

## FINAL EXAMINATION VERSION B

**INSTRUCTIONS:** This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators or calculators with alphabetical keyboards are NOT permitted. Mobile phones or other wireless devices are NOT permitted. Fractional answers are acceptable. Decimal answers, if rounded, must be correct to at least three significant digits. Points will be subtracted for illegible writing or incorrect rounding. Point values for each question are noted in brackets.

**I. Multiple choice:** Please circle the one best answer to each question. [2 pts each, 50 pts total]

- (1) A "natural monopoly" is a firm that enjoys
- an exclusive government franchise allowing it alone to sell the product.
  - exclusive ownership of a natural resource essential for producing the product.
  - a downward-sloping average cost curve.
  - patent protection.
- (2) In the "Structure-Conduct-Performance" paradigm, "Structure" does not include
- concentration.
  - elasticity of market demand.
  - deadweight loss.
  - current technology.
- (3) In the United States, "monopolization" is illegal under the
- Sherman Act Section 1.
  - Sherman Act Section 2.
  - Clayton Act.
  - Federal Trade Commission Act.
- (4) One implication of the Cournot model of oligopoly is that the equilibrium price is lower
- the more firms are in the industry.
  - the more elastic is market demand.
  - both of the above.
  - none of the above.
- (5) After firms agree to maximize their joint profits, each firm will have an incentive to cheat on any agreement by quietly
- lowering its output level.
  - lowering its price.
  - raising its price.
  - none of the above.
- (6) Which market model predicts the largest quantity of total output?
- Price competition.
  - Collusion to maximize joint profits.
  - Cournot oligopoly.
  - All models predict the same quantity of output, if all use the same assumptions about market demand and marginal cost.
- (7) Under U.S. law, price-fixing is illegal
- if price is raised significantly above marginal cost.
  - per se*, except in industries Congress has exempted.
  - if total market quantity is reduced significantly below the competitive quantity.
  - if significant deadweight loss can be shown.
- (8) Consider an industry that behaves like a Cournot oligopoly. Holding constant the industry elasticity of demand, the Lerner index (or price-cost margin) is
- positively related to the industry's HHI.
  - negatively related to the industry's HHI.
  - positive but constant because it depends only on the industry's elasticity of demand.
  - zero, as in all Cournot oligopolies.
- (9) Suppose a computer manufacturer merged with a maker of processor chips. This would be an example of a
- horizontal merger.
  - vertical merger.
  - conglomerate merger for product extension.
  - conglomerate merger for market extension.
  - pure conglomerate merger.

(10) Which statute requires prior notification of mergers to the Federal Trade Commission and the Antitrust Division of the Department of Justice?

- a. Sherman Act Section 2.
- b. Hart-Scott-Rodino Act.
- c. Clayton Act.
- d. Federal Trade Commission Act.
- e. Celler-Kefauver Act.

(11) According to the DOJ-FTC *Horizontal Merger Guidelines*, the ability of a hypothetical monopolist to impose a "small but significant and nontransitory increase in price" should be used to

- a. compare with any cost savings.
- b. compute a merged firm's Lerner index.
- c. decide whether a merger should be opposed.
- d. define the extent of a market.
- e. distinguish vertical, horizontal, and conglomerate mergers.
- f. regulate price in a market.

(12) Typically, if the definition of the market is broadened to include more products believed to be close substitutes, then

- a. the Hirschman-Herfindahl index (HHI) will increase.
- b. the HHI will decrease.
- c. The HHI is not usually affected by market definition.

(13) Suppose the manufacturer of a product wants to induce retailers to provide marketing services, like showrooms and personalized sales. There are several ways a manufacturer can do this, but they do *not* include

- a. giving retailers exclusive territories.
- b. setting a minimum retail price.
- c. setting a maximum retail price.

(14) The Supreme Court stated that "the law does not make mere size an offense" in its decision in

- a. Standard Oil v. U.S (1911).
- b. U.S. v. U.S. Steel (1920).
- c. U.S. v. Alcoa (1945).
- d. U.S. v. United Shoe Machinery (1953).
- e. Utah Pie v. Continental Baking (1967).
- f. Berkey Photo v. Kodak (1979).

(15) According to the Areeda-Turner (1975) rule, a firm should be presumed to be engaging in predatory pricing if its price is less than its

- a. average total cost.
- b. marginal cost
- c. average variable cost.
- d. average fixed cost.

(16) According to the "essential facilities" doctrine, a company is guilty of monopolization if one can show all of the following, *except*

- a. control of the facility by a monopolist.
- b. a difference in price between the monopolist and the competitor.
- c. the competitor's inability to duplicate the facility.
- d. denial of use of facility to the competitor.
- e. the feasibility of providing the facility to the competitor.

(17) Social deadweight loss is minimized when price is set equal to

- a. average fixed cost.
- b. marginal cost.
- c. average variable cost.
- d. average total cost.

(18) The *rate base* for a regulated public utility is

- a. the number of customers it serves.
- b. the minimum usage price it may charge.
- c. the value of its plant and equipment.
- d. the monthly service fee for its lowest-price customers.

(19) A barrier to peak-load pricing for electric power in practice is that

- a. the relevant economic theory is not yet developed.
- b. not enough electric power is available.
- c. sophisticated usage meters are not installed.
- d. demand for power fluctuates during the day and over the year.

(20) Assume that in some wholesale electricity market, all producers are paid the same equilibrium price, and that no firm has the ability to manipulate the final price. Then each firm's optimal bid is

- a. greater than its true marginal cost.
- b. less than its true marginal cost.
- c. equal to its true marginal cost.
- d. zero.

(21) Spot prices for wholesale electricity are volatile during peak periods because wholesale

- a. demand is price-elastic but supply is inelastic.
- b. supply is price-elastic but demand is inelastic.
- c. demand and supply are both price-inelastic.
- d. demand and supply are both price-elastic.

- (22) Which of the following changes would *not* reduce market power in wholesale electricity markets?
- a. Implementing flexible pricing at the retail level.
  - b. Connecting more power producers to the system.
  - c. Requiring large producers to sell most of their power through long-term forward contracts.
  - d. Using “pay as bid” prices to compensate power producers.

- (23) Cross-subsidization between markets causes deadweight loss in
- a. the market priced below cost.
  - b. the market priced above cost.
  - c. both markets.
  - d. None of the above.

- (24) Which industry was regulated first in the United States?
- a. Railroads.
  - b. Trucking.
  - c. Airlines.
  - d. All three industries were regulated simultaneously.

- (25) From 1938 when the Civil Aeronautics Board was created to 1978 when the Airline Deregulation Act was passed, the CAB received 79 applications for new trunk airlines. How many applications were approved?
- a. 0.
  - b. 5.
  - c. 12.
  - d. 39.
  - e. 79.

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**II. Problems:** Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

(1) [Monopoly, markup formula, Lerner index: 4 pts] ABC Amusement Park enjoys a local monopoly. Its marginal cost per customer is \$12.00. The management believes the elasticity of demand for admissions is -2.5.

- a. What admission price should ABC set, to maximize profit?
- b. Compute ABC’s Lerner index (also called the “price-cost margin” or the “markup ratio”).

\$

(2) [Cournot duopoly: 14 pts] Suppose a market is served by only two firms: Ames Products Company and Boone Products Company. Suppose the two firms form a *symmetric Cournot duopoly*, each firm setting its own quantity while taking the other firm's quantity as given. Let  $q_A$  = Ames's quantity and  $q_B$  = Boone's quantity, so that total market quantity  $Q = q_A + q_B$ . The market demand curve is  $P = 15 - (Q/10)$ . Each firm has constant marginal and average cost equal to \$3. Circle your final answers. Use the space at the bottom of the next page for scratch work.

- a. Find an expression for Ames's revenue, as a function of its own quantity and the quantity produced by the other firm:  $Rev_A(q_A, q_B)$ .

- b. Find an expression for Ames's marginal revenue, as a function of its own quantity and the quantity produced by the other firm:  $MR_A(q_A, q_B)$ .

- c. Find an expression for Ames's reaction function (or best reply function), showing how much Ames will produce for any given level of quantity set by the other firm:  $q_A^* = f(q_B)$ .

- d. Assume the equilibrium is symmetric (that is, assume  $q_A^* = q_B^*$ ) and compute Ames's equilibrium quantity  $q_A^*$ .

Question continues on next page.

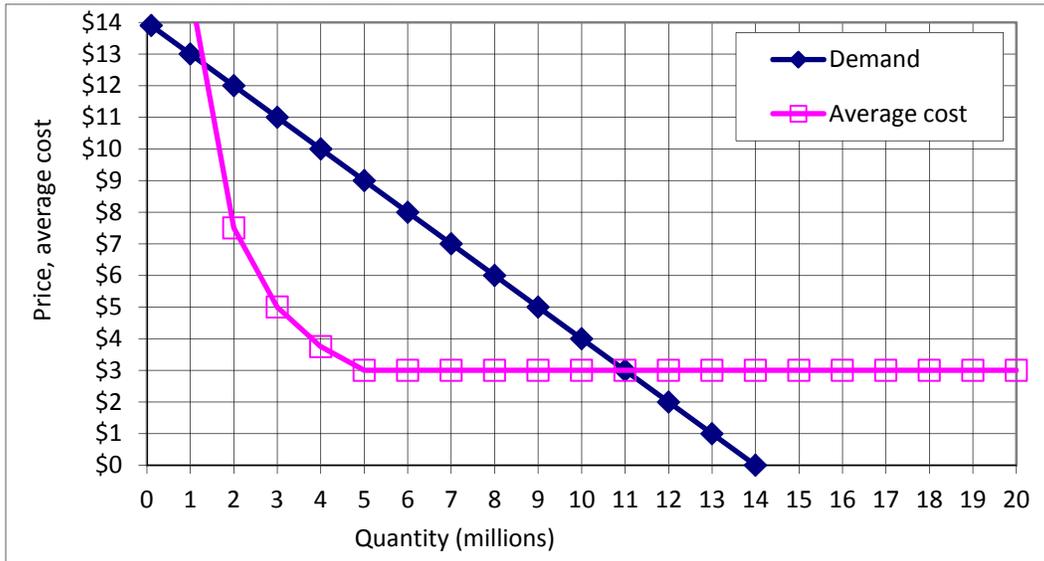
e. Compute total market quantity  $Q^*$  and the equilibrium price  $P^*$ .

f. Compute the Lerner index of market power  $[(P-MC)/P]$ .

g. Compute the social deadweight loss from Cournot duopoly.



(3) [Entry barriers and contestable markets: 26 pts] The graph below shows a market where the incumbent firm now produces seven million units of output and sets a price of \$7. The average cost curve applies to the incumbent and to any other firm that tries to enter this market.



- What is minimum average cost?
- What is the minimum efficient scale?
- Assume  $MC=AC$  and compute the incumbent's Lerner index (or "price-cost margin").

\$
million

First, suppose a second firm enters the market and produces three million units of output. Assume the Bain-Sylos postulate: the incumbent firm keeps its output level fixed at seven million and lets the market price fall.

- What is the new market price?
- What is the entrant's average cost?
- Does the entrant make a profit or a loss?
- How much?

\$
\$
\$ million

Alternatively, suppose a second firm enters the market and offers a price of \$6. Do not assume the Bain-Sylos postulate. Instead assume the market is *contestable* and the incumbent firm keeps its price fixed at \$7.

- What is the entrant's quantity?
- What is the entrant's average cost?
- Does the entrant make a profit or a loss?
- How much?
- What price *should* the incumbent set to prevent entry?
- Compute the incumbent's Lerner index (or "price-cost margin") assuming it sets price as in part (l).

million
\$
\$ million
\$

(4) [HHI and merger guidelines: 12 pts] Suppose the market shares in an industry are as follows.

Firm	#1	#2	#3	#4	#5	#6	#7	#8	#9
Market share	20%	20%	10%	10%	10%	10%	10%	5%	5%

- a. Compute the current value of the Hirschman-Herfindahl index.
- b. Under the 2010 DOJ-FTC *Horizontal Merger Guidelines*, would this industry be classified as “unconcentrated,” “moderately concentrated,” or “highly concentrated”?


Now suppose Firm #3 were to merge with Firm #8.

- c. Compute the postmerger value of the Hirschman-Herfindahl index.
- d. Under the 2010 DOJ-FTC *Horizontal Merger Guidelines*, would this industry now be classified as “unconcentrated,” “moderately concentrated,” or “highly concentrated”?
- e. On the basis of these concentration calculations alone, would the government likely oppose this merger, according to the *Guidelines*? (Answer yes or no.)
- f. Why or why not?


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(5) [Successive monopolies with fixed proportions: 26 pts] Suppose an upstream monopoly firm produces a proprietary sauce that is used by a downstream industry to make pizzas. The upstream firm has constant marginal cost (equal to average cost) of  $MC_S = \$1$ . Each pizza requires exactly one unit of sauce and \$3 of other inputs in fixed proportion. Therefore the downstream industry has constant marginal cost (equal to average cost) of \$3 plus the price of sauce,  $P_S$ , which is set by the upstream monopolist. The key assumptions are

Marginal and average cost of sauce:	$MC_S = AC_S = \$1.$
Marginal and average cost of pizzas:	$MC_P = AC_P = \$3 + P_S$
Demand for pizzas:	$P_P = 12 - (Q/100).$

- a. [2 pts] Find the equation for the marginal revenue curve for pizzas. [Hint: If demand is linear, marginal revenue has the same vertical intercept, but twice the slope, as the demand curve.]

$MR_P =$
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[Question continues on next page.]

Now compare market outcomes under two scenarios: (i) upstream and downstream markets are both monopolized, and (ii) upstream and downstream are served by a vertically-integrated monopoly.

(i) First suppose both upstream and downstream markets are both monopolized. This is the scenario of "successive monopolies" or "double marginalization."

b. [2 pts] Find the equation for the derived demand curve for sauce. [Hint: Set the marginal cost of the pizzas equal to  $MR_P$  and solve for  $P_S$ .]

$$P_S =$$

c. [2 pts] Find the equation for the marginal revenue curve for sauce. [Hint: For linear demand curves, marginal revenue has the same vertical intercept, but twice the slope, as the demand curve.]

$$MR_S =$$

Now compute the quantity of sauce (and thus pizzas) sold  $Q$ , the price of sauce  $P_S$ , the upstream sauce monopolist's profit, the price of pizzas  $P_P$ , and the downstream pizza monopolist's profit. Insert your answers in column (i) in the **Table of Results** below.

(ii) Second, assume the upstream and downstream industries are served by a vertically-integrated monopoly. The marginal cost of pizzas for the vertically-integrated monopoly is therefore  $MC = \$1 + \$3$ .

Now compute the quantity of pizzas, the price of pizzas  $P_P$ , and the integrated monopolist's profit. Insert your answers in column (ii) of the Table of Results below.

<b>Table of Results</b> [18 pts]	<b>(i) Successive monopolies</b>	<b>(ii) Vertically integrated monopoly</b>
Q = quantity of sauce (and pizzas)		
$P_S$ = price of sauce	\$	
Profit of upstream firm	\$	
$P_P$ = price of pizzas	\$	\$
Profit of downstream firm	\$	
Total upstream + downstream profits	\$	\$

d. [2 pts] Suppose this industry were initially organized as successive monopolies. Then suppose the upstream firm proposed to merge with the downstream firm. Should the government try to block the merger? Why or why not?

(6) [Tying: 14 pts] Suppose a monopoly cable TV service believes that representative households A, B, and C are willing to pay the following amounts for premium channels.

	Household A	Household B	Household C
Comedy channel	\$5	\$20	\$5
Action channel	\$10	\$5	\$25
Sports channel	\$25	\$20	\$5

Suppose that each channel were priced separately, and suppose the cable TV service wishes to maximize revenue.

- a. What price should be charged for the comedy channel? 

\$
----
- b. What price should be charged for the action channel? 

\$
----
- c. What price should be charged for the sports channel? 

\$
----
- d. How much revenue would the cable TV service receive in total for all three channels and all three customers? 

\$
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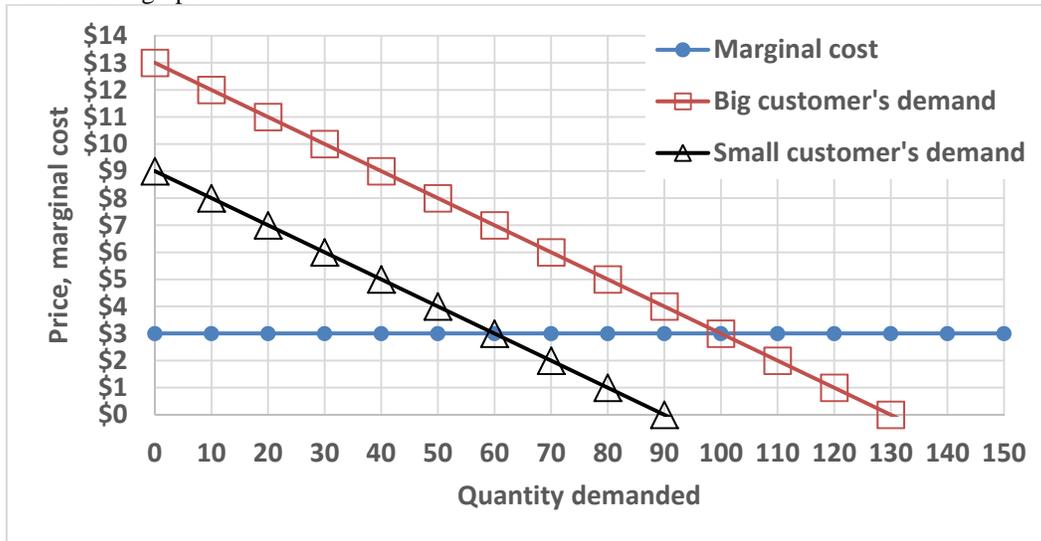
Suppose instead that all three channels were bundled and priced as a “premium package,” and not sold separately. Again assume the cable TV service wishes to maximize revenue.

- e. What price should be charged for the package of three channels? 

\$
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- f. How much revenue would the cable TV service receive in total for all three customers? 

\$
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- g. Should the cable TV service sell the channels *separately* or as a *package*?

(7) [Multipart tariffs: 26 pts] Suppose a regulated firm has a marginal cost (= average variable cost) of \$3. In addition to the marginal cost shown in the graph below, the firm has "fixed" or overhead costs of \$200 million per month. The firm serves both big customers and customers. Their representative individual monthly demand curves are also shown in the graph.



Consider two alternative tariffs:

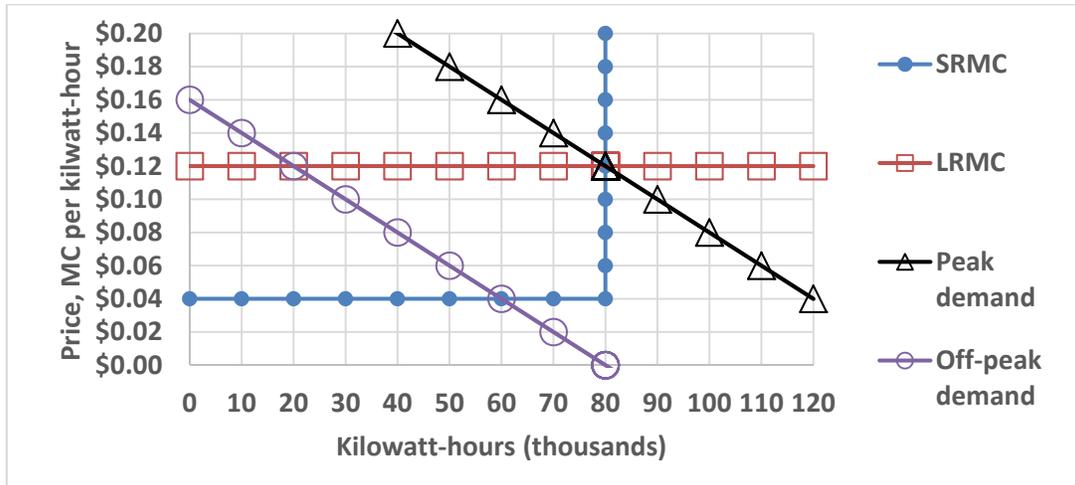
- (i) **Two-part tariff.** Each customer must pay an entry fee (or monthly charge) of \$100 and a per-unit usage charge of \$3 per unit.
- (ii) **Declining-block tariff.** Each customer must pay \$5 per unit for the first 60 units purchased, and \$3 per unit thereafter.

Assume there are one million big customers and one million small customers. Compute the following.

	(i) Two-part tariff	(ii) Declining-block tariff
a. What quantity would a typical big customer buy?	units	units
b. What quantity would a typical small customer buy?	units	units
c. Compute the firm's total revenue.	\$ million	\$ million
d. Compute the firm's total cost (including the "fixed" cost).	\$ million	\$ million
e. Does the firm make a <i>profit</i> , a <i>loss</i> , or just <i>break even</i> ?		
f. Compute the social deadweight loss from this pricing policy.	\$ million	\$ million

g. Which of these tariffs do you favor? Why?

(8) [Peak-load pricing: 22 pts] Suppose cost and demand for electricity are given by the following graph. Costs are shown as short-run marginal cost (SRMC) and long-run marginal cost (LRMC) curves. LRMC includes the cost of building new capacity. Demands are shown as peak demand and off-peak demand. Assume for simplicity that peak and off-peak periods are the only periods, and they are of equal duration.



a. Explain in words why SRMC bends up vertically at 80 thousand kilowatt hours.

First, suppose efficient peak-load pricing is used.

- b. Find the price of electricity during the peak period.
- c. Find the quantity of electricity demanded during the peak period.
- d. Find the price of electricity during the off-peak period
- e. Find the quantity of electricity demanded during the off-peak period.

\$	per kWh
	thousand kWh
\$	per kWh
	thousand kWh

Now suppose instead a uniform price of **\$ 0.10** per kilowatt-hour is used in both peak and off-peak periods.

- f. Find the quantity of electricity demanded during the peak period.
- g. Find the quantity of electricity demanded during the off-peak period.
- h. Would generation capacity have to *increase, decrease, or stay the same* to accommodate uniform pricing?
- i. By how much?
- j. In the graph above, shade the areas representing social deadweight loss from uniform pricing.
- k. Compute the social deadweight loss from uniform pricing.

	thousand kWh
	thousand kWh
	thousand kWh

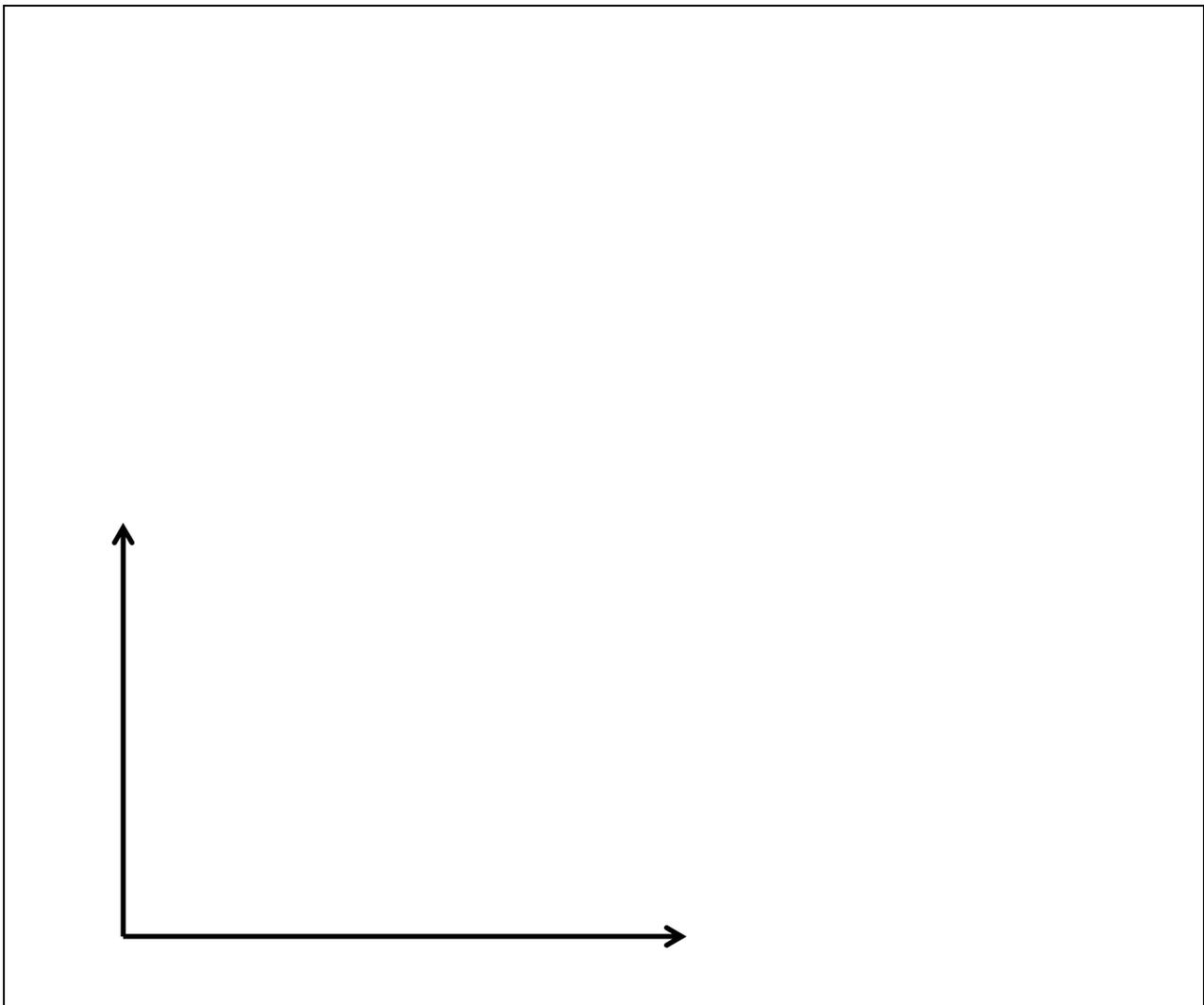
\$	thousand
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**III. Critical thinking:** Write a short essay answering *just one* question below (your choice). Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling. [6 pts]

(1) Suppose a proposed horizontal merger would increase industry concentration sufficiently that it would be presumed by antitrust authorities to enhance market power. Describe two situations where the authorities might approve the merger anyway, according to the 2010 Horizontal Merger Guidelines. (Ignore the graph.)

(2) Bridges are expensive to construct, so often the money to pay for their construction is recovered through tolls. In big cities, bridges are intensively used on weekdays (Monday-Friday) but only lightly used on weekends (Saturday-Sunday).

- a. Are bridges a *joint cost* or a *common cost*<sup>i</sup> for weekday traffic and weekend traffic? Why? Justify your answer and illustrate it with a production-possibility curve.
- b. Assume that the government wants to set tolls so as that price equals marginal cost. Should the cost of bridge construction be included in weekday tolls only, in weekend tolls only, or both? Why?



[end of exam]

<sup>i</sup> Use Kahn's definitions of *common cost* and *joint costs*. Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Volume 1, New York: Wiley, 1970, pp.78-79.