ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2019
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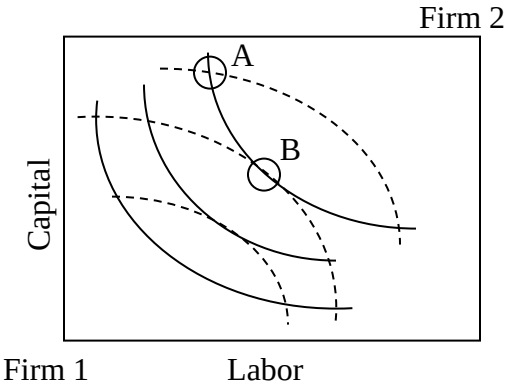
# EXAMINATION #4 VERSION A
# "General Equilibrium and Market Power"
# November 19, 2019

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—7 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) 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.

(4) 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 blue eyes have more elastic demand than people with brown eyes. To maximize the monopolist's profit, which market segment should get the *lower* price?

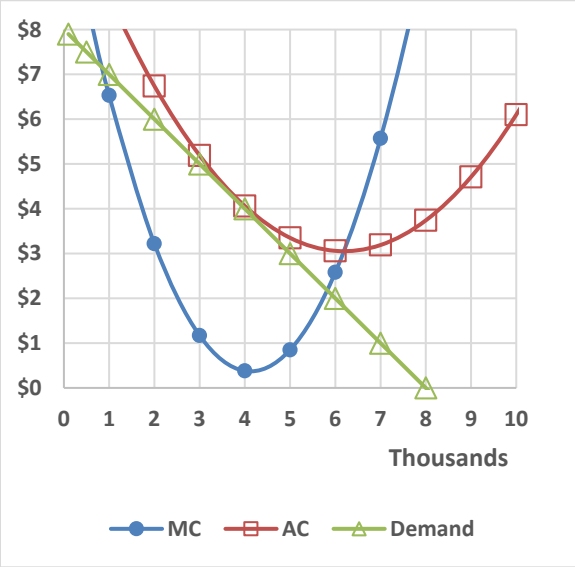
a. people with blue eyes.
b. people with brown eyes.
c. both segments should get the same price because marginal cost is constant.
d. cannot be determined from information given.

(5) Which market model predicts the highest equilibrium price?

a. Price competition.
b. Collusion to maximize joint profits.
c. Cournot oligopoly.
d. All models predict the same equilibrium price, if all use the same assumptions about market demand and marginal cost.

(6) The following graph shows long-run equilibrium for a representative firm under monopolistic competition. This firm's long-run equilibrium quantity is

a. 4 thousand.
b. 5 thousand.
c. 6 thousand.
d. 7 thousand.
e. 8 thousand.

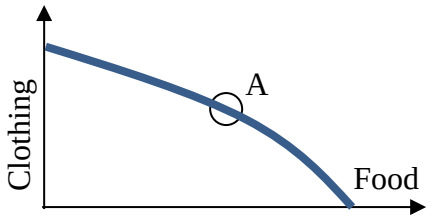



(7) Which of the following characterizes a Nash equilibrium of a game?

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 **–1/3**.




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 clothing on the vertical axis and food 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 **$ 12**, then what must be the price of a unit of food? — $

(2) [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 mobile phone service has a price elasticity of demand of -2.

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

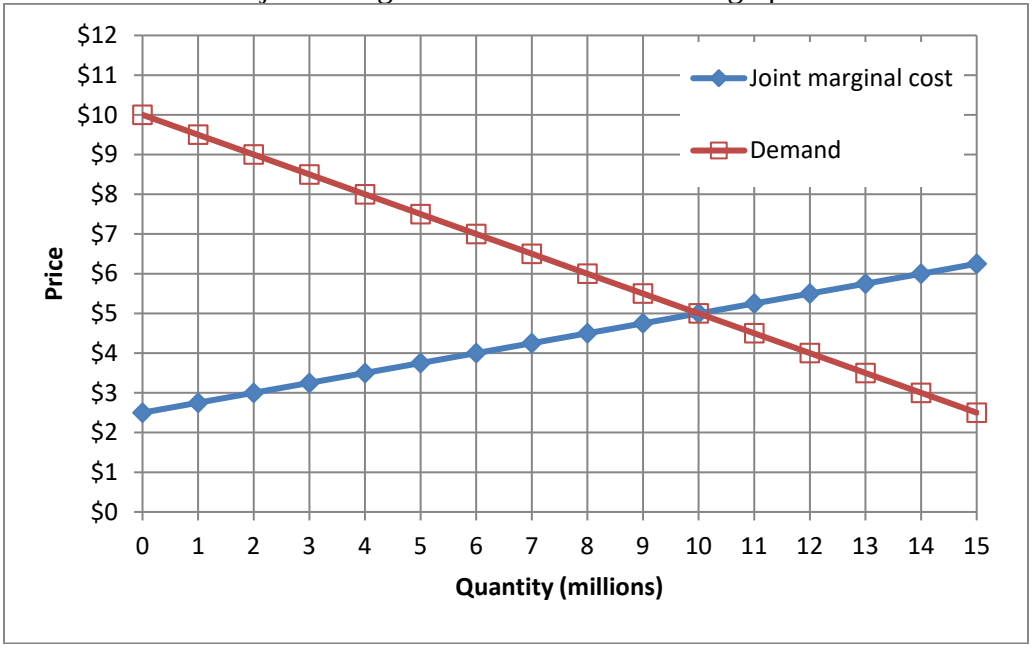
b. Compute the Lerner index if this market is a symmetric Cournot duopoly of two firms.

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

(3) [Comparison of models: 6 pts] In long-run equilibrium, which models predict that price equals each firm's marginal cost, and which models predict that price equals each firm's average cost? Write YES or NO in each box.

| | P = MC | P = AC |
|---|---|---|
| a. Perfect competition. | | |
| b. Monopoly. | | |
| c. Monopolistic competition. | | |

(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 these firms engage in price competition.

a. Compute competitive equilibrium market price. $

b. Compute competitive equilibrium market quantity. million

c. Compute the amount of deadweight loss. $ million

Now suppose these firms form a cartel to maximize jointly the sum of their profits. The equation for demand is **P = 10 – (Q/2)**, where Q = quantity in millions.

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? million

h. Compute the amount of deadweight loss. $ million

(5) [Game theory: 12 pts] Old Firm has been the only firm in a certain market so it can set the market price. New Firm is deciding whether to enter this market. The following table describes their interaction as a game in normal form.

| | | Old Firm: Low price | Old Firm: High price |
|---|---|---|---|
| New Firm | Stay out of market | New gets \$0 million.<br>Old gets \$-2 million. | New gets \$0 million.<br>Old gets \$10 million. |
| | Enter market | New gets \$-1 million.<br>Old gets \$-3 million. | New gets \$5 million.<br>Old gets \$5 million. |

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

| | |
|---|---|
| New Firm plays "Stay out" and Old Firm plays "Low price" | |
| New Firm plays "Stay out" and Old Firm plays "High price" | |
| New Firm plays "Enter market" and Old Firm plays "Low price" | |
| New Firm plays "Enter market" and Old Firm plays "High price" | |

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

| | |
|---|---|
| New Firm plays "Stay out" and Old Firm plays "Low price" | |
| New Firm plays "Stay out" and Old Firm plays "High price" | |
| New Firm plays "Enter market" and Old Firm plays "Low price" | |
| New Firm plays "Enter market" and Old Firm plays "High price" | |

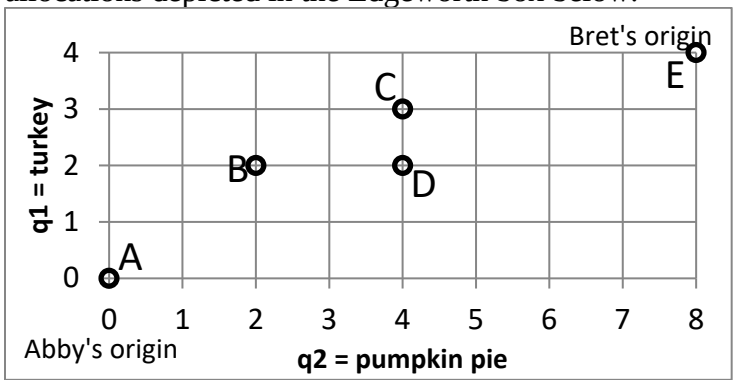
c. Which outcomes of this game (if any) are Nash equilibria in pure strategies? Answer "YES" or "NO."

| | |
|---|---|
| New Firm plays "Stay out" and Old Firm plays "Low price" | |
| New Firm plays "Stay out" and Old Firm plays "High price" | |
| New Firm plays "Enter market" and Old Firm plays "Low price" | |
| New Firm plays "Enter market" and Old Firm plays "High price" | |

[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] Abby and Bret both like turkey ($q_1$) and pumpkin pie ($q_2$). Abby's utility function is $\mathbf{U_A = q_1^3\, q_2}$. Bret's utility function is $\mathbf{U_B = q_1\, q_2}$. A total of 4 servings of turkey and 8 slices of pumpkin pie 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 $TC(Q) = 4Q + (Q^2/40)$. This monopolist faces a demand curve given by $P = 10 - (Q/20)$. Note: question continues on next page. Use graph at bottom of next page for scratch work.

a. Find the monopolist's marginal cost function.

b. Find the monopolist's average cost function.

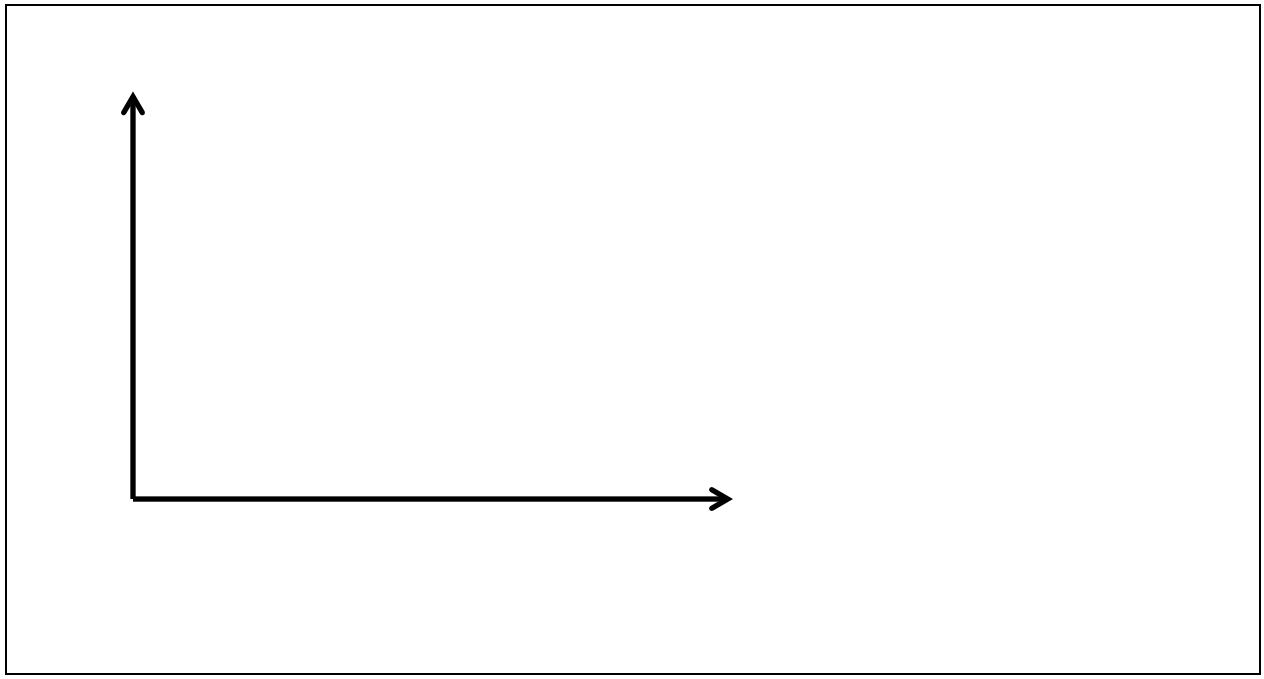
c. Find the monopolist's marginal revenue function.

d. Compute the monopolist's profit-maximizing level of output $Q_M$.

e. Compute the monopolist's profit-maximizing price $P_M$.

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: $TR_1(q_1,q_2)$.

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: $MR_1(q_1,q_2)$.

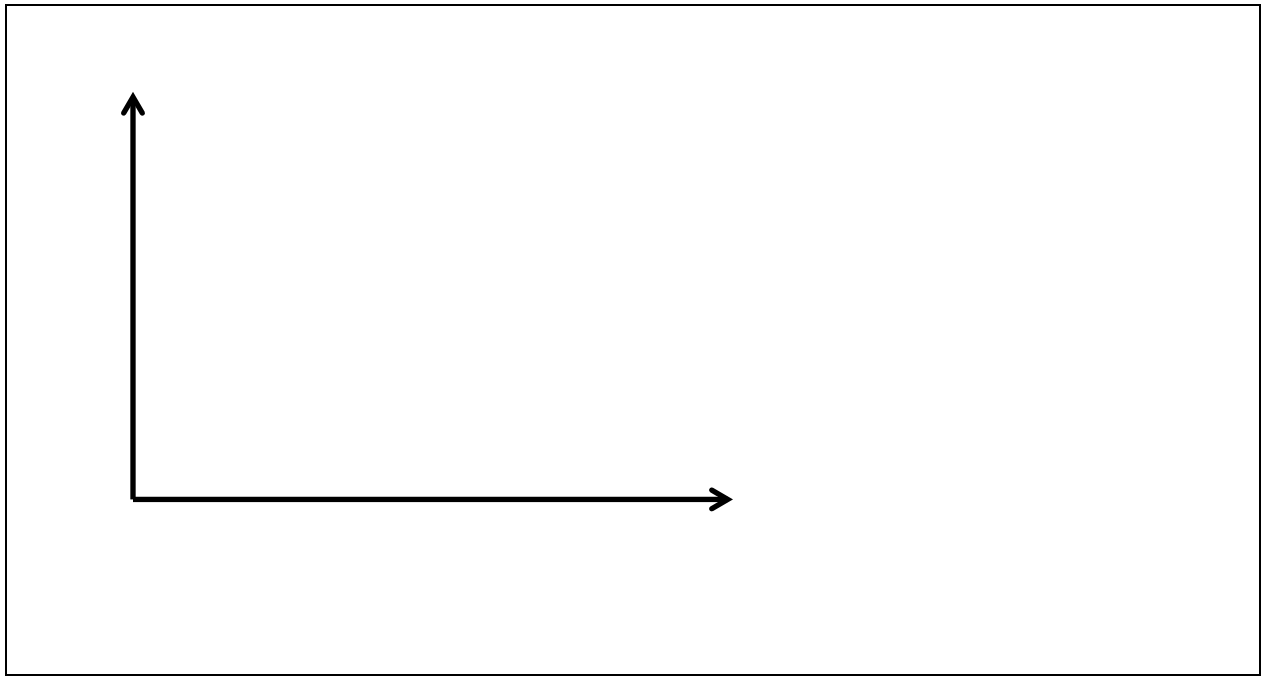
c. Find an expression for firm #1's reaction function, showing how much firm #1 will produce for any given quantity set by the other firm: $q_1^* = f(q_2)$.

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). [5 pts]

(1) Consider an Edgeworth box for two people who happen to have *identical* utility functions. Will the contract curve pass through the exact center of the Edgeworth box? Why or why not?

(2) Suppose there are two firms in a market, each with marginal cost and average cost equal to $3. The firms choose *prices* (not quantities as in a Cournot game). Assume initially that Firm A has chosen a price of $10.

a. What price is Firm B's best reply to Firm A's initial price? Why?
b. What price is Firm A's best reply to Firm B's price? Why?
c. What is the Nash equilibrium of this game? Why?

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]