

1. Feram and Ocel are the only two steel manufacturers in the region. Feram is deciding whether to transport its steel with Truck or Rail. Ocel is deciding whether to produce its steel as Sheets or Beams. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Feram's profit, and the second entry shows Ocel's profit. Each firm independently and simultaneously chooses its strategy. Assume that Feram and Ocel know all the information in the matrix and do not cooperate.

		Ocel	
		Sheets	Beams
Feram	Truck	\$40 million, \$95 million	\$20 million, \$125 million
	Rail	\$50 million, \$75 million	\$30 million, \$25 million

Part A

What is Feram's most profitable strategy if Ocel chooses to produce Sheets?

Part B

Does Ocel have a dominant strategy? Explain using numbers from the payoff matrix.

Part C

Identify the Nash equilibrium (or equilibria) for this game, or state that none exists.

Part D

Suppose Feram incurs a \$20 million increase in the cost of Rail transport, with no change in the cost of Truck transport. Redraw the payoff matrix, including the firms, strategies, and payoffs, showing how the \$20 million increase in the cost of Rail transport affects the payoff matrix.

Part E

Suppose instead that Feram and Ocel now cooperate and merge into one new firm, Acier, which is now the only producer of steel in the region. Acier produces the profit-maximizing quantity of steel and is earning positive economic profit. Draw a correctly labeled graph for Acier, and show each of the following.

- Acier's profit-maximizing quantity, labeled Q_1
- Acier's profit-maximizing price, labeled P_1
- The average total cost curve, labeled ATC, consistent with Acier earning positive economic profit
- The area of deadweight loss, shaded completely

Part F

Government regulators impose a lump-sum tax on Acier. In the short run, will Acier's profit-maximizing price of steel increase, decrease, or remain the same as a result of the lump-sum tax? Explain.

1. Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

A. Draw a correctly labeled graph for Voda Reservoir and show each of the following.

- The profit-maximizing quantity, labeled Q_M
- The profit-maximizing price, labeled P_M
- The average total cost curve consistent with Voda Reservoir earning negative economic profit, labeled ATC
- The area of deadweight loss, shaded completely

B. Suppose the government requires Voda Reservoir to produce the socially optimal quantity of bottled water. On your graph in part A, show the socially optimal quantity of bottled water, labeled Q_S .

C. Suppose instead the government grants a per-unit subsidy to Voda Reservoir. What will happen to Voda Reservoir's profit-maximizing quantity of bottled water? Explain.

D. Suppose new producers have entered the bottled-water market and Voda Reservoir continues to operate in the bottled-water market. Will the demand for Voda Reservoir's bottled water become more elastic, become less elastic, or stay the same as new producers enter the market?

E. Voda Reservoir hires workers in a perfectly competitive labor market.

- If the demand for bottled water increases, what will happen to Voda Reservoir's demand for labor? Explain.
- The government implements a new regulation that increases the minimum age required for a worker to be employed in a bottled-water factory. What will happen to the market wage in the short run? Explain.

1. Arzeze Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeze Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.

(a) Draw a correctly labeled graph for Arzeze Pharma and show each of the following.

- (i) The profit-maximizing quantity of eye treatments, labeled Q^*
- (ii) The profit-maximizing price, labeled P^*
- (iii) The average total cost curve consistent with positive economic profit, labeled ATC
- (iv) The area representing consumer surplus, shaded completely

(b) Suppose Arzeze Pharma wants to charge a price that maximizes its total revenue rather than its profit.

- (i) On your graph in part (a), show the revenue-maximizing quantity, labeled Q_R .
- (ii) At quantity Q_R identified in part (b)(i), is the demand for eye treatments elastic, inelastic, or unit elastic?

(c) Suppose now that Arzeze Pharma engages in perfect price discrimination.

- (i) On your graph in part (a), show the lowest price that Arzeze Pharma would charge, labeled P_2 .
- (ii) What would happen to consumer surplus? Explain.

(d) Suppose instead that Arzeze Pharma's patent expires. Will the demand for Arzeze Pharma's treatment become more elastic, become less elastic, or not change? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. RKB is a profit-maximizing monopoly that produces a new, patented electronic device. RKB is earning positive economic profit.

(a) Draw a correctly labeled graph for RKB, and show each of the following.

- (i) The profit-maximizing quantity, labeled Q_M
- (ii) The profit-maximizing price, labeled P_M
- (iii) The average total cost curve consistent with RKB earning positive economic profit
- (iv) The area representing the deadweight loss, shaded completely

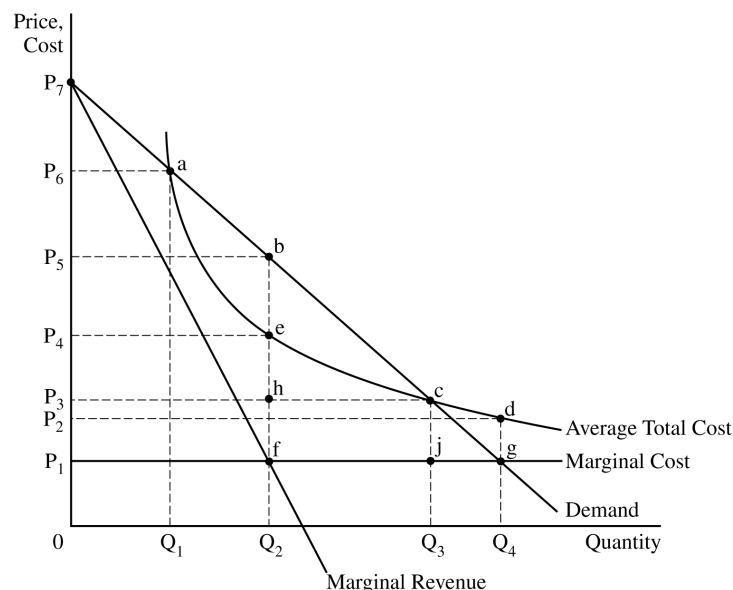
(b) The government wants RKB to produce the allocatively efficient quantity. Would the government impose a binding price ceiling, a binding price floor, a per-unit tax, or a lump-sum tax?

(c) Suppose that the government does not impose the policy you identified in part (b). Consumers now become aware of research that confirms the use of this new device harms users' vision. Given widespread consumer awareness of this research, what will happen to RKB's profit-maximizing quantity in the short run? Explain.

(d) Assume that RKB hires workers in a perfectly competitive labor market.

- (i) Draw a correctly labeled graph for the labor market, showing the equilibrium wage and quantity of labor, labeled W_E and Q_E , respectively.
- (ii) Suppose immigration increases the number of workers in this labor market. On your graph in part (d)(i), show the new equilibrium wage and quantity of labor, labeled W_2 and Q_2 , respectively.
- (iii) RKB uses the optimal combination of capital and labor in its production process. The firm rents capital at \$500 per unit, and the last unit of capital rented has a marginal product of 2,500 units. If the marginal product of the last unit of labor hired is 1,000 units, calculate the wage rate. Show your work.

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3. The graph shows the cost and revenue curves for an unregulated, profit-maximizing monopoly.

- Is the firm shown in this graph a natural monopoly? Explain.
- Using the labeling from the graph, identify the area representing the deadweight loss for this profit-maximizing monopoly.
- In order to improve resource allocation, the government sets a price that results in the firm earning zero economic profit.
 - Using the labeling from the graph, identify the price and resulting quantity the firm would produce.
 - Will this government policy eliminate the deadweight loss? Explain using labeling from the graph.
- Instead, the government decides to set a price that results in the socially optimal quantity of output. Will the firm earn positive, negative, or zero economic profit? Explain using labeling from the graph.

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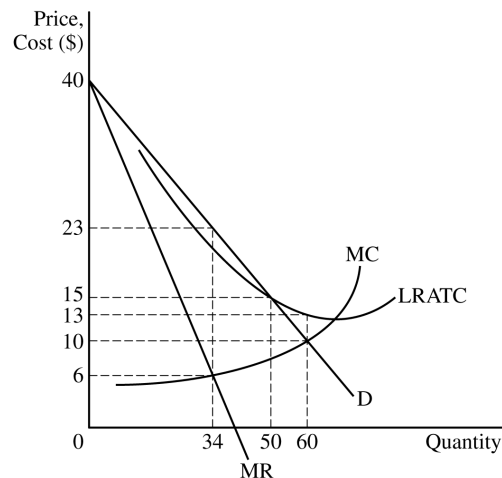
END OF EXAM

1. A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

- Draw a correctly labeled graph for the firm and show each of the following.
 - The quantity of carbon-capture devices produced by the firm, labeled Q_M
 - The price charged by the firm, labeled P_M
 - The area representing consumer surplus, shaded completely
- The government is considering different options to regulate the firm.
 - Suppose the government is considering taxing the firm. Could using a per-unit tax change the firm's output to the socially optimal quantity? Explain.
 - Instead, suppose the government imposes a price ceiling so that the firm produces the socially optimal quantity. On your graph in part (a), label the quantity and price after the price ceiling is imposed as Q_C and P_C .
 - At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.
- Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.
 - If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.
 - Starting at the total-revenue-maximizing quantity, if the firm reduces the price by 10%, would the quantity demanded increase by less than 10%, by more than 10%, or by exactly 10%?

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. The graph provided shows the demand (D), long-run average total cost (LRATC), marginal cost (MC), and marginal revenue (MR) curves for a natural monopoly.



- (a) Over the output range of 0 to 60 units, is this firm experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain.
- (b) Using numbers from the graph, identify the price and quantity produced at which the monopolist earns zero economic profit.
- (c) Assume that regulators impose a price ceiling that results in the firm producing the socially optimal quantity in the short run.
- Calculate the total revenue at the price ceiling. Show your work.
 - Explain why the firm requires a subsidy to continue producing in the long run.
 - Calculate the lump-sum subsidy that would be required for the monopolist to produce the socially optimal quantity in the long run. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

1. The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.
- (a) Draw a correctly labeled graph for SkyRunner, and show each of the following.
- The profit-maximizing quantity of tickets, labeled Q_M
 - The profit-maximizing price of a ticket, labeled P_M
 - The area representing profits, shaded completely

Now the island's tourist bureau asks the government to consider the following two proposals.

- Proposal I: Set a price ceiling on tickets that eliminates all deadweight loss.
- Proposal II: Eliminate SkyRunner's monopoly rights, which will remove all barriers to entry.

- (b) Suppose the government adopts proposal I. On your graph in part (a), indicate the quantity of tickets sold in the short run, labeled Q_C .
- (c) Suppose instead the government adopts proposal II. How will each of the following be affected in the long run compared to the market conditions in part (a) ?
- The quantity of tickets sold by SkyRunner. Explain.
 - The price elasticity of demand for SkyRunner's airline service. Explain.
 - SkyRunner's profits
 - The deadweight loss in the market. Explain.

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1. NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(a) Draw a correctly labeled graph of NCHart making a positive economic profit, and show each of the following.

- (i) The profit-maximizing quantity, labeled Q_m
- (ii) The profit-maximizing price, labeled P_m

(b) At Q_m from part (a)(i), is demand elastic, unit elastic, or inelastic? Explain using information from the graph.

(c) Instead of maximizing profit, suppose NCHart considers providing the new drug to as many patients as possible as long as it can generate enough revenue to cover its total costs.

- (i) On your graph from part (a), show the quantity that is consistent with this goal, labeled Q_z .
- (ii) At Q_z from part (c)(i), is there a deadweight loss? Explain.

(d) NCHart's patent expires next year, and a new firm, TXDrug, is considering whether to Enter this market or Stay Out. NCHart can either produce Q_m or Q_z . The firms independently and simultaneously choose their actions. The first entry in the payoff matrix represents NCHart's payoff and the second entry represents TXDrug's payoff. Both firms have complete information. Use the payoff matrix below to answer the following questions.

		TXDrug	
		Stay Out	Enter
NCHart	Q_m	\$10, \$0	\$4, \$1
	Q_z	\$0, \$0	-\$2, -\$1

- (i) Does TXDrug have a dominant strategy? Explain using strategies and payoffs from the payoff matrix.
- (ii) What is the best response for NCHart if TXDrug chooses to Stay Out?
- (iii) Identify the Nash equilibrium.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

MICROECONOMICS

Section II

Total Time—1 hour

Reading Period—10 minutes

Writing Period—50 minutes

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. Use a pen with black or dark blue ink.

1. As the only gas station in a small town, FillUp has a local monopoly on the sale of gasoline. FillUp is currently earning positive economic profit.
 - (a) Draw a correctly labeled graph for FillUp and show each of the following.
 - (i) FillUp's profit-maximizing quantity, labeled Q_F
 - (ii) FillUp's profit-maximizing price, labeled P_F
 - (iii) The deadweight loss associated with FillUp's profit-maximizing quantity, shaded completely
 - (iv) The maximum quantity at which FillUp would earn zero economic profit, labeled Q_Z
 - (b) Assume that FillUp's fixed costs increase because of a new lease on its property and FillUp stays in business. Will each of the following increase, decrease, or remain unchanged at FillUp's profit-maximizing quantity?
 - (i) The deadweight loss. Explain.
 - (ii) FillUp's economic profit
 - (c) Assume the demand for gasoline decreases because people bike to work more often.
 - (i) What must be true for FillUp to continue to operate in the short run?
 - (ii) What happens to FillUp's profit-maximizing quantity and price in the short run assuming the firm continues to operate?

MICROECONOMICS**Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

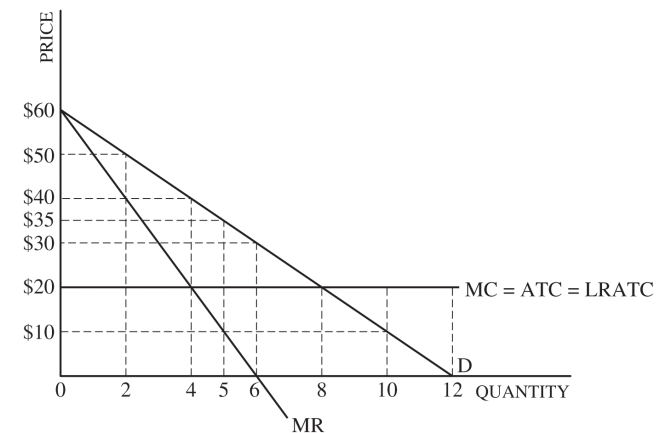
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1. Gigantic Pharmaceutical Corporation has a patent on a prescription drug, making it the only manufacturer of that prescription drug. Gigantic is currently earning a positive economic profit.
 - (a) Draw a correctly labeled graph for Gigantic and show each of the following.
 - (i) The profit-maximizing quantity, labeled Q_G
 - (ii) The profit-maximizing price, labeled P_G
 - (iii) The average total cost curve, labeled ATC
 - (iv) The area representing the consumer surplus, shaded completely
 - (b) Suppose the demand for the prescription drug increases, and Gigantic hires its warehouse workers in a perfectly competitive labor market.
 - (i) What will happen to Gigantic's demand for warehouse workers? Explain.
 - (ii) What will happen to the wage rate Gigantic pays its warehouse workers and the number of warehouse workers it hires?
 - (c) After Gigantic's patent expires, another firm enters the prescription drug market and produces an identical drug that sells for a lower price.
 - (i) What will happen to Gigantic's producer surplus?
 - (ii) What will happen to the consumer surplus in this prescription drug market? Explain.

MICROECONOMICS**Section II****Planning time—10 minutes****Writing time—50 minutes**

Directions: You have 10 minutes to read all of the questions in this booklet, to sketch graphs, to make notes, and to plan your answers. You will then have 50 minutes to answer all three of the following questions. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. In answering the questions, you should emphasize the line of reasoning that generated your results; it is not enough to list the results of your analysis. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. Use a pen with black or dark blue ink.

1. The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.



- (a) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.
 - (i) The quantity produced
 - (ii) The price
 - (iii) The allocatively efficient quantity
- (b) At the profit-maximizing quantity from part (a)(i), is the monopolist experiencing economies of scale? Explain.