ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2022
William M. Boal

Signature: ______________________________

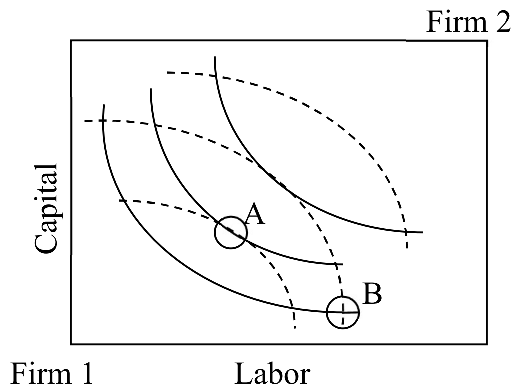
Printed name: ______________________________

EXAMINATION 4 VERSION A
"General Equilibrium and Market Power"
November 22, 2022

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—12 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.

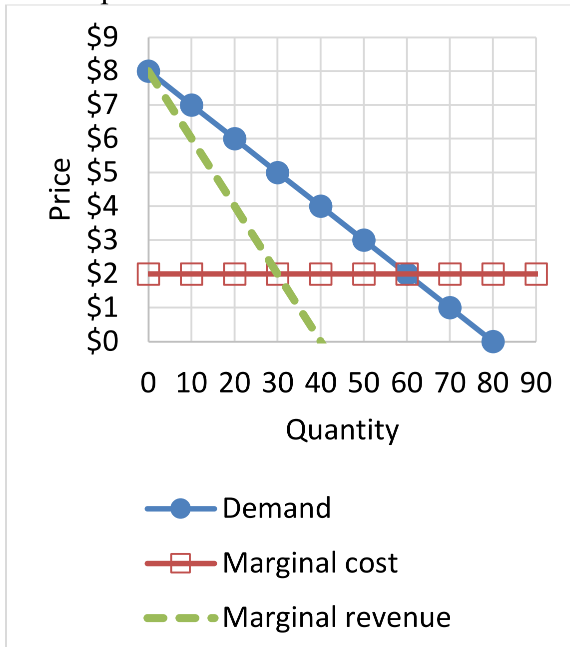
(3) The so-called "First Welfare Theorem" of general equilibrium theory states that
a. competitive forces push the economy toward the corners of the Edgeworth box.
b. any competitive equilibrium is on the contract curve.
c. if all markets are competitive, then everyone enjoys the same income.
d. all is for the best in the best of all possible worlds.

(4) If marginal cost is greater 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) Suppose a sandwich vendor with market power is now selling 8 sandwiches per hour at a price of \$6. If she cuts the price to \$5.50, she can sell one more sandwich per hour (that is, a total of 9 sandwiches per hour). The vendor's marginal revenue for the ninth sandwich is therefore
a. zero.
b. \$0.50.
c. \$1.50.
d. \$5.50.
e. \$6.00.

(6) A "natural monopoly" is a firm that enjoys
a. a downward-sloping average cost curve.
b. patent protection.
c. an exclusive government franchise allowing it alone to sell the product.
d. exclusive ownership of a natural resource essential for producing the product.

The next two questions refer to the graph of a monopolist below.



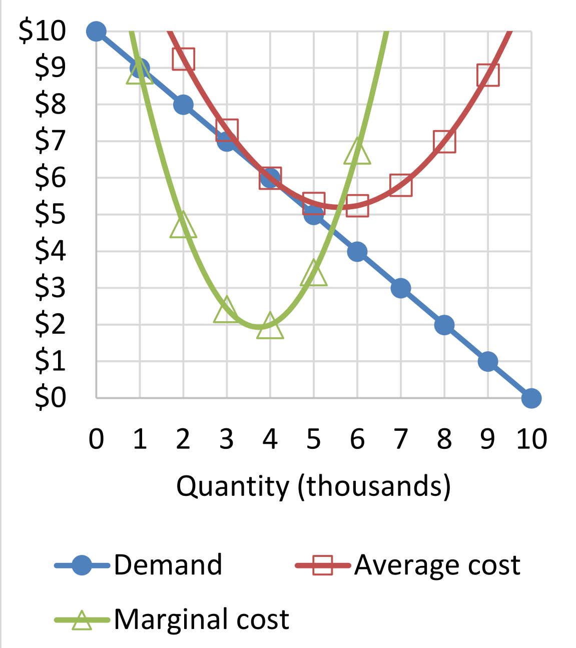
(7) What quantity of output will the monopolist choose if it must charge the *same* price to all customers?
a. 0 units.
b. 30 units.
c. 40 units.
d. 60 units.
e. 80 units.

(8) What quantity of output will the monopolist choose if it can engage in *perfect price discrimination*, setting a different price for each unit according to willingness-to-pay?
a. 0 units.
b. 30 units.
c. 40 units.
d. 60 units.
e. 80 units.

(9) 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.

(10) Which market model predicts the largest quantity of total output?
a. Price competition.
b. Collusion to maximize joint profits.
c. Cournot oligopoly.
d. All models predict the same quantity of output, if all use the same assumptions about market demand and marginal cost.

The next two questions refer to the following graph of a representative firm under monopolistic competition.

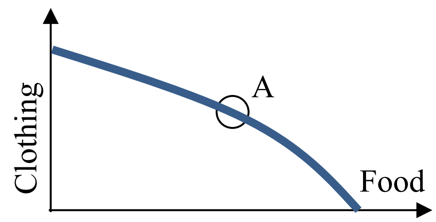


(11) Long-run equilibrium quantity for this firm is about
a. 4 thousand.
b. 5 thousand.
c. 6 thousand.
d. 7 thousand.
e. 8 thousand.

(12) Long-run equilibrium price for this firm is about
a. $2 .
b. $3 .
c. $4 .
d. $5 .
e. $6 .

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 clothing must be given up in order to produce one more unit of food?	units of clothing
b. 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
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 **\$ 6**, then what must be the price of a unit of food?	\$

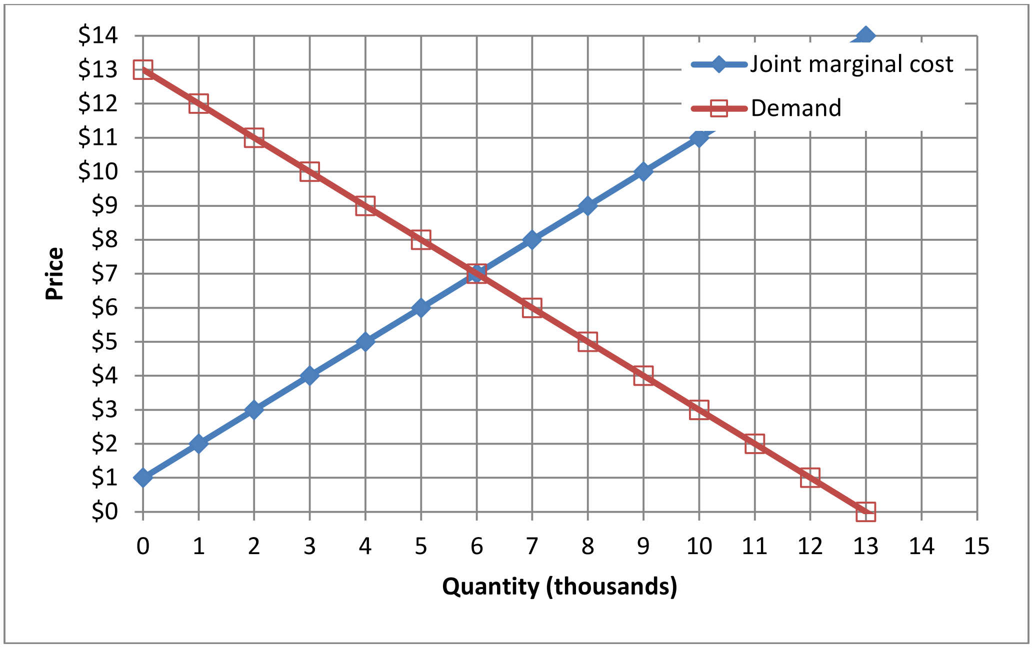
(2) [Monopoly price discrimination: 4 pts] Suppose a skating rink believes that the elasticity of demand for admission by adults is −2, and the elasticity of demand by children is −5 . Assume the rink has a marginal cost of \$8 per ticket.

a. Compute the skating rink's profit-maximizing admission price for adults.	\$
b. Compute the skating rink's profit-maximizing admission price for children.	\$

(3) [Lerner index of market power: 4 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 oligopoly of five firms.	

(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. 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 = 13 – Q**, 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] Grocery chains A and B are choosing locations for a new store. 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 expressed by the following game in normal form.

		Chain B	
		Locate uptown	Locate downtown
Chain A	Locate uptown	A gets \$2 million. B gets \$2 million.	A gets \$4 million. B gets \$6 million.
	Locate downtown	A gets \$6 million. B gets \$4 million.	A gets \$3 million. B gets \$3 million.

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

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

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

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

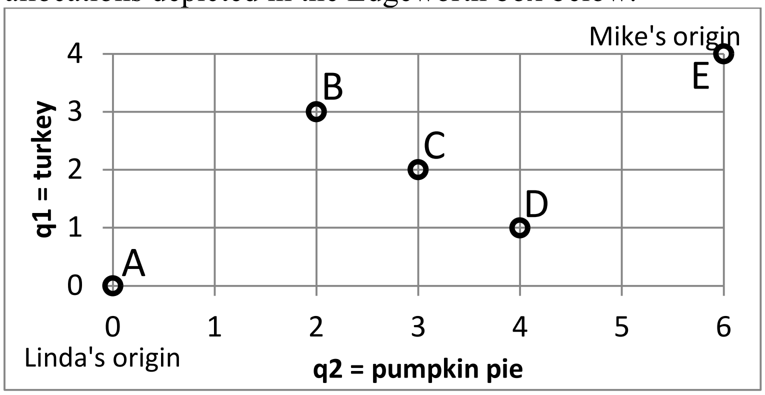
c. Which outcomes of this game (if any) are Nash equilibria in pure strategies? Answer "YES" or "NO."

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

[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] Linda and Mike both like turkey (q_1) and pumpkin pie (q_2). Linda's utility function is $\mathbf{U_L = q_1 q_2^3}$. Mike's utility function is $\mathbf{U_M = q_1^2 q_2}$. A total of 4 servings of turkey and 6 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 **$TC(Q) = 3Q + (Q^2/20)$.** This monopolist faces a demand curve given by **$P = 15 - (Q/20)$.** Show your work and circle your final answers. 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 **$P = 14 - (Q/10)$.** Each firm has constant marginal and average cost equal to **\$2**. Show your work and circle your final answers. 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). [4 pts]

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

(2) Reconsider the duopoly in problem (3) above. Suppose each firm maximizes its own profit while taking the other firm's *price* as given. Compute the equilibrium price, the total output and the deadweight loss. Show your work and circle your final answers. (You may use the graph below 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]