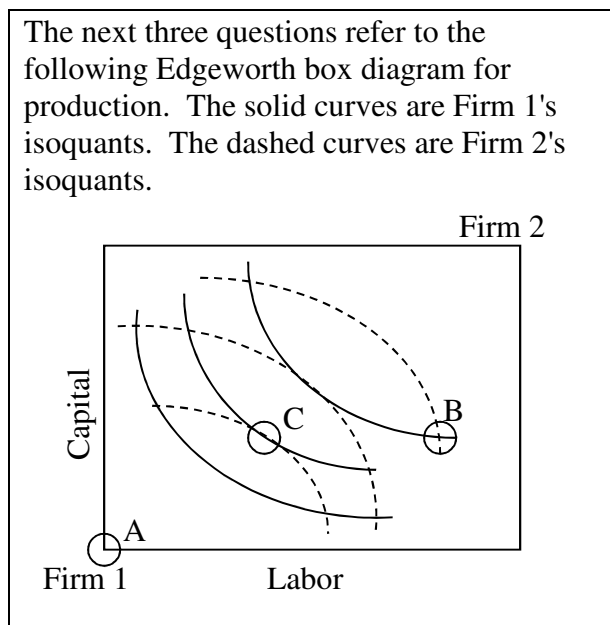


EXAMINATION #4 VERSION B
“General Equilibrium and Market Power”
December 3, 2012

INSTRUCTIONS: This exam is closed-book, closed-notes, and calculators are NOT permitted. Point values for each question are noted in brackets.

I. MULTIPLE CHOICE: Circle the one best answer to each question. Feel free to use margins for scratch work [1 pt each—12 pts total]

The next three questions refer to the following Edgeworth box diagram for production. The solid curves are Firm 1's isoquants. The dashed curves are Firm 2's isoquants.

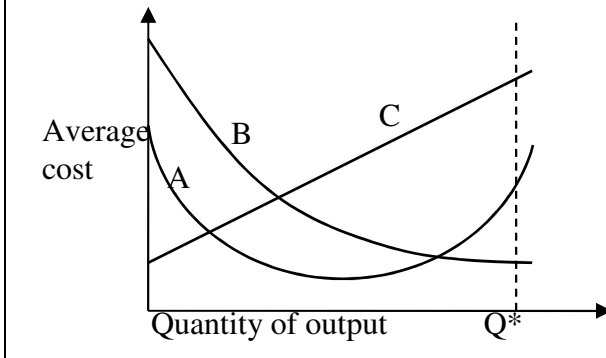


- (2) Firm 1 and Firm 2 have identical marginal rates of substitution in production at
- allocation B only.
 - allocation C only.
 - both allocations B and C.
 - neither allocation B nor C.

- (3) The contract curve for this Edgeworth box diagram does *not* pass through
- Allocation A.
 - Allocation B.
 - Allocation C.
 - The contract curve passes through all three allocations.
 - The contract curve does not pass through any of these three allocations.

- (1) From allocation B, *both* firms can produce more output if
- Firm 1 gives Firm 2 some capital, and Firm 2 gives Firm 1 some labor.
 - Firm 1 gives Firm 2 some labor, and Firm 2 gives Firm 1 some capital.
 - Firm 1 gives Firm 2 some capital and some labor.
 - Firm 2 gives Firm 1 some capital and some labor.
 - No trade will allow both firms to produce more output.

The next question refers to the graph below of alternative average cost curves. Assume that industry output is at least Q^* .



- (4) Which average cost curve above is typical of a firm that enjoys a natural monopoly?
- Average cost curve A.
 - Average cost curve B.
 - Average cost curve C.
 - None of the above.
 - Cannot be determined from information given.
- (5) Which equation for average cost implies that the firm enjoys a natural monopoly?
- $AC(q) = 10 - 0.2 q^{-1}$.
 - $AC(q) = 4 + 100 q^{-1}$.
 - $AC(q) = 0.001 q^2 + 0.01 q + 3$.
 - $AC(q) = 10$.
 - $AC(q) = 0.2 q$.
- (6) If marginal cost is less than marginal revenue at the current level of output, the firm can increase its profit by
- increasing output.
 - decreasing output.
 - either increasing or decreasing output.
 - none of the above.
 - Cannot be determined from information given.

- (7) Monopoly causes economic inefficiency because
- monopoly prices are unfair.
 - it is unfair for one firm to control the market.
 - monopolists are usually wealthier than their customers.
 - some consumers, willing to pay the marginal cost of the product, are not served.
 - monopolists enjoy profits, called monopoly rents, even in the long run.

- (8) Suppose the demand for a monopolist's product has an elasticity of -5 , and the monopolist's marginal cost is $\$12$. Then the profit-maximizing price is
- $\$7.33$.
 - $\$15.00$.
 - $\$20.00$.
 - $\$30.00$.
 - $\$60.00$.

- (9) Suppose a monopolist faces constant marginal cost, but finds that its price elasticity of demand varies by market segment. In particular, it finds that people with brown eyes have less elastic demand than people with blue eyes. To maximize the monopolist's profit, which market segment should get the *higher* price?
- people with blue eyes.
 - people with brown eyes.
 - both segments should get the same price because marginal cost is constant.
 - cannot be determined from information given.

(10) Suppose an industry is served by just two firms: Firm A and Firm B. If Firm A *decreases* its output while Firm B leaves its output unchanged, then Firm B's profit will

- remain unchanged.
- decrease.
- increase.
- Cannot be determined from information given.

(11) Suppose all the firms in an industry reach an agreement to raise the product price above the competitive level and thereby maximize the sum of their profits. Then each firm has an incentive to cheat on the agreement by individually

- producing less output than its quota as specified in the agreement.
- increasing its price even further.
- decreasing its price.
- all of the above.

(12) The term "differentiated products" means, in economics,

- products for which different consumers have different elasticities of demand.
- the derivative of a firm's output.
- the derivative of a firm's revenue with respect to its output.
- products that are not perfect substitutes.
- products that a firm sells to different customers at different prices.

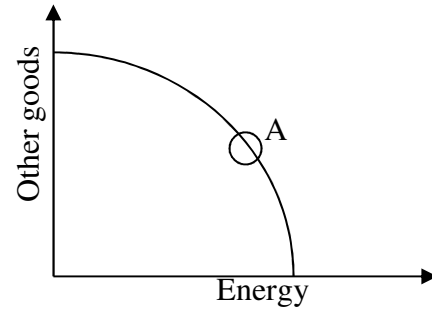
II. SHORT ANSWER: Please write your answers in the boxes on this question sheet. Use margins for scratch work.

(1) [Cost minimization across firms: 6 pts] Suppose Firm A and Firm B must together produce a total of 100 units of output at *minimum total cost*. Firm A's marginal cost function is given by $MC_A = 5 + (q_A/10)$, where q_A denotes Firm A's output level. Firm B's marginal cost function is given by $MC_B = 6 + (q_B/20)$, where q_B denotes Firm B's output level.

- What output level q_A should be produced by Firm A?
- What output level q_B should be produced by Firm B?
- Suppose Firm A and Firm B are competitive firms, taking price as given. What market price would motivate Firm A and Firm B to produce these output levels?

	units
	units
	\$

(2) [General equilibrium: 10 pts] Consider the graph at right of an economy's production-possibility curve. Assume this economy is in general competitive equilibrium at point A, where the slope of the production-possibility curve is -6 .



- Suppose this country wants to produce 30 more units of energy. To do so, must the country *increase* or *decrease* production of other goods?
- By how much?
- What is this country's opportunity cost of a single unit of *other goods*?
- Consider the consumer's budget line with energy on the horizontal axis and other goods on the vertical axis. What must be the slope of every consumer's budget line in this economy?
- If the price of other goods is \$2 per unit, then what must be the price of energy?

units of other goods
units of energy
\$

(3) [Marginal revenue: 6 pts] Suppose a taco vendor with market power is now selling 20 tacos per hour at a price of \$5.00. If she cuts the price to \$4.95, she can sell one more taco per hour (that is, a total of 21 tacos per hour).

- Compute the vendor's marginal revenue for the 21st taco.

\$

Suppose the marginal cost of making a taco is \$3.00 per taco, and suppose the vendor does lower her price to \$4.95 to sell 21 tacos per hour.

- Will the vendor's hourly profit *increase* or *decrease*?
- By how much?

\$

(4) [Monopoly price discrimination: 4 pts] Suppose the producer of the "Nutcracker" ballet believes that the elasticity of demand for tickets by adults is -2 , and the elasticity of demand by children is -6 . Assume the ballet has a marginal cost of \$20 per ticket.

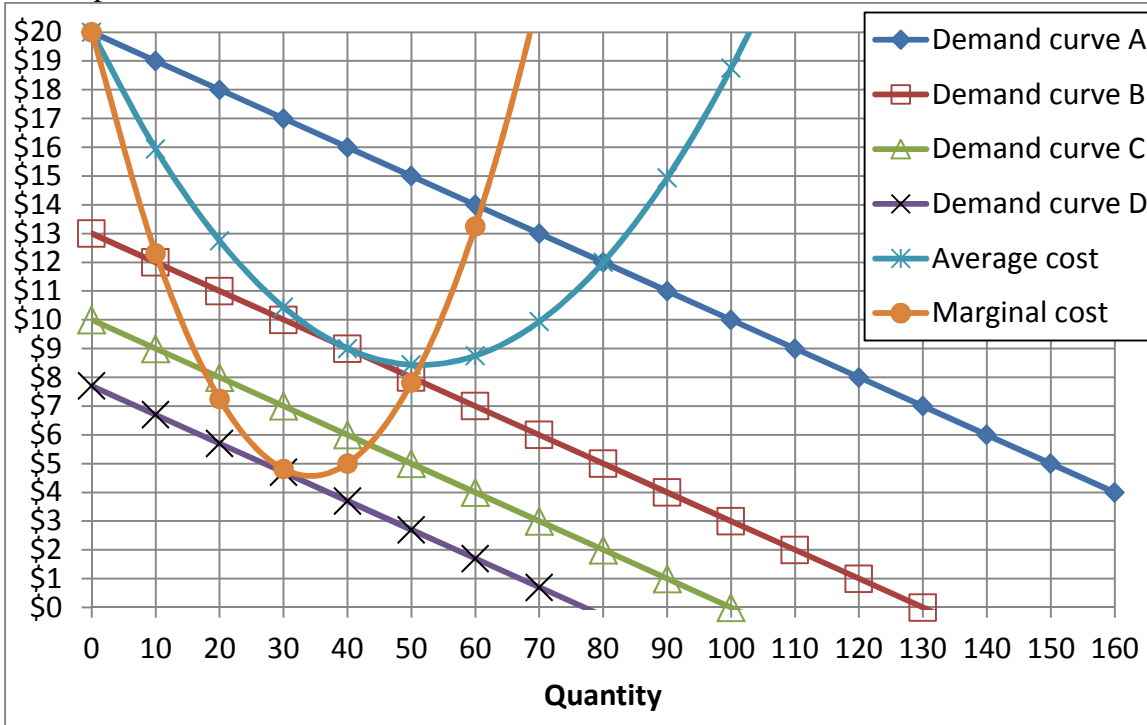
- Compute the ballet's profit-maximizing ticket price for adults.
- Compute the ballet's profit-maximizing ticket price for children.

\$
\$

(5) [Lerner index of market power: 6 pts] The Lerner index of market power is defined as the fraction of price that represents a markup over marginal cost: $L = (P - MC) / P$. Suppose the market for laundry soap has a price elasticity of demand of -4.

- Compute the Lerner index if the market for laundry soap is a monopoly.
- Compute the Lerner index if the market for laundry soap is a symmetric Cournot oligopoly of 5 firms.
- Compute the Lerner index if the market for laundry soap is a symmetric Cournot oligopoly of 20 firms.

(6) [Monopolistic competition: 8 pts] Consider the market for restaurants in a city. There is free entry—it is easy to start a new restaurant. However, each restaurant offers somewhat different food, so consumers do not view restaurants as perfect substitutes. The following graph shows a representative restaurant.



- Which demand curve shows long-run equilibrium in this market—demand curve A, demand curve B, demand curve C, or demand curve D?
- What is the long-run equilibrium quantity for this restaurant?
- What is the long-run equilibrium price for this restaurant?
- What is the long-run equilibrium profit for this restaurant?

units
\$
\$

III. PROBLEMS: Please write your answers in the boxes on this question sheet. Show your work and circle your final answers.

(1) [General equilibrium, exchange efficiency: 14 pts] Xavier and Yolanda like ice cream and cake. Xavier's utility function is given by $U_X = q_{1X}^2 q_{2X}$, where q_{1X} denotes the quantity of ice cream and q_{2X} denotes the quantity of cake he eats. Yolanda's utility function is given by $U_Y = q_{1Y} q_{2Y}$, where q_{1Y} denotes the quantity of ice cream and q_{2Y} denotes the quantity of cake she eats.

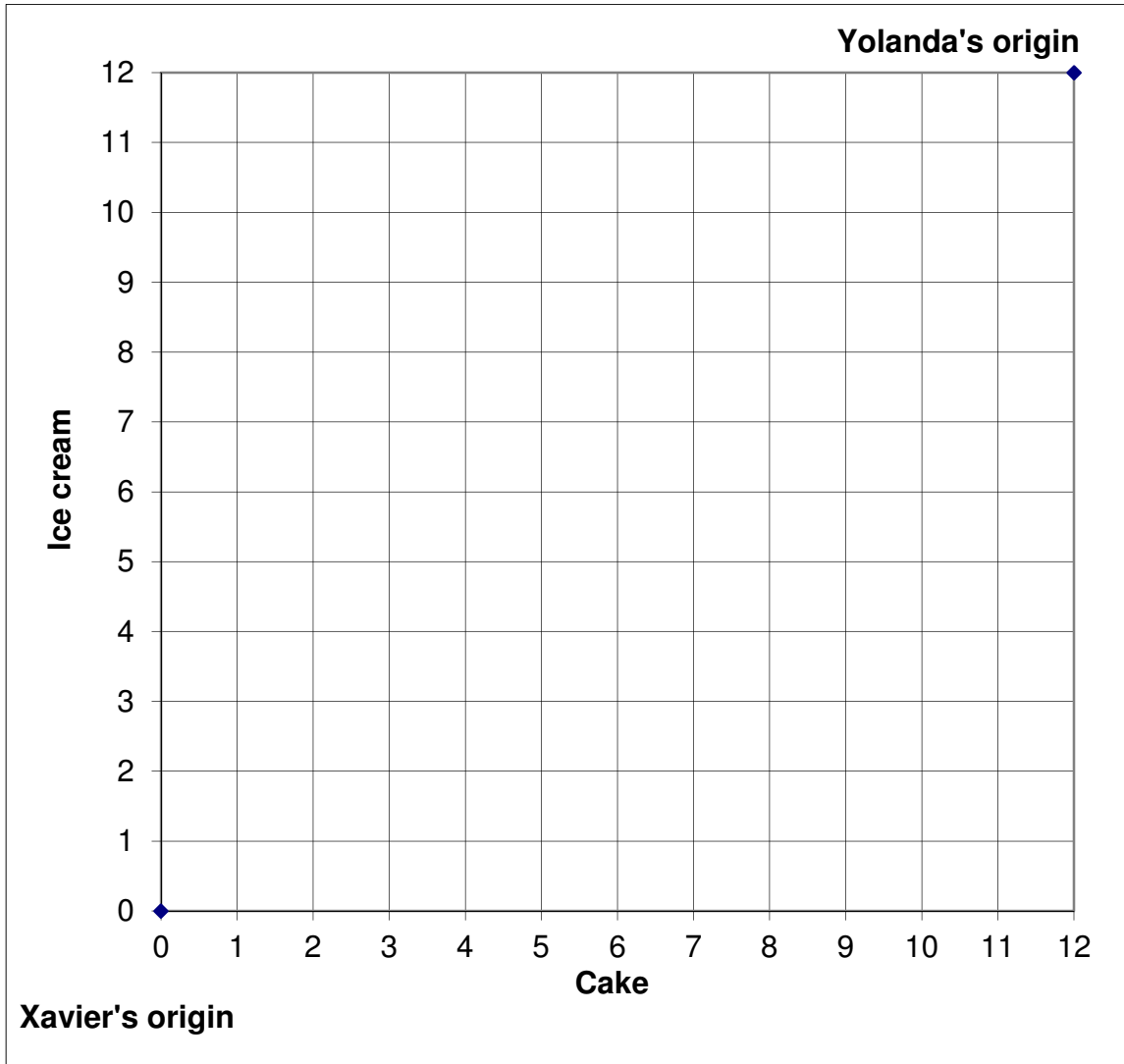
- a. [2 pts] Find a formula for Xavier's marginal rate of substitution in consumption of cake for ice cream—that is, the slope of Xavier's indifference curve with ice cream on the vertical axis and cake on the horizontal axis.

- b. [2 pts] Find a formula for Yolanda's marginal rate of substitution in consumption of cake for ice cream—that is, the slope of Yolanda's indifference curve with ice cream on the vertical axis and cake on the horizontal axis.

[6 pts] There are a total of 12 scoops of ice cream and 12 pieces of cake available. Six examples of feasible allocations are given below. State whether each allocation is Pareto *efficient* or *inefficient*.

Allocation	Xavier		Yolanda		<i>Efficient or inefficient?</i>
	Ice cream (q_{1X})	Cake (q_{2X})	Ice cream (q_{1Y})	Cake (q_{2Y})	
C	6	6	6	6	
D	0	0	12	12	
E	6	4	6	8	
F	3	3	3	6	
G	8	6	4	6	
H	12	12	0	0	

- (i) [4 pts] Plot and label the above *efficient* allocations only in the Edgeworth box on the next page, and sketch the contract curve for Xavier and Yolanda.



(2) [Monopoly pricing, deadweight loss: 16 pts] An electronics company is considering whether to develop and patent a new computer chip. Annual demand for the chip is predicted to be given by $P = 30 - (Q/2,000)$. Marginal cost of production is predicted to be constant and equal to \$10. There are also up-front costs of developing the chip and acquiring a patent.

- a. If the company were to develop and patent the chip, what *quantity* would it produce and what *price* would it set?

- b. What is the *maximum* amount of up-front costs the company would pay for developing and patenting the chip? For simplicity, assume the patent would be valid for only one year. [Hint: What level of up-front costs would reduce profits to zero?]

- c. After the patent runs out, other companies could produce the chip with same marginal cost, but without having to incur up-front costs. What *quantity* would then be produced and what *price* would prevail in the market, which is now competitive?

- d. Compute the predicted *deadweight loss* to society from monopoly pricing of this chip. [Hint: First sketch the graph.]

(3) [Cournot duopoly: 14 pts] Suppose two firms form a symmetric Cournot duopoly, each firm setting its own quantity while taking the other firm's quantity as given. Let q_1 = firm #1's quantity and q_2 = firm #2's quantity, so that total market quantity $Q = q_1 + q_2$. The market demand curve is $P = 20 - (Q/10)$. Each firm has constant marginal and average cost equal to \$5. Circle your final answers. Use the space at the bottom of the next page for scratch work. Note: question continues on next page.

- a. Find an expression for firm #1's revenue, as a function of its own quantity and the quantity produced by the other firm: $Rev_1(q_1, q_2)$. [Hint: By definition, $Rev_1 = P q_1$. Here, replace P by the equation for the demand curve, and then replace Q by $(q_1 + q_2)$.]

- b. Find an expression for firm #1's marginal revenue, as a function of its own quantity and the quantity produced by the other firm: $MR_1(q_1, q_2)$. [Hint: $MR_1(q_1, q_2) = \partial Rev_1(q_1, q_2) / \partial q_1$.]

- c. Find an expression for firm #1's reaction function, showing how much firm #1 will produce for any given level of quantity set by the other firm: $q_1^* = f(q_2)$. [Hint: Set $MR_1 = MC$ and solve for q_1 as a function of q_2 .]

- d. Assume the equilibrium is symmetric (that is, assume $q_1^* = q_2^*$) and compute firm #1's equilibrium quantity q_1^* .

Note: question continues on next page.

e. Compute total market quantity Q^* and the equilibrium price P^* .

f. Compute the total profit of both firms.

g. Compute the social deadweight loss.



IV. CRITICAL THINKING: Answer just *one* of the questions below (your choice). [4 pts]

(1) Suppose a monopolist has constant marginal cost, also equal to average cost, of $MC=AC=\$2$. The monopolist faces a demand curve given by $P = 12 Q^{-0.5}$. What quantity should the monopolist produce to maximize profit? What price should it charge? How much profit will it enjoy? Show your work and circle your final answers.

(2) Suppose *three* firms form a symmetric Cournot *triopoly*. Each firm chooses its quantity of output to maximize its own profit, taking as given the output levels of the other two firms. The marginal cost of each firm is constant and equal to \$3. The market demand curve is given by $P = 15 - (Q/100)$. What quantity will each firm produce? What will be the market price? Show your work and circle your final answers.

Circle the question you are answering and write your answer below. Full credit requires good grammar, legible writing, accurate spelling, and correct reasoning.

[end of exam]