ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2017
William M. Boal

Signature: _____

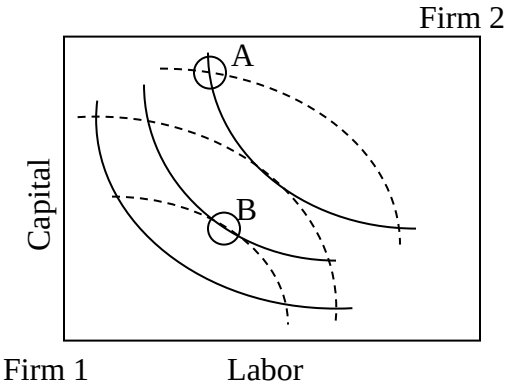
Printed name: _____

EXAMINATION #4 VERSION A
"General Equilibrium and Market Power"
November 21, 2017

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—11 pts total].

The next two 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.



(1) From allocation A, *both* firms can produce more output if
a. Firm 1 gives Firm 2 some capital, and Firm 2 gives Firm 1 some labor.
b. Firm 1 gives Firm 2 some labor, and Firm 2 gives Firm 1 some capital.
c. Firm 1 gives Firm 2 some capital and some labor.
d. Firm 2 gives Firm 1 some capital and some labor.
e. No trade will allow both firms to produce more output.

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

(3) Walras's Law implies that
a. only one market can be in disequilibrium at a time.
b. it is impossible for only one market to be in disequilibrium.
c. any random set of prices can produce general equilibrium.
d. the quantity of excess demand must equal the quantity of excess supply.

(4) The so-called "First Welfare Theorem" of general equilibrium theory states that
a. competitive forces push the economy toward the corners of the Edgeworth box.
b. any competitive equilibrium is on the contract curve.
c. deadweight loss is measured by the area of a triangle.
d. all is for the best in the best of all possible worlds.

(5) Which equation for average cost implies that the firm enjoys a natural monopoly?
a. $AC(q) = 3$.
b. $AC(q) = 0.25\ q$.
c. $AC(q) = 3 - 0.1\ q^{-1}$.
d. $AC(q) = 3 + 100\ q^{-1}$.
e. $AC(q) = 0.002\ q^2 + 0.01\ q + 1$.

(6) Suppose a flower vendor with market power is now selling 5 bouquets per hour at a price of \$10. If she cuts the price to \$9, she can sell one more bouquet per hour (that is, a total of 6 bouquets per hour). The vendor's marginal revenue for the sixth bouquet is therefore
a. negative \$1 .
b. \$1 .
c. \$4 .
d. \$9 .
e. \$10 .

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

(8) The Cournot model of oligopoly assumes that each firm maximizes its profit while taking its rivals'
a. prices as given.
b. output quantities as given.
c. costs as given.
d. all of the above.

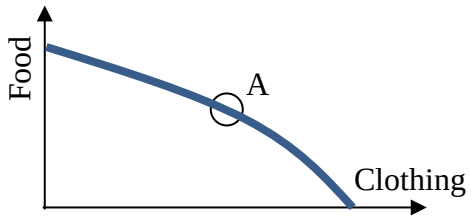
(9) The term "differentiated products" means, in economics,
a. the derivative of a firm's output.
b. the derivative of a firm's revenue with respect to its output.
c. products that are not perfect substitutes.
d. products that a firm sells to different customers at different prices.
e. products for which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

(10) Equilibrium in the model of monopolistic competition implies
a. price equals marginal cost.
b. price equals average cost.
c. firms enjoy positive economic profits.
d. zero deadweight loss.
e. All of the above.

(11) Which of the following characterizes a Nash equilibrium of a game?
a. The sum of the payoffs for both players is maximized.
b. Neither player wants to change strategies unilaterally.
c. Neither player can be made better off without the other player being made worse off.
d. Each player is receiving the highest possible payoff in the game.

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 **–4**.



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

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

c. Consider the typical consumer's budget line with food on the vertical axis and clothing on the horizontal axis. What must be the slope of every consumer's budget line in this economy?

d. If the price of a unit of clothing is **$ 8**, then what must be the price of a unit of food? — $

(2) [Monopoly price discrimination: 4 pts] Suppose a movie theatre believes that the elasticity of demand for admission by adults is -3, and the elasticity of demand by children is -9. Assume the theatre's marginal cost is $4 per admission.

a. Compute the profit-maximizing admission price for adults. — $

b. Compute the profit-maximizing admission price for children. — $

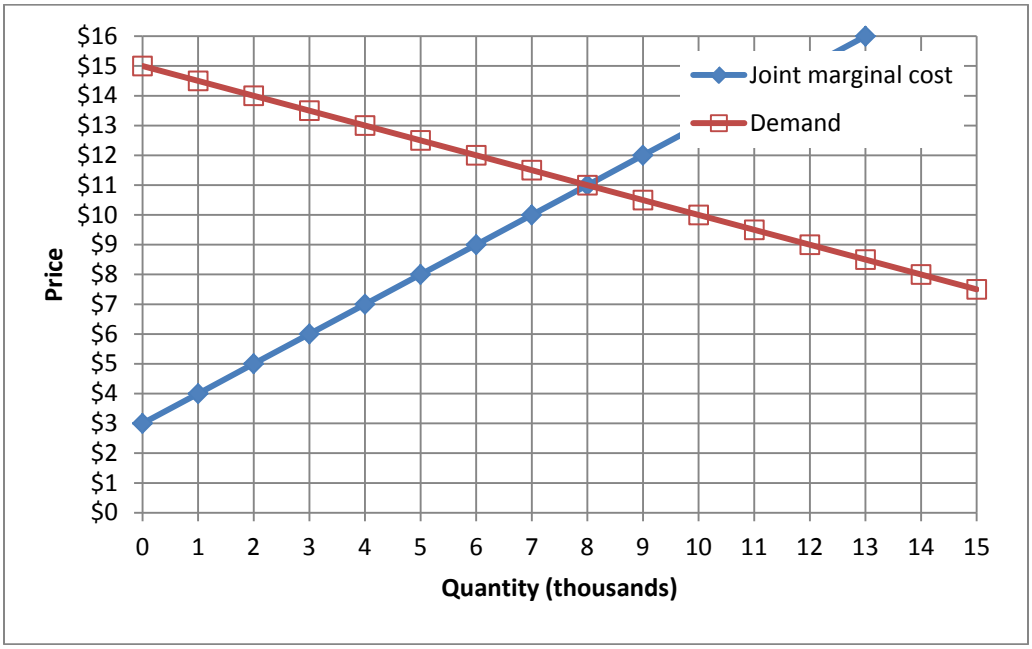
(3) [Lerner index of market power: 3 pts] The Lerner index of market power is defined as the fraction of price that represents a markup over marginal cost: L = (P-MC)/P. Suppose the market for mobile phone service has a price elasticity of demand of -4.

a. Compute the Lerner index if this market is a monopoly.

b. Compute the Lerner index if this market is a symmetric Cournot oligopoly of five firms.

c. Compute the Lerner index if this market is a symmetric Cournot oligopoly with a very large number of firms (approaching infinity).

(4) [Collusion/joint profit maximization: 16 pts] Three firms produce a particular widely-used food additive. Market demand and the three firms' joint marginal cost are shown in the graph below.



First, suppose these firms engage in price competition.

a. Compute competitive equilibrium market price. $_____

b. Compute competitive equilibrium market quantity. _____ thousand

c. Compute the amount of deadweight loss. $_____ thousand

Now suppose these firms form a cartel to maximize jointly the sum of their profits. The equation for demand is **P = 15 – (Q/2)**, where Q = quantity in thousands.

d. Find the equation for the cartel's marginal revenue.

MR = _____

e. Carefully plot and label the cartel's marginal revenue curve in the graph above.

f. What price will the firms jointly set? $_____

g. How much output will the firms produce, in total? _____ thousand

h. Compute the amount of deadweight loss. $_____ thousand

(5) [Game theory: 12 pts] Restaurant chains A and B want more customers. Each chain finds that advertising is costly but helps attract customers away from its rival. Their situation is expressed by the following game in normal form.

		Chain B: Advertise	Chain B: Do not advertise
Chain A	Advertise	A gets \$2 million. B gets \$2 million.	A gets \$5 million. B gets \$1 million.
	Do not advertise	A gets \$1 million. B gets \$5 million.	A gets \$4 million. B gets \$4 million.

a. Which outcomes of this game (if any) are Pareto-optimal[1]? Answer "YES" or "NO."

Chain A plays "Advertise" and Chain B plays "Advertise"	
Chain A plays "Advertise" and Chain B plays "Do not advertise"	
Chain A plays "Do not advertise" and Chain B plays "Advertise"	
Chain A plays "Do not advertise" and Chain B plays "Do not advertise"	

b. Which outcomes of this game (if any) are dominant-strategy equilibria[2]? Answer "YES" or "NO."

Chain A plays "Advertise" and Chain B plays "Advertise"	
Chain A plays "Advertise" and Chain B plays "Do not advertise"	
Chain A plays "Do not advertise" and Chain B plays "Advertise"	
Chain A plays "Do not advertise" and Chain B plays "Do not advertise"	

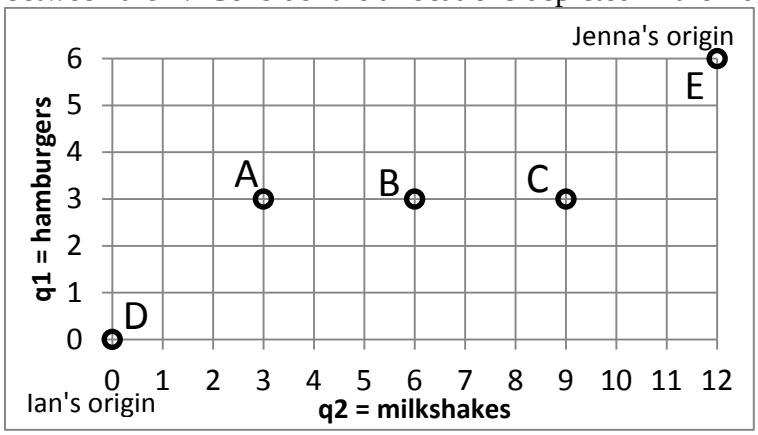
c. Which outcomes of this game (if any) are Nash equilibria in pure strategies? Answer "YES" or "NO."

Chain A plays "Advertise" and Chain B plays "Advertise"	
Chain A plays "Advertise" and Chain B plays "Do not advertise"	
Chain A plays "Do not advertise" and Chain B plays "Advertise"	
Chain A plays "Do not advertise" and Chain B plays "Do not advertise"	

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

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] Ian and Jenna both like hamburgers and milkshakes. Let q_1 denote hamburgers and q_2 denote milkshakes. Ian's utility function is $\mathbf{U_I = q_1^3 q_2}$. Jenna's utility function is $\mathbf{U_J = q_1 q_2}$. A total of 6 hamburgers and 12 milkshakes 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, profit maximization: 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 $P = 13 - (Q/20)$.

a. Find the monopolist's marginal cost function.

b. Find the monopolist's average cost function.

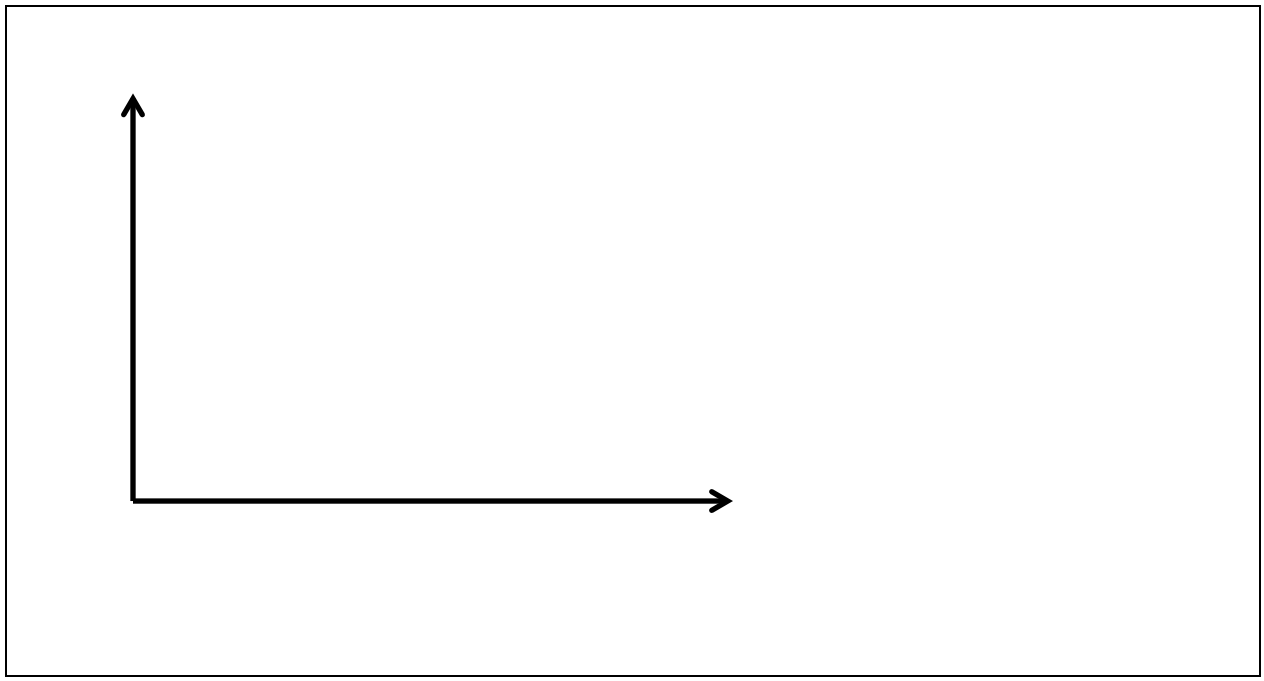
c. Find the monopolist's marginal revenue function.

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 $P = 14 - (Q/20)$. 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: $MR_1(q_1,q_2)$.

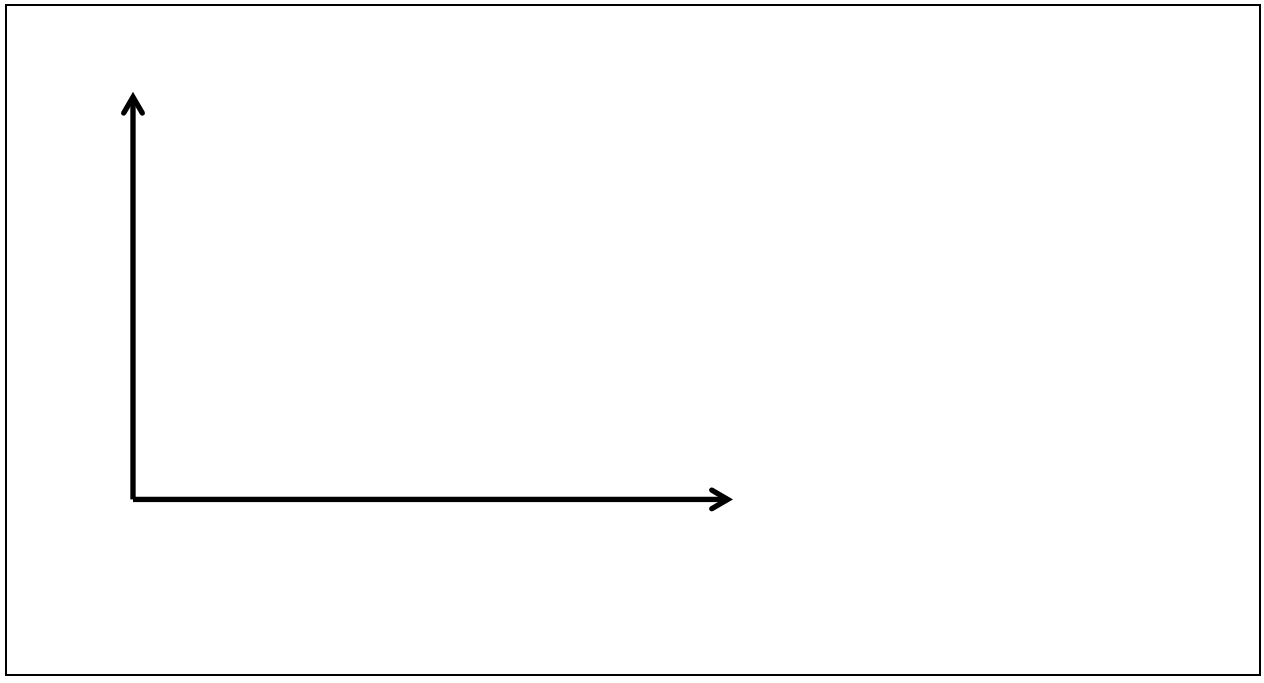
c. Find an expression for firm #1's reaction function, showing how much firm #1 will produce for any given quantity set by the other firm: $q_1^* = f(q_2)$.

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 combined 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) Reconsider the monopoly in problem (2) above. Suppose the firm is capable of setting a separate price for every unit sold, engaging in perfect price discrimination. Compute the firm's profit maximizing quantity, its revenue, and its profit. Show your work and circle your final answers. (You may use the graph for scratch work.)

(2) Reconsider the duopoly in problem (3) above. Suppose the two firms collude to maximize the sum of their profits. Compute the two firms' profit-maximizing total quantity, their price, and their total profit. Show your work and circle your final answers. (You may use the graph for scratch work.)

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]