

Week 18

AP Microeconomics

Homework bundle for this week

本周作业合集

exercises.lol

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4. Imperfect Competition

Starter Quiz · 课前小测

AP Microeconomics

Name: _____ Score: _____

1. A firm with market power faces a demand curve that is:
 - ☐ downward-sloping
 - ☐ horizontal (flat)
 - ☐ vertical
 - ☐ upward-sloping
2. A monopoly is a **price maker**, which means it:
 - ☐ chooses its price by choosing its output
 - ☐ must accept the market price
 - ☐ always charges marginal cost
 - ☐ cannot earn a profit
3. Price discrimination means:
 - ☐ charging different buyers different prices for the same good
 - ☐ refusing to serve some buyers
 - ☐ charging everyone the same low price
 - ☐ setting price equal to marginal cost
4. Monopolistic competition has:
 - ☐ many firms selling differentiated products
 - ☐ one firm with no substitutes
 - ☐ a few interdependent firms
 - ☐ identical products from every firm
5. The defining feature of an oligopoly is:
 - ☐ mutual interdependence between a few firms
 - ☐ thousands of tiny firms
 - ☐ identical products only
 - ☐ no barriers to entry
6. A price taker can raise its price above the market price and still sell everything.
 - ☐ True ☐ False

7. For a monopoly, marginal revenue is below the price because it must cut the price on every unit to sell more.

☐ True ☐ False

8. Select **all** conditions needed for price discrimination.

- ☐ the firm has market power
- ☐ buyers can be sorted by willingness to pay
- ☐ resale can be prevented
- ☐ the market is perfectly competitive

Tick every correct option.

9. Anything that stops new firms from entering a market is a _____ to entry.

10. Demand is $P = 100 - Q$, so $MR = 100 - 2Q$. With $MC = 20$, what is the monopoly quantity where $MR = MC$?

4. Imperfect Competition

Answers · 答案

AP Microeconomics

1. downward-sloping

To sell more it must lower its price — a downward-sloping demand curve.

2. chooses its price by choosing its output

With no rivals, the monopolist picks the point on the demand curve that maximises profit.

3. charging different buyers different prices for the same good

It bases each buyer's price on their willingness to pay.

4. many firms selling differentiated products

Many firms compete, but each product is a little different — giving slight market power.

5. mutual interdependence between a few firms

With only a few firms, each must consider how rivals will react.

6. False

A price taker must accept the market price; charging more loses all its buyers.

7. True

Lowering the price on all units makes the extra revenue (MR) smaller than the price.

8. the firm has market power; buyers can be sorted by willingness to pay; resale can be prevented

Market power, sortable buyers, and no resale — perfect competition rules it out.

9. barrier

Barriers to entry protect economic profit in the long run.

10. 40

Set $100 - 2Q = 20 \rightarrow 2Q = 80 \rightarrow Q = 40$.

4.1 Introduction to Imperfectly Competitive Markets

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS imperfectly competitive 不完全竞争 • monopoly 垄断 • monopsony 买方垄断
• oligopoly 寡头 • barriers to entry 进入壁垒

Objective

Build the skills to answer exam questions on **imperfectly competitive markets**.

You must be able to:

- define an **imperfectly competitive market** 不完全竞争市场 and contrast it with perfect competition
- describe **monopoly** 垄断, **oligopoly** 寡头, **monopolistic competition** 垄断竞争, and **monopsony** 买方垄断
- explain the role of **barriers to entry** 进入壁垒
- explain why such firms face a **downward-sloping demand curve** and have **market power** 市场势力

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Imperfect competition

Firms have **market power** — some control over price — so each faces a **downward-sloping demand curve** (unlike a price-taking competitive firm).

■ Four structures

- **Monopoly** — one seller.
- **Oligopoly** — a few interdependent sellers.
- **Monopolistic competition** — many sellers, differentiated products.
- **Monopsony** — a single **buyer** of a factor.

■ Barriers to entry

Patents, high fixed costs, or control of a resource block entry, letting firms keep long-run economic profit.

2 Practice

2.1 State one difference between perfect and imperfect competition. [2]

2.2 Name the four market structures listed above. [2]

2.3 State why barriers to entry matter for an imperfectly competitive firm. [1]

3 Exam-style questions

3.1 An imperfectly competitive firm faces a demand curve that is [1]

- **A** horizontal
- **B** downward-sloping
- **C** vertical
- **D** upward-sloping

3.2 A market with a single seller is a [1]

- **A** monopoly
- **B** oligopoly
- **C** monopsony
- **D** perfectly competitive market

3.3 A firm is the only seller in its market and is protected by patents.

- (a) Name the market structure. [1]
- (b) State what the patents act as. [1]
- (c) State what they allow the firm to keep in the long run. [1]

Solutions

2.1 a perfectly competitive firm is a price taker (horizontal demand); an imperfectly competitive firm has market power and a downward-sloping demand curve.

2.2 monopoly, oligopoly, monopolistic competition, monopsony.

2.3 they block entry, letting the firm keep economic profit in the long run.

3.1 B.

3.2 A.

3.3 (a) a monopoly. (b) a barrier to entry. (c) long-run economic profit.

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

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

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

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

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

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

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

(d) Suppose instead that Arzeeye Pharma's patent expires. Will the demand for Arzeeye 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.

4.2 Monopoly

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS monopoly 垄断 • deadweight loss 无谓损失 • natural monopoly 自然垄断

Objective

Build the skills to answer exam questions on **monopoly**.

You must be able to:

- explain why a **monopoly** 垄断 is a price maker whose **marginal revenue** lies below its demand
- determine the profit-maximizing quantity and price using $MR = MC$
- identify the **deadweight loss** 无谓损失 a monopoly creates
- describe a **natural monopoly** 自然垄断

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Price maker

To sell more, a monopolist must **lower its price** on all units, so **marginal revenue lies below** the demand curve.

■ Profit maximization

Produce where $MR = MC$, then read the **price** off the **demand** curve above that quantity.

■ Inefficiency and natural monopoly

A monopoly produces where $P > MC$, so it is **allocatively inefficient** and creates a **deadweight loss**. A **natural monopoly** has such large fixed costs that one firm is the least-cost producer.

2 Practice

2.1 State why a monopolist's marginal revenue lies below its demand curve. [1]

2.2 State the rule a monopolist uses to choose its quantity. [1]

2.3 State why a monopoly is allocatively inefficient. [1]

3 Exam-style questions

3.1 A monopoly maximizes profit where [1]

- A $P = MC$
- B $MR = MC$
- C $P = ATC$
- D $MR = 0$

3.2 A monopoly is allocatively inefficient because it produces where [1]

- A $P = MC$
- B $P > MC$
- C $P < MC$
- D $P = 0$

3.3 A monopolist produces where $MR = MC$ at $Q = 40$, charging $P = \$25$ (from demand), with $ATC = \$18$.

(a) Find the economic profit per unit. [1]

(b) Find the total economic profit. [1]

(c) State why the monopoly creates a deadweight loss. [1]

Solutions

2.1 to sell an extra unit it must lower the price on all units, so the added revenue is less than the price.

2.2 produce where marginal revenue equals marginal cost.

2.3 it produces where price exceeds marginal cost, so some beneficial units are not made.

3.1 B.

3.2 B.

3.3 (a) $25 - 18 = \$7$. (b) $7 \times 40 = \$280$. (c) it underproduces (relative to $P = MC$), so mutually beneficial trades are lost.

Name: _____

AP Microeconomics: 2026

- 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. Arzeeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.
- (a) Draw a correctly labeled graph for Arzeeye Pharma and show each of the following.
- The profit-maximizing quantity of eye treatments, labeled Q^*
 - The profit-maximizing price, labeled P^*
 - The average total cost curve consistent with positive economic profit, labeled ATC
 - The area representing consumer surplus, shaded completely
- (b) Suppose Arzeeye Pharma wants to charge a price that maximizes its total revenue rather than its profit.
- On your graph in part (a), show the revenue-maximizing quantity, labeled Q_R .
 - At quantity Q_R identified in part (b)(i), is the demand for eye treatments elastic, inelastic, or unit elastic?
- (c) Suppose now that Arzeeye Pharma engages in perfect price discrimination.
- On your graph in part (a), show the lowest price that Arzeeye Pharma would charge, labeled P_2 .
 - What would happen to consumer surplus? Explain.
- (d) Suppose instead that Arzeeye Pharma's patent expires. Will the demand for Arzeeye 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

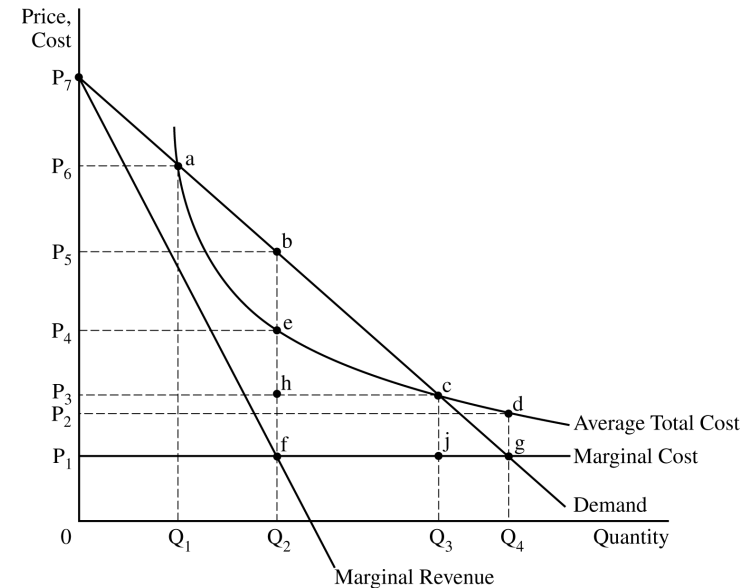
(b) The government wants RKB to produce the allocatively efficient quantity. Would the government impose a binding price ceiling, a binding price floor, a per-unit tax, or a lump-sum tax?

(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.

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

- (a) Is the firm shown in this graph a natural monopoly? Explain.
- (b) Using the labeling from the graph, identify the area representing the deadweight loss for this profit-maximizing monopoly.
- (c) In order to improve resource allocation, the government sets a price that results in the firm earning zero economic profit.
 - (i) Using the labeling from the graph, identify the price and resulting quantity the firm would produce.
 - (ii) Will this government policy eliminate the deadweight loss? Explain using labeling from the graph.
- (d) 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.

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. 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.

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

- (i) The quantity of carbon-capture devices produced by the firm, labeled Q_M
- (ii) The price charged by the firm, labeled P_M
- (iii) The area representing consumer surplus, shaded completely

(b) The government is considering different options to regulate the firm.

- (i) 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.
- (ii) 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 .
- (iii) At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.

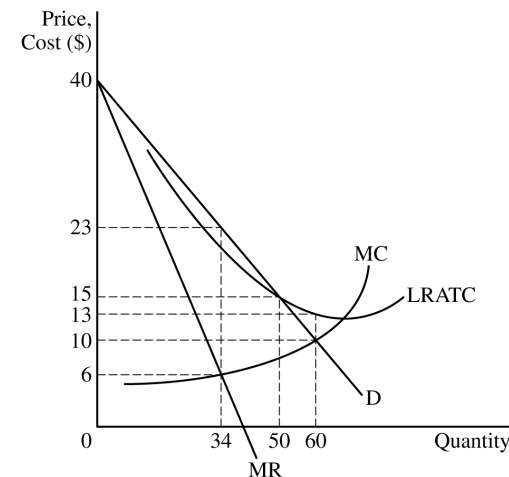
(c) Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.

- (i) If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.
- (ii) 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.

- (i) Calculate the total revenue at the price ceiling. Show your work.
- (ii) Explain why the firm requires a subsidy to continue producing in the long run.
- (iii) 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.

- (i) The profit-maximizing quantity of tickets, labeled Q_M
- (ii) The profit-maximizing price of a ticket, labeled P_M
- (iii) 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) ?

- (i) The quantity of tickets sold by SkyRunner. Explain.
- (ii) The price elasticity of demand for SkyRunner's airline service. Explain.
- (iii) SkyRunner's profits
- (iv) The deadweight loss in the market. 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. 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**

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. 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.

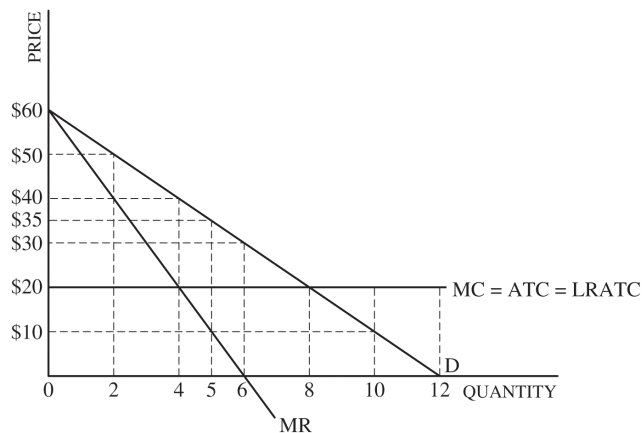
MICROECONOMICS
Section II

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.
- The quantity produced
 - The price
 - The allocatively efficient quantity
- (b) At the profit-maximizing quantity from part (a)(i), is the monopolist experiencing economies of scale? Explain.

AP MICROECONOMICS • EXERCISE SHEET

4.3 Price Discrimination

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS price discrimination 价格歧视 • deadweight loss 无谓损失 • market power 市场势力

Objective

Build the skills to answer exam questions on **price discrimination**.

You must be able to:

- define **price discrimination** 价格歧视 and list the conditions required
- explain **perfect (first-degree) price discrimination**
- analyse its effect on output, **consumer surplus**, and **producer surplus**
- explain why perfect price discrimination is allocatively efficient with no deadweight loss

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Price discrimination

Charging different buyers **different prices** for the same good. It needs: **market power**, a way to **separate** buyers by willingness to pay, and no **resale** between them.

■ Perfect price discrimination

The firm charges each buyer their **maximum willingness to pay**, capturing **all** consumer surplus as producer surplus.

■ Efficiency

It produces the **allocatively efficient** quantity (up to $P = MC$), so there is **no deadweight loss** — but consumers gain nothing.

2 Practice

2.1 Define price discrimination.

[1]

2.2 State two conditions needed for a firm to price discriminate. [2]

2.3 State what happens to consumer surplus under perfect price discrimination. [1]

3 Exam-style questions

3.1 Perfect price discrimination charges each buyer [1]

- **A** the same price
- **B** their maximum willingness to pay
- **C** marginal cost
- **D** zero

3.2 Under perfect price discrimination, the deadweight loss is [1]

- **A** doubled
- **B** zero
- **C** at its maximum
- **D** unchanged

3.3 A firm can identify each buyer's willingness to pay and prevent resale.

(a) Name the pricing strategy it can use. [1]

(b) State what happens to consumer surplus. [1]

(c) State whether output is allocatively efficient. [1]

Solutions

2.1 charging different buyers different prices for the same good.

2.2 any two of: market power, ability to separate buyers, ability to prevent resale.

2.3 it is reduced to zero (captured by the firm).

3.1 B.

3.2 B.

3.3 (a) perfect (first-degree) price discrimination. (b) it falls to zero. (c) yes — it is allocatively efficient.

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.

MICROECONOMICS

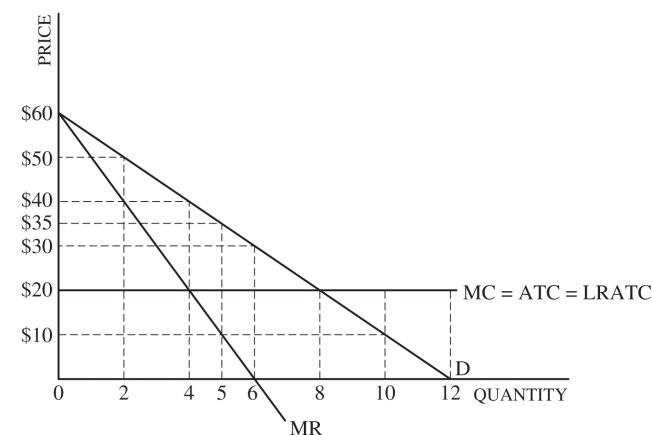
Section II

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.

4.4 Monopolistic Competition

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS differentiated 差异化 • monopolistic competition 垄断竞争
 • excess capacity 过剩产能 • market power 市场势力

Objective

Build the skills to answer exam questions on **monopolistic competition**.

You must be able to:

- list the characteristics of **monopolistic competition** 垄断竞争
- determine the short-run profit-maximizing quantity using $MR = MC$
- explain the long-run equilibrium where demand is tangent to ATC and economic profit is zero
- explain why it is inefficient ($P > MC$) with **excess capacity** 过剩产能

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Characteristics

Many firms, **differentiated** products, and **free entry and exit**. Each firm has a little market power, so its demand slopes downward.

■ Short run vs long run

Short run: produce where $MR = MC$; the firm may earn profit or loss. **Long run:** entry (or exit) shifts demand until it is **tangent to ATC**, giving **zero economic profit**.

■ Inefficiency

It produces where $P > MC$ and **not** at minimum ATC, so it has **excess capacity**. Firms rely on product differentiation and advertising.

2 Practice

2.1 State two characteristics of monopolistic competition. [2]

2.2 State the long-run economic profit level. [1]

2.3 State why monopolistic competition is inefficient. [1]

3 Exam-style questions

3.1 In monopolistic competition, products are [1]

- A identical
- B differentiated
- C free
- D unavailable

3.2 In long-run equilibrium, a monopolistically competitive firm earns [1]

- A economic profit
- B a loss
- C normal profit
- D nothing at all

3.3 A café in a town with many cafés is earning short-run economic profit.

- (a) State what happens to its demand as new cafés enter. [1]
(b) State its long-run economic profit. [1]
(c) Name one form of non-price competition it might use. [1]

Solutions

2.1 any two of: many firms, differentiated products, free entry and exit.

2.2 zero economic profit (normal profit).

2.3 it produces where $P > MC$ and above minimum ATC (excess capacity).

3.1 B.

3.2 C.

3.3 (a) its demand falls (shifts left) toward tangency with ATC. (b) zero economic profit.
(c) advertising or product differentiation (any one).

3. The table below shows the total cost and total benefit of advertisements placed by AZY Foods, a firm in the retail food market.

Number of Advertisements	Total Cost (\$)	Total Benefit (\$)
1	300	1,200
2	500	2,200
3	800	3,000
4	1,300	3,600
5	2,100	4,000
6	3,000	4,200
7	4,100	4,200

- (a) Calculate the total net benefit of placing three advertisements. Show your work.
- (b) Calculate the marginal net benefit of the third advertisement. Show your work.
- (c) What is the optimal number of advertisements placed by AZY Foods? Explain using marginal analysis.
- (d) Suppose over the next year the marginal benefit that AZY Foods receives from each advertisement increases by \$300. Identify the optimal number of advertisements.
- (e) There are many firms in the retail food market. Each firm places its own firm-specific advertisements without considering the actions of its competitors. In what market structure is AZY Foods operating?

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



3. Camden’s Cakery is one of many dessert cafés serving a local community. Each café produces a slightly differentiated product, there are no barriers to entry or exit, and the firm is in long-run equilibrium.
- (a) Draw a correctly labeled graph showing Camden’s demand curve, marginal revenue curve, marginal cost curve, and long-run average total cost curve. Label Camden’s profit-maximizing output Q_m and its price P_m .
- (b) On your graph in part (a), label the output at which total revenue is maximized Q_R .
- (c) Do firms in this market experience economies of scale, diseconomies of scale, or neither in long-run equilibrium? Explain.

STOP

END OF EXAM



4.5 Oligopoly and Game Theory

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS payoff matrix 收益矩阵 • dominant strategy 占优策略 • nash equilibrium 纳什均衡
• oligopoly 寡头垄断 • prisoner's dilemma 囚徒困境

Objective

Build the skills to answer exam questions on **oligopoly and game theory**.

You must be able to:

- describe an **oligopoly** 寡头垄断 with few firms and **mutual interdependence** 相互依存
- explain how **collusion** 合谋 and a **cartel** 卡特尔 raise prices
- use a **payoff matrix** 收益矩阵 and identify a **dominant strategy** 占优策略 and a **Nash equilibrium** 纳什均衡
- explain the **prisoner's dilemma** 囚徒困境

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Oligopoly

A **few** large firms that are **mutually interdependent** — each firm's best choice depends on what rivals do.

■ Collusion

If firms **collude** to form a **cartel**, they can restrict output and raise prices toward the **monopoly** outcome.

■ Game theory

A **dominant strategy** is best whatever the rival does. A **Nash equilibrium** is an outcome from which neither firm wants to deviate. In a **prisoner's dilemma**, both would gain by cooperating, but each has an incentive to defect — so cooperation often fails.

2 Practice

2.1 State two features of an oligopoly. [2]

2.2 Define a dominant strategy. [1]

2.3 State why firms in a prisoner's dilemma may fail to cooperate. [2]

3 Exam-style questions

3.1 An oligopoly has [1]

- **A** one firm
- **B** a few interdependent firms
- **C** very many firms
- **D** no firms

3.2 A successful cartel raises prices toward the [1]

- **A** competitive outcome
- **B** monopoly outcome
- **C** zero-price outcome
- **D** marginal-cost outcome

3.3 Two firms each choose “high price” or “low price”. Each earns more by cutting its price whatever the other does.

(a) Name each firm’s strategy. [1]

(b) Name the likely outcome (both charge a low price). [1]

(c) Name this type of game. [1]

Solutions

2.1 any two of: few firms, mutual interdependence, barriers to entry, differentiated or identical products.

2.2 a choice that is best for a firm no matter what its rival does.

2.3 each firm has an incentive to defect for a better individual payoff, so the cooperative outcome is not a stable equilibrium.

3.1 B.

3.2 B.

3.3 (a) a dominant strategy (charge the low price). (b) the Nash equilibrium. (c) a prisoner’s dilemma.

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.

3. Tony's Trinkets and Bitaly's Bracelets are the only two firms in a town that produce and sell jewelry. Tony's Trinkets is deciding whether to produce Unique jewelry or Typical jewelry. Bitaly's Bracelets is deciding whether to produce Gold jewelry or Silver jewelry. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Tony's Trinkets' profit, and the second entry shows Bitaly's Bracelets' profit. Each firm independently and simultaneously chooses its strategy. Assume that the two firms know all the information in the matrix and do not cooperate.

		Bitaly's Bracelets	
		Gold	Silver
Tony's Trinkets	Unique	\$15, \$21	\$20, \$19
	Typical	\$10, \$7	\$21, \$16

- Suppose Bitaly's Bracelets chooses to produce Silver jewelry. Is choosing to produce Unique jewelry the best choice for Tony's Trinkets? Explain using numbers from the payoff matrix.
- Is Bitaly's Bracelets' dominant strategy to produce Gold jewelry, to produce Silver jewelry, or does it not have a dominant strategy? Explain using numbers from the payoff matrix.
- Identify all Nash equilibria for this game.
- Suppose Tony's Trinkets' profit from producing Typical jewelry increases regardless of what Bitaly's Bracelets does. What is the minimum amount by which Tony's Trinkets' profit must increase in order for Typical jewelry to become a dominant strategy: \$2, \$4, \$6, \$11, or \$15?
- Suppose instead that these two firms now cooperate and merge into one firm to maximize their combined profits. The new firm will have two locations and continue to face the same actions and payoffs. Calculate the new firm's maximum combined profit. Show your work.

STOP
END OF EXAM

		Field Cruiser	
		Reliability	Power
Nice Ride	Safety	\$10 million, \$28 million	\$32 million, \$35 million
	Comfort	\$30 million, \$40 million	\$25 million, \$20 million

3. Nice Ride and Field Cruiser are the only two producers of vehicles. Nice Ride is deciding whether to improve Safety or Comfort. Field Cruiser is deciding whether to improve Reliability or Power. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Nice Ride’s profit, and the second entry shows Field Cruiser’s profit. Each firm independently and simultaneously chooses its strategy. Assume the two firms know all the information in the matrix and do not cooperate.
- (a) What is Field Cruiser’s most profitable strategy if Nice Ride chooses to improve Safety?
- (b) Does Nice Ride have a dominant strategy? Explain using numbers from the payoff matrix.
- (c) Is Nice Ride choosing to improve Safety and Field Cruiser choosing to improve Power a Nash equilibrium? Explain using numbers from the payoff matrix.
- (d) Suppose Nice Ride and Field Cruiser decide to merge to maximize combined profits and choose to keep producing both Nice Ride and Field Cruiser vehicles. Assuming the values in the payoff matrix do not change, what would be the new firm’s total profit?
- (e) Suppose instead that a change in fuel prices reduces the profitability of choosing to improve Power by \$10 million for Field Cruiser. Identify each firm’s profit at 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.

STOP

END — EXAM



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.



Dee's Pizzeria

		Enter	Stay Out
Patrick's Pie	Advertise	\$50, -\$2	\$175, \$0
	Do Not Advertise	\$150, \$15	\$100, \$0

3. Patrick's Pie is currently the only pizzeria in College Town. It can either advertise or not advertise. Dee's Pizzeria is contemplating whether to enter or stay out of the College Town market. Each pizza establishment independently and simultaneously makes its decision. The payoff matrix above shows the profits for each combination of decisions, and both players have complete information. The first entries in the payoff matrix are Patrick's profit, and the second entries are Dee's profit.
- What actions maximize the combined total profits for Patrick's Pie and Dee's Pizzeria?
 - Conditional on your response in part (a), does either Patrick's Pie or Dee's Pizzeria have an incentive to cheat on this combination of actions that maximize the combined total profits? Explain using numbers from the matrix for each pizzeria.
 - Does Patrick's Pie have a dominant strategy?
 - Identify the Nash equilibrium or equilibria actions for this game.
 - Ignoring antitrust considerations, suppose that Patrick pays Dee's Pizzeria \$20 if Dee chooses to "Stay Out."
 - Redraw this matrix including players, actions, and payoffs, showing how Patrick's Pie payment to Dee affected the payoffs.
 - Identify the Nash equilibrium for the redrawn matrix.

STOP**END OF EXAM**

Boulevard

		Delivery	No Delivery
Jackpot	6:00 P.M.	\$35, \$30	\$55, \$20
	9:00 P.M.	\$25, \$50	\$45, \$40

3. Jackpot Florist and Boulevard Gardens share the market for floral bouquets in Tuliptown. Jackpot is deciding whether to close at 6:00 P.M. or to close at 9:00 P.M., and Boulevard is deciding whether to offer Delivery or No Delivery. The payoff matrix above shows the annual profits for each combination of actions that the firms can choose. The first entry shows Jackpot's profit, and the second entry shows Boulevard's profit.
- Assume that both firms know all the information in the matrix and act simultaneously and independently.
- Is Jackpot's dominant strategy to close at 6:00 P.M., to close at 9:00 P.M., or does it not have a dominant strategy?
 - Suppose Jackpot chooses to close at 6:00 P.M. and Boulevard chooses No Delivery. Is this the profit-maximizing action by Boulevard? Explain using values from the payoff matrix.
 - How much profit will Boulevard earn in the Nash equilibrium?
 - Suppose these two firms merge to form one company with two locations and still face the same actions and payoffs. Which strategies would the new company choose to maximize its combined profit?
 - Now assume that instead of merging, Jackpot proposes a plan to cooperate with Boulevard. Jackpot would agree to close at 9:00 P.M., and Boulevard would agree to No Delivery. If either firm breaks the agreement, it **MUST** subtract \$12 from its profit that is then added to the other firm's profit.
 - Assuming the agreement was in effect and enforced, redraw the matrix, including the players, actions, and payoffs.
 - Assuming Boulevard is a profit-maximizing firm and there are no antitrust concerns, would Boulevard agree to Jackpot's proposal? Explain using specific values from the redrawn payoff matrix.

STOP**END OF EXAM**

2. Breadbasket and Quicklunch are the only two sandwich shops serving a small town. Each shop can choose to set a high price or a low price for sandwiches. The payoff matrix below shows the daily profits for each combination of prices that the two shops could choose. The first entry shows Breadbasket's profits, and the second entry shows Quicklunch's profits. Assuming that both shops know the information shown in the matrix, answer the following.

		Quicklunch	
		High Price	Low Price
Breadbasket	High Price	\$105, \$110	\$40, \$130
	Low Price	\$120, \$80	\$75, \$70

- (a) Does each shop have a dominant strategy to set a high price, a dominant strategy to set a low price, or does it have no dominant strategy?
- (i) Breadbasket
- (ii) Quicklunch
- (b) If the two shops do not cooperate on setting prices, what will be the profit for each shop?
- (i) Breadbasket
- (ii) Quicklunch
- (c) The town government is concerned that food prices are too high. It decides to give a daily subsidy of \$20 to any shop that chooses to set a low price for its food items. Redraw the payoff matrix under the government subsidy system.

Using your redrawn payoff matrix, answer each of the following.

- (i) Would Quicklunch choose to set a high price or a low price? Explain using specific values from your redrawn matrix.
- (ii) Would the profits for Breadbasket increase, decrease, or stay the same? Explain with a comparison to your answer in part (b)(i). Use the specific values.