government will force you to charge a price such that you will break even.

Answer the following questions:

(i) **(10 Points)** What profit will you make from each of the three possible government actions (no regulation and two types of regulation)?

(ii) **(5 Points)** If your utility for wealth is $u(W) = \sqrt{W}$, will you decide to go ahead and develop the software? Show why or why not.

Question 6 – (15 Points)

An art gallery is frequented by both art students and rich art lovers. The inverse demand curve for both groups for entry into the art gallery is:

$$p_S(q_S) = 20 - q_S$$
$$p_R(q_R) = 40 - q_R$$

The art gallery has the following cost function:

$$c(q_S, q_R) = 10(q_S + q_R) + 10$$

(i) **(7 Points)** Suppose first that the art gallery can't tell the two groups apart. What price should it charge for entry? How many people will visit the art gallery? What will the art gallery's profits be? What is the consumer surplus?

(ii) **(6 Points)** Now suppose the art gallery can charge different prices to the different groups. The students will show that they are students by showing their student cards. What prices should the art gallery charge to both groups? How many of each group will visit the art gallery? What will the art gallery's profits be? What will the total consumer surplus be?

(iii) **(2 Points)** Suppose the art gallery can't tell the groups apart and now decided to offer two types of gallery experiences. One gives only entry but the other also includes a tour. The prices and quality of two different entry tickets are designed such that the students self select into the ticket that doesn't include a tour and the rich group self selects into the more ticket that does include the tour. What degree of price discrimination would this be? (No calculation is required).

Question 7 – (18 Points)

Answer the following questions about these games.

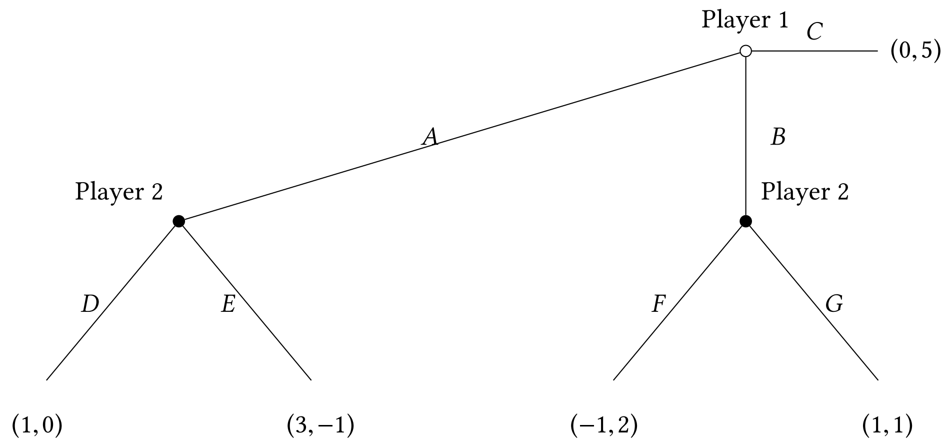
(i) **(6 Points)** Find all the Nash equilibria (pure and mixed) of the following game:

	ℓ	r
u	$2,2$	$0,5$
d	$5,0$	$1,1$

(ii) **(6 Points)** Find all the Nash equilibria (pure and mixed) of the following game:

	L	R
U	$3,-3$	$-1,2$
D	$-3,4$	$5,-6$

(iii) **(6 Points)** Find the subgame-perfect Nash equilibrium of this extensive-form game:



Question 8 – (18 Points)

Two firms compete in a particular industry by simultaneously setting quantities. The market price is then determined from the sum of the two firms' quantities. They both have the same cost function:

$$c_1(q_1) = 4q_1 \qquad \text{and} \qquad c_2(q_2) = 4q_2$$

The inverse demand curve for the good that they sell is:

$$p(q) = 10 - q$$

where $q = q_1 + q_2$, the sum of the two firms' quantities.

(i) **(6 Points)** Find the Cournot equilibrium quantities (show your work, do not just write down the final answer). What profits will each firm make?

(ii) **(4 Points)** If both firms decided to collude and form a cartel in order to increase their profits, what quantity will they jointly produce and what profits would they get? (Assume both firms will produce the same output and share the cartel profits equally).

(iii) **(4 Points)** If firm 1 were to cheat on the cartel, what quantity should it produce in order to maximize its profits (assuming firm 2 will stick to the cartel quantity)? What profit would it make by cheating?

(iv) **(4 Points)** Suppose that when they formed the cartel they said that if any firm cheated on the cartel they would both produce at the Cournot equilibrium forever. If the interest rate is 10%, would any firm firm want to cheat on the cartel? Show why or why not.