9062395123

⇒) W

question (1)

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3. A monopolist firm faces a demand with constant elasticity of −2.0. It has a constant marginal cost of $20 per unit and sets a price to maximize profit. If marginal cost should increase by 25 percent, would the price charged also rise by 25 percent?

Approach

① (Theory) →

② Mathematical background

$$\int , \frac{d}{dx} , \boxed{Beta/Gamma function}$$

③ Economic Interpretations

Thermal ~~method~~

4. A firm faces the following average revenue (demand) curve:

$$P = 120 - 0.02Q$$

where Q is weekly production and P is price, measured in cents per unit. The firm's cost function is given by $C = 60Q + 25{,}000$. Assume that the firm maximizes profits.

a. What is the level of production, price, and total profit per week?

b. If the government decides to levy a tax of 14 cents per unit on this product, what will be the new level of production, price, and profit?

6. Suppose that an industry is characterized as follows:

$C = 100 + 2q^2$	each firm's total cost function
$MC = 4q$	firm's marginal cost function
$P = 90 - 2Q$	industry demand curve
$MR = 90 - 4Q$	industry marginal revenue curve

a. If there is *only one firm* in the industry, find the monopoly price, quantity, and level of profit.

b. Find the price, quantity, and level of profit if the industry is competitive.

c. Graphically illustrate the demand curve, marginal revenue curve, marginal cost curve, and average cost curve. Identify the difference between the profit level of the monopoly and the profit level of the competitive industry in two different ways. Verify that the two are numerically equivalent.

7. Suppose a profit-maximizing monopolist is producing 800 units of output and is charging a price of $40 per unit.

   a. If the elasticity of demand for the product is −2, find the marginal cost of the last unit produced.

   b. What is the firm's percentage markup of price over marginal cost?

   c. Suppose that the average cost of the last unit produced is $15 and the firm's fixed cost is $2000. Find the firm's profit.

8. A firm has two factories, for which costs are given by:

$$\text{Factory \#1: } C_1(Q_1) = 10Q_1^2$$

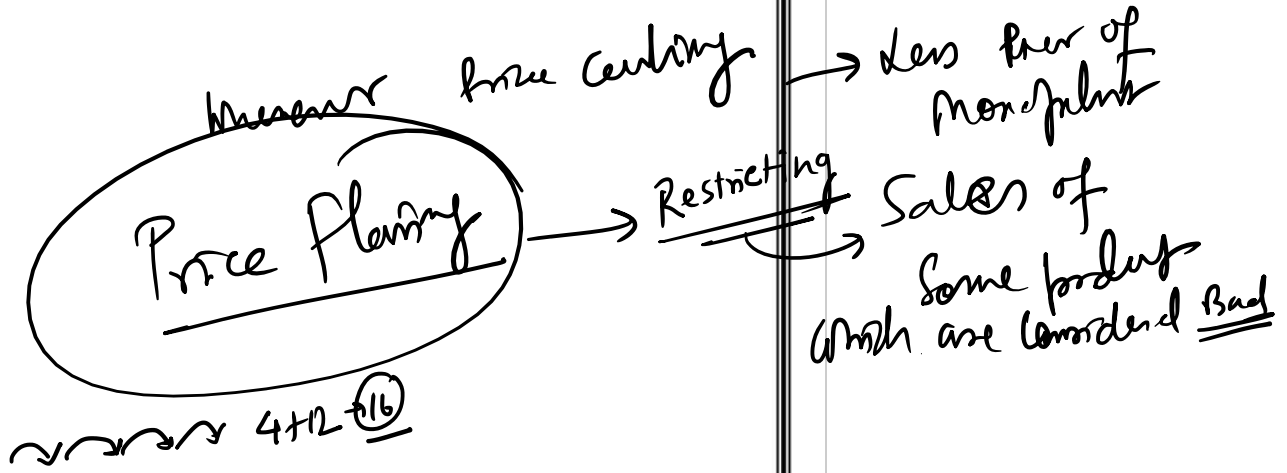$$\text{Factory \#2: } C_2(Q_2) = 20Q_2^2$$

The firm faces the following demand curve:

$$P = 700 - 5Q$$

where Q is total output—i.e., $Q = Q_1 + Q_2$.

a. On a diagram, draw the marginal cost curves for the two factories, the average and marginal revenue curves, and the total marginal cost curve (i.e., the marginal cost of producing $Q = Q_1 + Q_2$). Indicate the profit-maximizing output for each factory, total output, and price.

b. Calculate the values of Q_1, Q_2, Q, and P that maximize profit.

c. Suppose that labor costs increase in Factory 1 but not in Factory 2. How should the firm adjust (i.e., raise, lower, or leave unchanged) the following: Output in Factory 1? Output in Factory 2? Total output? Price?

9. A drug company has a monopoly on a new patented medicine. The product can be made in either of two plants. The costs of production for the two plants are $MC_1 = 20 + 2Q_1$ and $MC_2 = 10 + 5Q_2$. The firm's estimate of demand for the product is $P = 20 - 3(Q_1 + Q_2)$. How much should the firm plan to produce in each plant? At what price should it plan to sell the product?

Measure   Price Ceiling   → Less Power of Monopoly

Price Planning → Restricting Sales of Some product which are considered Bad

4+12 = 16

Q.4. A monopolist faces the demand curve $P = 11 - Q$, where P is measured in dollars per unit and Q in thousands of units. The monopolist has a constant average cost of $6 per unit.
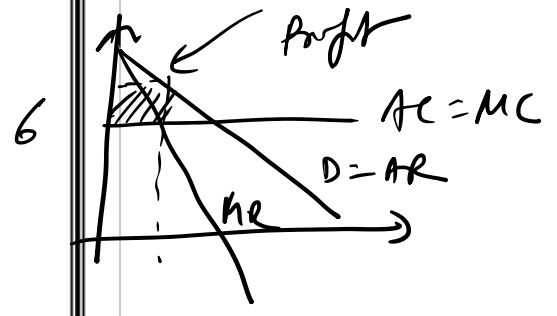
a. Draw the average and marginal revenue curves and the average and marginal cost curves. What are the monopolist's profit-maximizing price and quantity? What is the resulting profit? Calculate the firm's degree of monopoly power using the Lerner index.

b. A government regulatory agency sets a price ceiling of $7 per unit. What quantity will be produced, and what will the firm's profit be? What happens to the degree of monopoly power?

c. What price ceiling yields the largest level of output? What is that level of output? What is the firm's degree of monopoly power at this price?

--- Handwritten annotations (page 1) ---

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$AC = \dfrac{TC}{Q}$

$AC = 6$
$TC = 6Q$
$MC = 6$

6

Profit
$AC = MC$
$D = AR$
MR

For Part B
$7 = 11 - Q$
$Q = 4$
$\pi = 7.4\ m^n$
$-6\ m^n$
$= 4\ m^n$

LR
$\dfrac{P - MC}{P}$
$= \dfrac{8.5 - 6}{8.5}$
$= \dfrac{2.5}{8.5}$
$= 0.94$

$P = 11 - Q$
$TR = 11Q - Q^2$
$MR = 11 - 2Q$

$MC = 6$

$11 - 2Q = 6$
$Q \Rightarrow 2.5 = Q$ ~ $2.5\ m\ units$
$P = 11 - 2.5 = 8.5$

$\pi = TR - TC$
$= AR \cdot Q - AC \cdot Q$
$= 8.5 \cdot 2.5 - 6 \cdot 2.5$
$= 6.25$

$\dfrac{P - MC}{P}$
$\dfrac{7 - 6}{7} = \dfrac{1}{7} = 0.143$

Loses Some monopoly Power +
Lerner Index falls + Sales
Rises also

--- Page 2 ---

2. Michelle's Monopoly Mutant Turtles (MMMT) has the exclusive right to sell Mutant Turtle t-shirts in the United States. The demand for these t-shirts is $Q = 10,000/P^2$. The firm's short-run cost is SRTC = $2000 + 5Q$, and its long-run cost is LRTC = $6Q$.

a. What price should MMMT charge to maximize profit in the short run? What quantity does it sell, and how much profit does it make? Would it be better off shutting down in the short run?

b. What price should MMMT charge in the long run? What quantity does it sell and how much profit does it make? Would it be better off shutting down in the long run?

c. Can we expect MMMT to have lower marginal cost in the short run than in the long run? Explain why.

--- Handwritten annotations (page 2) ---

$MC = 5$

$MR = MC$
$P = 100\ Q^{-\frac{1}{2}}$
$PQ = 100\ Q^{\frac{1}{2}}$
$MR = 50\ Q^{-1/2}$
$MC = 5$
So, $5 = 50\ Q^{-\frac{1}{2}}$
$Q = 100$

So, $P = 100 (100^{-\frac{1}{2}})$
$= 100 \left(\dfrac{1}{10}\right)$
$P = 10$

$P > AVC$

LRMC > SRMC

6.5

$\pi = 10 \cdot 100 - \left[2000 + 5 \cdot 100\right]$
$= -1500$ Loss

Will he Continue? Yes becau

will he Continue? Yes becaun

$P \geq AVC$

6 for MR MC → 6 $50 Q^{-\frac{1}{2}} = 6$

$P = 100 (5011)^{2^{-\frac{1}{2}}}$ $Q = 69.44$

$= 100 \times 5/30 =$

$TR = PQ = 833.33$

12

$TC = 416.67$

Profit $= TR - TC > 0$

So, he un Remain in Bearsiners..

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9. The employment of teaching assistants (TAs) by major universities can be characterized as a monopsony. Suppose the demand for TAs is $W = 30,000 - 125n$, where W is the wage (as an annual salary) and n is the number of TAs hired. The supply of TAs is given by $W = 1000 + 75n$.

a. If the university takes advantage of its monopsonist position, how many TAs will it hire? What wage will it pay?

b. If instead, the university faced an infinite supply of TAs at the annual wage level of $10,000, how many TAs would it hire?
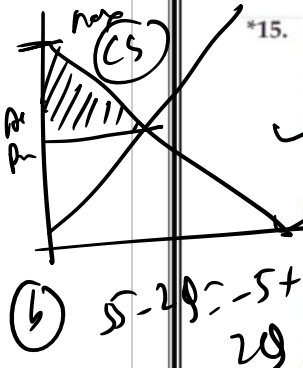
$30000 - 125n = 10000$

$20000 = 125n$

$\frac{20000}{125}$ $160 = n$

$Wn = 1000n + 75n^2$

TAl expenditure

$\frac{d}{dn}(Wn) = 1000 + 150n$

$30000 - 125n = 1000 + 150n$

or, $29000 = 275n$

or, $n = 105.5$

So, $1000 + 75(105.5)$

$= 8769$

*15. Dayna's Doorstops, Inc. (DD) is a monopolist in the doorstop industry. Its cost is $C = 100 - 5Q + Q^2$, and demand is $P = 55 - 2Q$.

a. What price should DD set to maximize profit? What output does the firm produce? How much profit and consumer surplus does DD generate?

b. What would output be if DD acted like a perfect competitor and set MC = P? What profit and consumer surplus would then be generated?

c. What is the deadweight loss from monopoly power in part (a)?

d. Suppose the government, concerned about the high price of doorstops, sets a maximum price at $27. How does this affect price, quantity, consumer surplus, and DD's profit? What is the resulting deadweight loss?

e. Now suppose the government sets the maximum price at $23. How does this decision affect price, quantity, consumer surplus, DD's profit, and deadweight loss?

f. Finally, consider a maximum price of $12. What will this do to quantity, consumer surplus, profit, and deadweight loss?
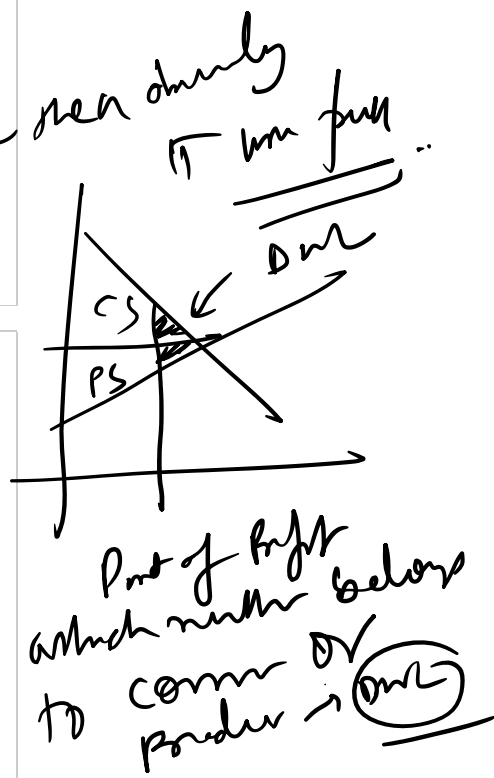
Handwritten annotations:

$TR = 55Q - 2Q^2$

(CS)

(b) $55 - 2Q = -5 + 2Q$

$Q = 15$

So,

$P = 55 - 2 \cdot 15 = 25$

$\Pi = 25 \cdot 15 - (100 - 5)(15 + 15^2)$

$= -725$

If they act like a P/C firm, then obviously Π will fall.

$MR = 55 - 4Q$
$MC = 2Q - 5$
So, $55 - 4Q = 2Q - 5$
$Q = 10$

$P = 55 - 2 \cdot 10 = 35$
$\Pi = TR - TC$
$= 35(10) - (100 - 5)(10 + 10^2)$
$= 200$

So,
$CS = 0.5 (10)(55 - 35)$
$= 0.5 \times 10 \times 20$
$= 100$

Part of profit which must belong to consumer or producer → (DWL)

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*16. There are 10 households in Lake Wobegon, Minnesota, each with a demand for electricity of $Q = 50 - P$. Lake Wobegon Electric's (LWE) cost of producing electricity is $TC = 500 + Q$.

a. If the regulators of LWE want to make sure that there is no deadweight loss in this market, what price will they force LWE to charge? What will output be in that case? Calculate consumer surplus and LWE's profit with that price.

b. If regulators want to ensure that LWE doesn't lose money, what is the lowest price they can impose? Calculate output, consumer surplus, and profit. Is there any deadweight loss?

c. Kristina knows that deadweight loss is something that this small town can do without. She suggests that each household be required to pay a fixed amount just to receive any electricity at all, and then a per-unit charge for electricity. Then LWE can break even while charging the price calculated in part (a). What fixed amount would each household have to pay for Kristina's plan to work? Why can you be sure that no household will choose instead to refuse the payment and go without

hold have to pay for Kristina's plan to work? Why can you be sure that no household will choose instead to refuse the payment and go without electricity?

---

18. A monopolist faces the following demand curve:

$$Q = 144/P^2$$

where Q is the quantity demanded and P is price. Its *average variable* cost is

$$AVC = Q^{1/2}$$

and its *fixed cost* is 5.

a. What are its profit-maximizing price and quantity? What is the resulting profit?

b. Suppose the government regulates the price to be no greater than $4 per unit. How much will the monopolist produce? What will its profit be?

c. Suppose the government wants to set a ceiling price that induces the monopolist to produce the largest possible output. What price will accomplish this goal?

4. Suppose that BMW can produce any quantity of cars at a constant marginal cost equal to $20,000 and a fixed cost of $10 billion. You are asked to advise the CEO as to what prices and quantities BMW should set for sales in Europe and in the United States. The demand for BMWs in each market is given by

$$Q_E = 4,000,000 - 100P_E$$

and

$$Q_U = 1,000,000 - 20P_U$$

where the subscript E denotes Europe, the subscript U denotes the United States. Assume that BMW can restrict U.S. sales to authorized BMW dealers only.

a. What quantity of BMWs should the firm sell in each market, and what should the price be in each market? What should the total profit be?

b. If BMW were forced to charge the same price in each market, what would be the quantity sold in each market, the equilibrium price, and the company's profit?

5. A monopolist is deciding how to allocate output between two geographically separated markets (East Coast and Midwest). Demand and marginal revenue for the two markets are

$$P_1 = 15 - Q_1 \qquad MR_1 = 15 - 2Q_1$$
$$P_2 = 25 - 2Q_2 \qquad MR_2 = 25 - 4Q_2$$

The monopolist's total cost is $C = 5 + 3(Q_1 + Q_2)$. What are price, output, profits, marginal revenues, and deadweight loss (i) if the monopolist can price discriminate? (ii) if the law prohibits charging different prices in the two regions?

*6. Elizabeth Airlines (EA) flies only one route: Chicago–Honolulu. The demand for each flight is $Q = 500 - P$. EA's cost of running each flight is $30,000 plus $100 per passenger.

a. What is the profit-maximizing price that EA will charge? How many people will be on each flight? What is EA's profit for each flight?

b. EA learns that the fixed costs per flight are in fact $41,000 instead of $30,000. Will the airline stay in business for long? Illustrate your answer using a graph of the demand curve that EA faces, EA's average cost curve when fixed costs are $30,000, and EA's average cost curve when fixed costs are $41,000.

c. Wait! EA finds out that two different types of people fly to Honolulu. Type A consists of business people with a demand of $Q_A = 260 - 0.4P$. Type B consists of students whose total demand is $Q_B = 240 - 0.6P$. Because the students are easy to spot, EA decides to charge them different prices. Graph each of these demand curves and their horizontal sum. What price does EA charge the students? What price does it charge other customers? How many of each type are on each flight?

d. What would EA's profit be for each flight? Would the airline stay in business? Calculate the consumer surplus of each consumer group. What is the total consumer surplus?

e. Before EA started price discriminating, how much consumer surplus was the Type A demand getting from air travel to Honolulu? Type B? Why did total consumer surplus decline with price discrimination, even though total quantity sold remained unchanged?

7. Many retail video stores offer two alternative plans for renting films:

- **A two-part tariff:** Pay an annual membership fee (e.g., $40) and then pay a small fee for the daily rental of each film (e.g., $2 per film per day).
- **A straight rental fee:** Pay no membership fee, but pay a higher daily rental fee (e.g., $4 per film per day).

What is the logic behind the two-part tariff in this case? Why offer the customer a choice of two plans rather than simply a two-part tariff?

8. Sal's satellite company broadcasts TV to subscribers in Los Angeles and New York. The demand functions for each of these two groups are

$$Q_{NY} = 60 - 0.25P_{NY}$$

$$Q_{LA} = 100 - 0.50P_{LA}$$

where Q is in thousands of subscriptions per year and P is the subscription price per year. The cost of providing Q units of service is given by

$$C = 1000 + 40Q$$

where $Q = Q_{NY} + Q_{LA}$.

a. What are the profit-maximizing prices and quantities for the New York and Los Angeles markets?

b. As a consequence of a new satellite that the Pentagon recently deployed, people in Los Angeles receive Sal's New York broadcasts and people in New York receive Sal's Los Angeles broadcasts. As a result, anyone in New York or Los Angeles can receive Sal's broadcasts by subscribing in either city. Thus Sal can charge only a single price. What price should he charge, and what quantities will he sell in New York and Los Angeles?

c. In which of the above situations, (a) or (b), is Sal better off? In terms of consumer surplus, which situation do people in New York prefer and which do people in Los Angeles prefer? Why?

*9. You are an executive for Super Computer, Inc. (SC), which rents out super computers. SC receives a fixed rental payment per time period in exchange for the right to unlimited computing at a rate of P cents per second. SC has two types of potential customers of equal number—10 businesses and 10 academic institutions. Each business customer has the demand function $Q = 10 - P$, where Q is in millions of seconds per month; each academic institution has the demand $Q = 8 - P$. The marginal cost to SC of additional computing is 2 cents per second, regardless of volume.

   a. Suppose that you could separate business and academic customers. What rental fee and usage fee would you charge each group? What would be your profits?

   b. Suppose you were unable to keep the two types of customers separate and charged a zero rental fee. What usage fee would maximize your profits? What would be your profits?

   c. Suppose you set up one two-part tariff—that is, you set one rental and one usage fee that both business and academic customers pay. What usage and rental fees would you set? What would be your profits? Explain why price would not be equal to marginal cost.

10. As the owner of the only tennis club in an isolated wealthy community, you must decide on membership dues and fees for court time. There are two types of tennis players. "Serious" players have demand

$$Q_1 = 10 - P$$

where Q_1 is court hours per week and P is the fee per hour for each individual player. There are also "occasional" players with demand

$$Q_2 = 4 - 0.25P$$

Assume that there are 1000 players of each type. Because you have plenty of courts, the marginal cost of court time is zero. You have fixed costs of $10,000 per week. Serious and occasional players look alike, so you must charge them the same prices.

a. Suppose that to maintain a "professional" atmosphere, you want to limit membership to serious players. How should you set the *annual* membership dues and court fees (assume 52 weeks per year) to maximize profits, keeping in mind the constraint that only serious players choose to join? What would profits be (per week)?

b. A friend tells you that you could make greater profits by encouraging both types of players to join. Is your friend right? What annual dues and court fees would maximize weekly profits? What would these profits be?

c. Suppose that over the years, young, upwardly mobile professionals move to your community, all of whom are serious players. You believe there are now 3000 serious players and 1000 occasional players. Would it still be profitable to cater to the occasional player? What would be the profit-maximizing annual dues and court fees? What would profits be per week?

2. Consider two firms facing the demand curve $P = 50 - 5Q$, where $Q = Q_1 + Q_2$. The firms' cost functions are $C_1(Q_1) = 20 + 10\,Q_1$ and $C_2(Q_2) = 10 + 12\,Q_2$.

   a. Suppose both firms have entered the industry. What is the joint profit-maximizing level of output? How much will each firm produce? How would your answer change if the firms have not yet entered the industry?

   b. What is each firm's equilibrium output and profit if they behave noncooperatively? Use the Cournot model. Draw the firms' reaction curves and show the equilibrium.

   c. How much should Firm 1 be willing to pay to purchase Firm 2 if collusion is illegal but a takeover is not?

3. A monopolist can produce at a constant average (and marginal) cost of AC = MC = $5. It faces a market demand curve given by $Q = 53 - P$.

   a. Calculate the profit-maximizing price and quantity for this monopolist. Also calculate its profits.

   b. Suppose a second firm enters the market. Let Q_1 be the output of the first firm and Q_2 be the output of the second. Market demand is now given by

   $$Q_1 + Q_2 = 53 - P$$

   Assuming that this second firm has the same costs as the first, write the profits of each firm as functions of Q_1 and Q_2.

   c. Suppose (as in the Cournot model) that each firm chooses its profit-maximizing level of output on the assumption that its competitor's output is fixed. Find each firm's "reaction curve" (i.e., the rule that gives its desired output in terms of its competitor's output).

   d. Calculate the Cournot equilibrium (i.e., the values of Q_1 and Q_2 for which each firm is doing as well as it can given its competitor's output). What are the resulting market price and profits of each firm?

   *e. Suppose there are N firms in the industry, all with the same constant marginal cost, MC = $5. Find the Cournot equilibrium. How much will each firm produce, what will be the market price, and how much profit will each firm earn? Also, show that as N becomes large, the market price approaches the price that would prevail under perfect competition.

4. This exercise is a continuation of Exercise 3. We return to two firms with the same constant average and marginal cost, AC = MC = 5, facing the market demand curve $Q_1 + Q_2 = 53 - P$. Now we will use the Stackelberg model to analyze what will happen if one of the firms makes its output decision before the other.

   a. Suppose Firm 1 is the Stackelberg leader (i.e., makes its output decisions before Firm 2). Find the reaction curves that tell each firm how much to produce in terms of the output of its competitor.

   b. How much will each firm produce, and what will its profit be?

5. Two firms compete in selling identical widgets. They choose their output levels Q_1 and Q_2 simultaneously and face the demand curve

$$P = 30 - Q$$

where $Q = Q_1 + Q_2$. Until recently, both firms had *zero marginal costs.* Recent environmental regulations have increased Firm 2's marginal cost to \$15. Firm 1's marginal cost remains constant at zero. True or false: As a result, the market price will rise to the *monopoly* level.

6. Suppose that two identical firms produce widgets and that they are the only firms in the market. Their costs are given by $C_1 = 60Q_1$ and $C_2 = 60Q_2$, where Q_1 is the output of Firm 1 and Q_2 the output of Firm 2. Price is determined by the following demand curve:

$$P = 300 - Q$$

where $Q = Q_1 + Q_2$.

a. Find the Cournot-Nash equilibrium. Calculate the profit of each firm at this equilibrium.

b. Suppose the two firms form a cartel to maximize joint profits. How many widgets will be produced? Calculate each firm's profit.

c. Suppose Firm 1 were the only firm in the industry. How would market output and Firm 1's profit differ from that found in part (b) above?

d. Returning to the duopoly of part (b), suppose Firm 1 abides by the agreement but Firm 2 cheats by increasing production. How many widgets will Firm 2 produce? What will be each firm's profits?

7. Suppose that two competing firms, A and B, produce a homogeneous good. Both firms have a marginal cost of MC = $50. Describe what would happen to output and price in each of the following situations if the firms are at (i) Cournot equilibrium, (ii) collusive equilibrium, and (iii) Bertrand equilibrium.

   a. Because Firm A must increase wages, its MC increases to $80.
   b. The marginal cost of both firms increases.
   c. The demand curve shifts to the right.

8. Suppose the airline industry consisted of only two firms: American and Texas Air Corp. Let the two firms have identical cost functions, $C(q) = 40q$. Assume that the demand curve for the industry is given by $P = 100 - Q$ and that each firm expects the other to behave as a Cournot competitor.

   a. Calculate the Cournot-Nash equilibrium for each firm, assuming that each chooses the output level that maximizes its profits when taking its rival's output as given. What are the profits of each firm?

   b. What would be the equilibrium quantity if Texas Air had constant marginal and average costs of $25 and American had constant marginal and average costs of $40?

   c. Assuming that both firms have the original cost function, $C(q) = 40q$, how much should Texas Air be willing to invest to lower its marginal cost from 40 to 25, assuming that American will not follow suit? How much should American be willing to spend to reduce its marginal cost to 25, assuming that Texas Air will have marginal costs of 25 regardless of American's actions?

*9. Demand for light bulbs can be characterized by $Q = 100 - P$, where Q is in millions of boxes of lights sold and P is the price per box. There are two producers of lights, Everglow and Dimlit. They have identical cost functions:

$$C_i = 10Q_i + \frac{1}{2}Q_i^2 (i = E, D)$$

$$Q = Q_E + Q_D$$

a. Unable to recognize the potential for collusion, the two firms act as short-run perfect competitors. What are the equilibrium values of Q_E, Q_D, and P? What are each firm's profits?

b. Top management in both firms is replaced. Each new manager independently recognizes the oligopolistic nature of the light bulb industry and plays Cournot. What are the equilibrium values of Q_E, Q_D, and P? What are each firm's profits?

c. Suppose the Everglow manager guesses correctly that Dimlit is playing Cournot, so Everglow plays Stackelberg. What are the equilibrium values of Q_E, Q_D, and P? What are each firm's profits?

d. If the managers of the two companies collude, what are the equilibrium values of Q_E, Q_D, and P? What are each firm's profits?

10. Two firms produce luxury sheepskin auto seat covers: Western Where (WW) and B.B.B. Sheep (BBBS). Each firm has a cost function given by

$$C(q) = 30q + 1.5q^2$$

The market demand for these seat covers is represented by the inverse demand equation

$$P = 300 - 3Q$$

where $Q = q_1 + q_2$, total output.

a. If each firm acts to maximize its profits, taking its rival's output as given (i.e., the firms behave as Cournot oligopolists), what will be the equilibrium quantities selected by each firm? What is total output, and what is the market price? What are the profits for each firm?

b. It occurs to the managers of WW and BBBS that they could do a lot better by colluding. If the two firms collude, what will be the profit-maximizing choice of output? The industry price? The output and the profit for each firm in this case?

c. The managers of these firms realize that explicit agreements to collude are illegal. Each firm must decide on its own whether to produce the Cournot quantity or the cartel quantity. To aid in making the decision, the manager of WW constructs a payoff matrix like the one below. Fill in each box with the profit of WW and the profit of BBBS. Given this payoff matrix, what output strategy is each firm likely to pursue?

PROFIT PAYOFF MATRIX	BBBS	
(WW PROFIT, BBBS PROFIT)	PRODUCE COURNOT q	PRODUCE CARTEL q
WW — Produce Cournot q		
WW — Produce Cartel q		

d. Suppose WW can set its output level *before* BBBS does. How much will WW choose to produce in this case? How much will BBBS produce? What is the market price, and what is the profit for each firm? Is WW better off by choosing its output first? Explain why or why not.