EXAMINATION #4 VERSION B
## "General Equilibrium and Market Power"
November 17, 2014

INSTRUCTIONS: This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices 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—9 pts total].

The next two questions refer to the following Edgeworth box diagram for consumption. The solid curves are Amanda's indifference curves. The dashed curves are Brian's indifference curves.
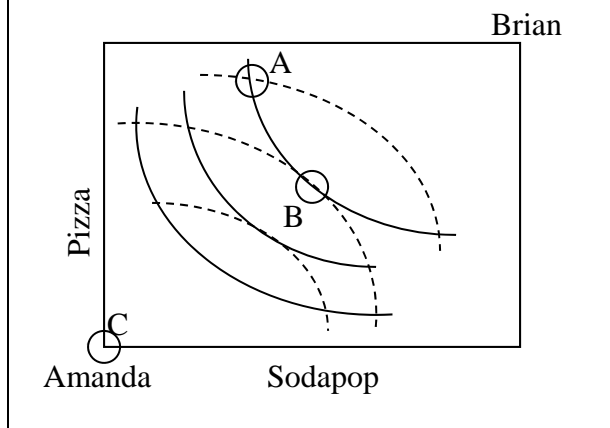
(1) From allocation A, *both* consumers can enjoy greater utility if
a. Amanda gives Brian some pizza, and Brian gives Amanda some sodapop.
b. Amanda gives Brian some sodapop, and Brian gives Amanda some pizza.
c. Amanda gives Brian some pizza and some sodapop.
d. Brian gives Amanda some pizza and some sodapop.
e. No trade will allow both consumers to enjoy greater utility.

(2) The contract curve for this Edgeworth box diagram does *not* pass through
a. Allocation A.
b. Allocation B.
c. Allocation C.
d. The contract curve passes through *all three* allocations.
e. The contract curve does not pass through any of these three allocations.

The next question refers to the graph below of alternative average cost curves. Assume that industry output is at least Q*.
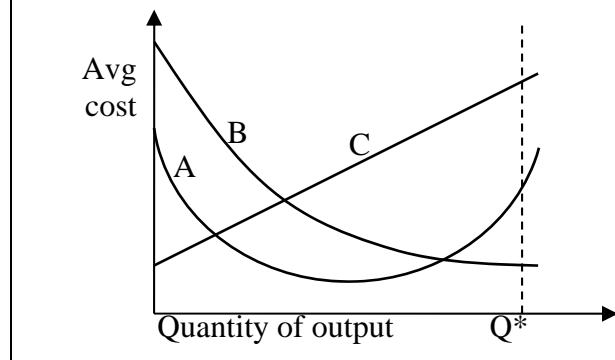
(3) Which curve above is typical of a firm that enjoys a natural monopoly?
a. Average cost curve A.
b. Average cost curve B.
c. Average cost curve C.
d. None of the above.
e. Cannot be determined from information given.

(4) If marginal cost is less than marginal revenue at the current level of output, the firm can increase its profit by
a. increasing output.
b. decreasing output.
c. either increasing or decreasing output.
d. none of the above.
e. Cannot be determined from information given.

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

(6) Suppose Firm A and Firm B must together produce a total of 100 units of output. Firm A's marginal cost is given by $MC_A = 10 + (q_A/10)$, where q_A denotes its own output level. Firm #B's marginal cost is given by $MC_B = 4 + (q_B/6)$, where q_B denotes its own output level. The output allocation that will minimize the total cost of both firms together is
a. $q_A = 0$ and $q_B = 100$.
b. $q_A = 20$ and $q_B = 80$.
c. $q_A = 40$ and $q_B = 60$.
d. $q_A = 50$ and $q_B = 50$.
e. $q_A = 60$ and $q_B = 40$.
f. $q_A = 80$ and $q_B = 20$.
g. $q_A = 100$ qnd $q_B = 0$.

(7) 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
a. producing less output than its quota as specified in the agreement.
b. increasing its price even further.
c. decreasing its price.
d. all of the above.

(8) According to the model of symmetric Cournot oligopoly, the Lerner index of market power will be greater,
a. the less elastic is market demand.
b. the more firms are in the industry.
c. both (a) and (b).
d. neither (a) nor (b).

(9) The term "differentiated products" means, in economics,
a. products that a firm sells to different customers at different prices.
b. products for which different consumers have different elasticities of demand.
c. the derivative of a firm's output.
d. the derivative of a firm's revenue with respect to its output.
e. products that are not perfect substitutes.

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

(1) [General equilibrium: 8 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 **–2**.
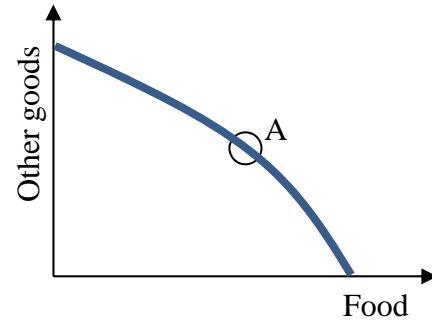
a. What is the opportunity cost of a unit of food? In other words, how many units of other goods must be given up in order to produce one more unit of food?

units of other goods

b. What is the opportunity cost of a unit of other goods? In other words, how many units of food must be given up in order to produce one more unit of other goods?

units of food

c. Consider the typical consumer's budget line with food 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?

d. If the price of food is **$ 2** per unit, then what must be the price of other goods?

$

(2) [Marginal revenue: 6 pts] Suppose a sandwich vendor with market power is now selling 20 sandwiches per hour at a price of $4.00. If she cuts the price to $3.85, she can sell one more sandwich per hour (that is, a total of 21 sandwiches per hour).

a. Compute the vendor's marginal revenue for the 21st sandwich.

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Suppose the marginal cost of making a sandwich is $2.00 per sandwich, and suppose the vendor does lower her price to $3.85 to sell 21 sandwiches per hour.

b. Will the vendor's hourly profit *increase* or *decrease*?

c. By how much?

$

(3) [Monopoly price discrimination: 4 pts] Suppose a ballet believes that the elasticity of demand for tickets by adults is −2, and the elasticity of demand by children is −7 . Assume the ballet has a marginal cost of $12 per ticket.

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

$

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

$

(4) [Collusion/joint profit maximization: 16 pts] Three firms produce laundry soap. Market demand and the three firms' joint marginal cost are shown in the graph below.
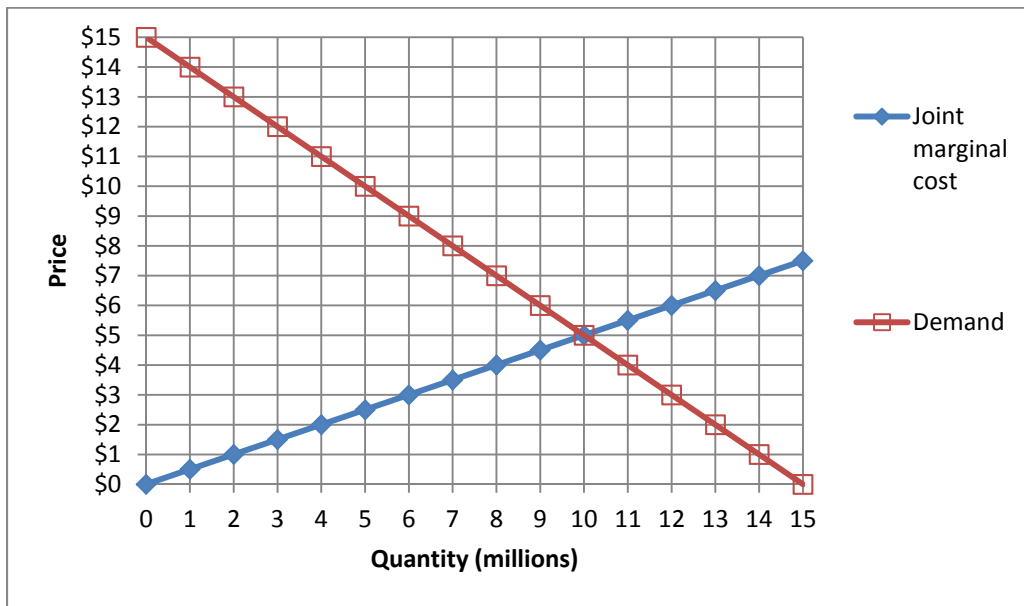
First, suppose the three firms form a cartel to maximize jointly the sum of their profits. The equation for demand is **P = 15 – Q**, where Q = quantity in millions.
  a. Find the equation for the cartel's marginal revenue.

  MR =

  b. Plot and label the cartel's marginal revenue curve in the graph above.

  c. What price will the firms jointly set? $

  d. How much output will the firms produce, in total?   million

  e. Compute the amount of deadweight loss. $ million

Alternatively, suppose the three firms engage in price competition.
  f. Compute competitive equilibrium market price. $

 g. Compute competitive equilibrium market quantity.   million

  h. Compute the amount of deadweight loss. $ million

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

(1) [Exchange efficiency: 12 pts] Jana and Kirk both like food (q_1) and clothing (q_2). Jana's utility function is $U_J = q_1 q_2$. Kirk's utility function is $U_K = q_1 q_2^3$. A total of 10 units of food and 12 units of clothing must be divided between them. Consider the allocations depicted in the Edgeworth box below.
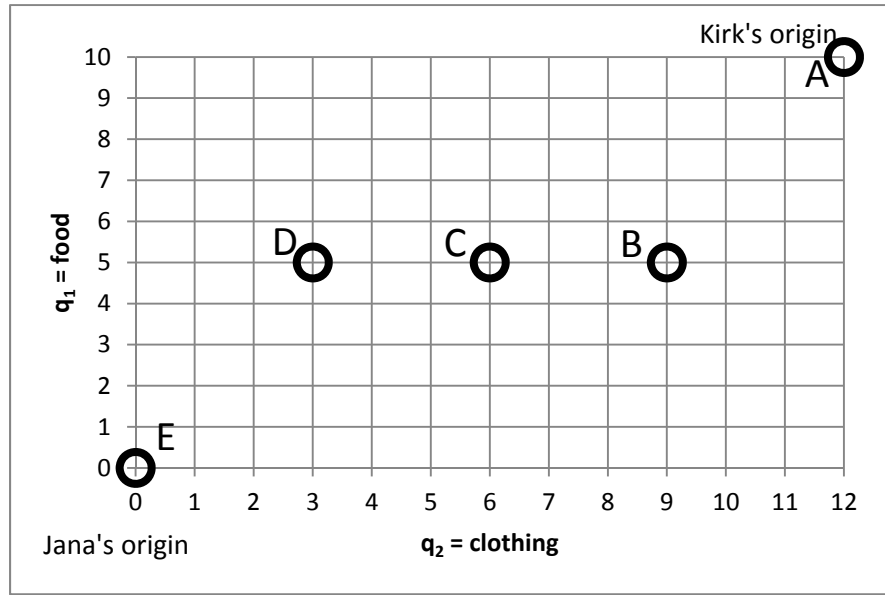
a. Is allocation A Pareto-efficient? Why or why not?

b. Is allocation B Pareto-efficient? Why or why not?

c. Is allocation C Pareto-efficient? Why or why not?

d. Is allocation D Pareto-efficient? Why or why not?

e. Is allocation E Pareto-efficient? Why or why not?

f. Sketch and label the contract curve in the Edgeworth box above.

(2) [Monopoly: 14 pts] Suppose a monopolist has total cost function given by TC(Q) = $Q + (Q^2/20)$. This monopolist faces a demand curve given by $P = 25 - (Q/20)$. Note: question continues on next page. Use graph at the bottom of next page for scratch work.

a. Find the monopolist's marginal cost function.

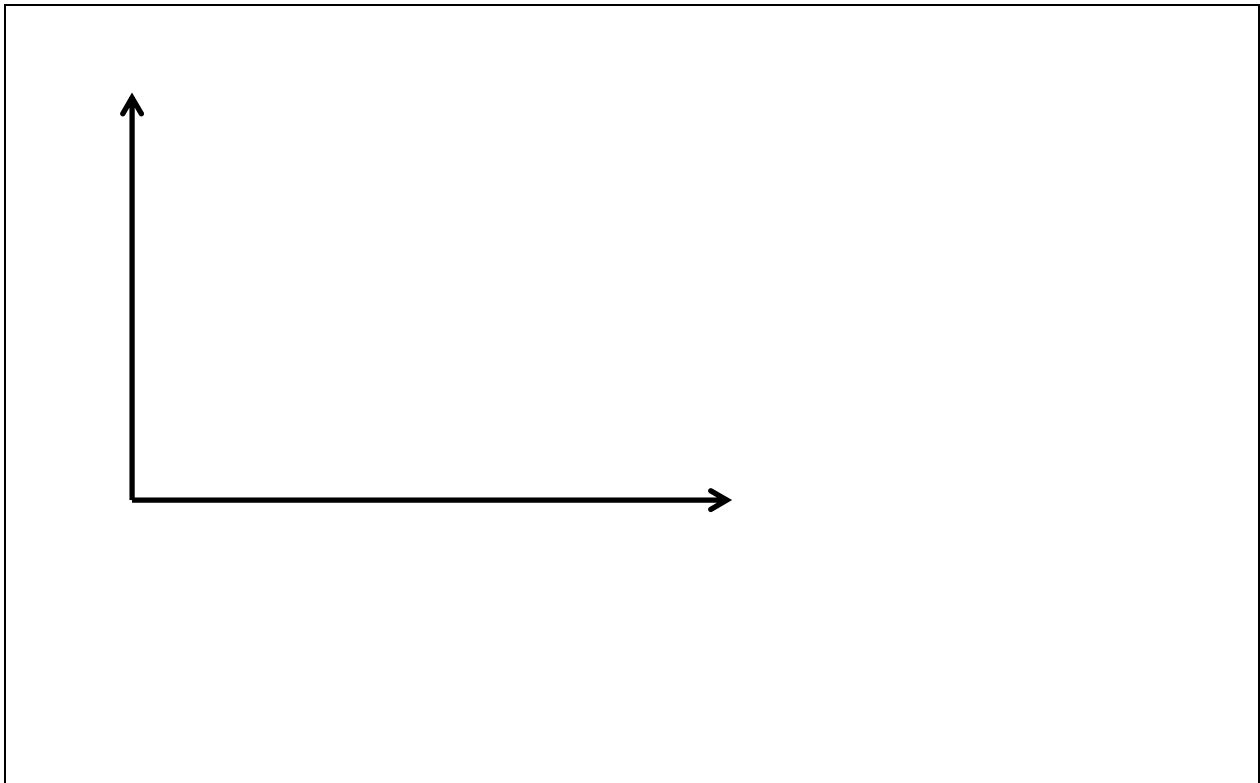b. Find the monopolist's average cost function.

c. Find the monopolist's marginal revenue function.

d. Compute the monopolist's profit-maximizing level of output Q*.

e. Compute the monopolist's profit-maximizing price P*.

f. Compute the monopolist's profit.

g. Compute the social deadweight loss caused by the monopolist. (You may use the graph for scratch work.)

(3) [Cournot duopoly: 14 pts] Suppose two makers of a consumer good 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 $P = 8 - (Q/10)$. Each firm has constant marginal and average cost equal to $2. Note: question continues on next page. Use graph at bottom of next page for scratch work.

    a.   Find an expression for firm #1's revenue, as a function of its own quantity and the quantity produced by the other firm: $Rev_1(q_1,q_2)$.

    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: $MR_1(q_1,q_2)$.

    c.   Find an expression for firm #1's reaction function, showing how much firm #1 will produce for any given quantity set by the other firm: $q_1^* = f(q_2)$.

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

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.

Price

Quantity

(4) [Game theory: 9 pts] Restaurant chains "Awsome Burgers" and "Big Burgers" are choosing locations for a new restaurant. The downtown location is more profitable than the uptown location, but if the chains choose the same location, they split the business. Their situation is described by the following game in normal form.

		Big Burgers	
		Locate uptown	Locate downtown
Awsome Burgers	Locate uptown	A gets $200 thousand. B gets $200 thousand.	A gets $400 thousand. B gets $600 thousand.
	Locate downtown	A gets $600 thousand. B gets $400 thousand.	A gets $300 thousand. B gets $300 thousand.

a. Which of the four outcomes of this game (if any) are Pareto-optimal[1]? Describe each such outcome by listing the *strategies* chosen by each retailer.

1.

2.

3.

4.

b. Which of the four outcomes of this game (if any) are dominant-strategy equilibria[2]? Describe each such equilibrium by listing the *strategies* chosen by each retailer.

1.

2.

3.

4.

c. Which of the four outcomes of this game (if any) are Nash equilibria in pure strategies? Describe each such equilibrium by listing the *strategies* chosen by each retailer.

1.

2.

3.

4.

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[1] Ignore the welfare of consumers.
[2] "Equilibria" is the plural form of "equilibrium."

IV. CRITICAL THINKING: Answer the question below. Show your work and circle your final answers. [8 pts]

(1) Two ice-cream stands are positioned at opposite ends of a beach. Yum-Yum is at the extreme left and Tasty Treat is at the extreme right, as shown in the diagram below. The beach is 1000 yards long and there are people scattered evenly along the beach—one person per yard.
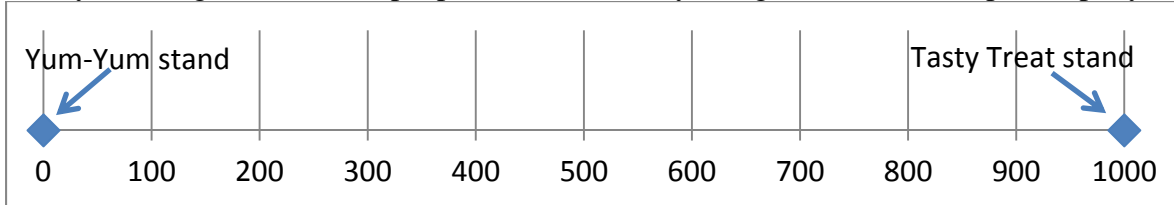
Everyone wants to buy one ice-cream cone. The only question is where they will buy it. No one wants to walk far. In fact, each person is willing to pay **two cents ($0.02)** to avoid walking (back and forth) one yard. In other words, each person's total price of an ice cream cone is **p + 0.02 D**, where p is the money price they pay and D is the distance to the stand. Naturally, each person chooses the stand with the lowest total price. Suppose that Tasty Treat sets a money price of P_T=$6.

    a. Find an equation relating quantity of customers that choose Yum-Yum to Yum-Yum's price p_Y. [Hint: set the total price of an ice-cream cone from Yum-Yum equal to the total price of a cone from Tasty Treat, and solve for D.]

    b. Find an equation relating Yum-Yum's total revenue to Yum-Yum's price p_Y.

    c. Compute the price p_Y that maximizes Yum-Yum's total revenue.

    d. Now suppose alternatively that no one minds walking, so they just choose the stand with the lowest money price P. Now what price p_Y would maximize Yum-Yum's revenue?

[end of exam]