17 OLIGOPOLY

WHAT'S NEW IN THE SIXTH EDITION:

There is a new *In the News* box on "The Next Big Antitrust Target?"

LEARNING OBJECTIVES:

By the end of this chapter, students should understand:

- what outcomes are possible when a market is an oligopoly.
- the prisoners' dilemma and how it applies to oligopoly and other issues.
- how the antitrust laws try to foster competition in oligopolistic markets.

CONTEXT AND PURPOSE:

Chapter 17 is the final chapter in a five-chapter sequence dealing with firm behavior and the organization of industry. Chapters 14 and 15 discussed the two extreme forms of market structure—competition and monopoly. The market structure that lies between competition and monopoly is known as *imperfect competition*. There are two types of imperfect competition—monopolistic competition, which we addressed in the previous chapter, and oligopoly, which is the topic of the current chapter.
The purpose of Chapter 17 is to address *oligopoly*—a market structure in which only a few sellers offer similar or identical products. Because there are only a few sellers in an oligopolistic market, oligopolistic firms are interdependent whereas competitive firms are not. That is, in a competitive market, the decisions of one firm have no impact on the other firms in the market while in an oligopolistic market, the decisions of any one firm may affect the pricing and production decisions of the other firms in the market.

KEY POINTS:

- Oligopolists maximize their total profits by forming a cartel and acting like a monopolist. Yet, if oligopolists make decisions about production levels individually, the result is a greater quantity and a lower price than under the monopoly outcome. The larger the number of firms in the oligopoly, the closer the quantity and price will be to the levels that would prevail under perfect competition.

- The prisoners' dilemma shows that self-interest can prevent people from maintaining cooperation, even when cooperation is in their mutual interest. The logic of the prisoners' dilemma applies in many situations including arms races, advertising, common-resource problems, and oligopolies.

- Policymakers use the antitrust laws to prevent oligopolies from engaging in behavior that reduces competition. The application of these laws can be controversial, because some behavior that may seem to reduce competition may in fact have legitimate business purposes.

CHAPTER OUTLINE:

I. Definition of **oligopoly: a market structure in which only a few sellers offer similar or identical products.**

II. Definition of **game theory: the study of how people behave in strategic situations.**

  A. By strategic, we mean a situation in which each person, in deciding what actions to take, must consider how others might respond to that action.

  B. Each firm in an oligopoly must act strategically, because its profit not only depends on how much output it produces, but also on how much other firms produce as well.

III. Markets with Only a Few Sellers

  A. A key feature of oligopoly is the tension between cooperation and self-interest.

    1. The group of oligopolists is better off cooperating and acting like a monopolist, producing a small quantity of output and charging a price above marginal cost.

    2. Yet, because the oligopolist cares about his own profit, there is an incentive to act on his own. This will limit the ability of the group to act as a monopoly.

  B. A Duopoly Example

    1. A duopoly is an oligopoly with only two members.

    2. Example: Jack and Jill own the only water wells in town. They have to decide how much water to bring to town to sell. (Assume that the marginal cost of pumping each gallon of water is zero.)

> Use this example and show the competitive equilibrium first. Then, show the monopoly price and output. Finally, explain how the two suppliers would end up producing a quantity between the competitive and monopoly output and charging a price between the competitive price and the monopoly price.

3. The demand for the water is as follows:

Quantity (gallons)	Price	Total Revenue (and Total Profit)
0	$120	$0
10	110	1,100
20	100	2,000
30	90	2,700
40	80	3,200
50	70	3,500
60	60	3,600
70	50	3,500
80	40	3,200
90	30	2,700
100	20	2,000
110	10	1,100
120	0	0

C. Competition, Monopolies, and Cartels

1. If the market for water were perfectly competitive, price would equal marginal cost ($0). This means that 120 gallons of water would be sold.

2. If a monopoly controlled the supply of water, profit would be maximized at a price of $60 and an output of 60 gallons.

   a. Note that in this case, price ($60) exceeds marginal cost ($0).

   b. This level of output is lower than the socially efficient level of output (120 gallons).

3. The duopolists may agree to act together to set the price and quantity of water.

   a. Definition of **collusion: an agreement among firms in a market about quantities to produce or prices to charge.**

   b. Definition of **cartel: a group of firms acting in unison.**

   c. If Jill and Jack did collude, they would agree on the monopoly outcome of 60 gallons and a price of $60.

   d. The cartel must also decide how to split the production of water. Each member will want a larger share because that means more profit.

***The Informant!, Chapter 11* (47:00-53:50).** Matt Damon plays Mark Whitacre in the movie chronicling the price-fixing scandal at Archer Daniels Midland (ADM). This clip shows Whitacre meeting with other executives from the lysine industry to set an agreement to limit production and keep the price of lysine high.

4. *In the News: Public Price Fixing*

    a. Firms that meet in secret to set prices run the risk of prosecution.

    b. This is an article from *The Wall Street Journal* suggesting that firms may collude by publicly posting prices.

D. The Equilibrium for an Oligopoly

1. It is often difficult for oligopolies to form cartels.

    a. Antitrust laws prohibit agreements among firms.

    b. Squabbling among cartel members over their shares is also likely to occur.

2. In the absence of a binding agreement, the monopoly outcome is unlikely.

3. Assume that Jack expects Jill to produce 30 gallons of water (half of the monopoly outcome).

    a. Jack could also produce 30 gallons and earn a profit of $1,800.

    b. However, he could produce 40 gallons and earn a profit of $2,000.

    c. Jack will want to produce 40 gallons.

4. Jill might reason the same way. If she expects Jack to produce 30 gallons, she could increase her profits by raising her output to 40 gallons.

5. If duopolists pursue their own self-interest when deciding how much to produce, they produce a quantity greater than the monopoly quantity, charge a price lower than the monopoly price, and earn total profit less than the monopoly profit.

6. Definition of **Nash equilibrium: a situation in which economic actors interacting with one another each choose their best strategy given the strategies that all the other actors have chosen.**

7. In this example, the Nash equilibrium occurs when both Jack and Jill are producing 40 gallons.

    a. Given that Jack expects Jill to produce 40 gallons, he will not be better off at any other output level than 40 gallons.

    b. Given that Jill expects Jack to produce 40 gallons, she will not be better off at any other output level than 40 gallons.

8. Note that the oligopolists could earn a higher total profit if they cooperated with one another, but instead pursue their own self-interest and earn a lower level of profit.

9. When firms in an oligopoly individually choose production to maximize profit, they end up somewhere between perfect competition and monopoly.

    a. The quantity of output produced by the oligopoly is greater than the level produced by a monopoly but less than the level produced by a competitive market.

b. The oligopoly price is less than the monopoly price but greater than the competitive price (which implies that it is greater than marginal cost).

***A Beautiful Mind*, Chapter 5.** Russell Crowe plays John Nash in this movie based loosely on Nash's life. In this scene, Nash is at a bar with friends and has an idea about self-interest and general equilibrium. The scene is not perfect and actually misstates the definition of a Nash equilibrium. This offers you a chance to see if students can identify the error.

E. How the Size of an Oligopoly Affects the Market Outcome

You might want to point out that the Nash equilibrium will be (*n/n* + 1) of the competitive output. Therefore, with two suppliers, the joint output (80 units) will be two-thirds of the competitive equilibrium (120 units). This will help to explain that as the number of firms in an oligopoly market increases, the market output quickly approaches the competitive outcome.

1. When an oligopolist decides to increase output, two things occur.

   a. Because price is greater than marginal cost, increasing output will increase profit. This is the *output effect*.

   b. Because increasing output will raise the total quantity sold, the price will fall and will therefore lower profit. This is the *price effect*.

2. The larger the number of sellers in the industry, the less concerned each seller is about its own impact on market price.

3. Thus, as the number of sellers in an oligopoly grows larger, an oligopolistic market looks more and more like a competitive market.

   a. Price will approach marginal cost.

   b. The quantity of output produced will approach the socially efficient level.

Activity 1—Four Markets for Widgets

Instructions
Divide the class into four groups. Group A consists of one student (the first volunteer). Group B consists of the next three volunteers. Group C consists of the other three volunteers. Group D is the rest of the class.

Each group manufactures a unique type of widget. The firms within a group compete, but there is no competition across groups. Widgets are produced by writing the word "widget" on a sheet of paper.

Group A represents a monopoly. The monopolist does not need to consider the actions of any other firms. The professor will buy one widget from Group A. The professor is willing to pay up to $1 for this widget.

Group B represents an oligopoly. This group can communicate with each other and can examine each other's bids. (Have these students sit together.) They are allowed to make their decisions jointly, and may make agreements to share profits. The professor will buy one widget from Group B. The professor is willing to pay up to $1.00 for this widget, but will buy it from the lowest bidder.

Group C also represents an oligopoly. This group cannot communicate with each other. (Move these students away from each other.) The professor will buy one widget from Group C. The

"We can lock you up for one year. However, if you confess to the bank robbery and implicate your partner, we will give you immunity. You will go free and your partner will get 20 years in jail. If you both confess, we won't need your testimony and avoid the cost of a trial so you will both get an intermediate sentence of eight years."

3. The decision for both Bonnie and Clyde can be described using a payoff matrix:

Figure 1

		Bonnie's Decision	
		Confess	Remain Silent
Clyde's Decision	Confess	Bonnie gets 8 years Clyde gets 8 years	Bonnie gets 20 years Clyde goes free
	Remain Silent	Bonnie goes free Clyde gets 20 years	Bonnie gets 1 year Clyde gets 1 year

4. Definition of **<u>dominant strategy</u>: a strategy that is best for a player in a game regardless of the strategies chosen by the other players.**

***Seinfeld, "The Pez Dispenser,"* (Season 3, 13:09-15:49; 19:00-21:00).** George is dating a pianist. He needs "hand," as she is clearly the alpha member of the pair. Kramer suggests a preemptive breakup. George analyzes—if she accepts the breakup, there's no loss, as she was going to break up with him anyway. If she rejects the breakup, he will have established himself as the alpha member. Therefore, the preemptive breakup is a dominant strategy.

5. Bonnie's dominant strategy is to confess.

   a. If Clyde remains silent, Bonnie can go free by confessing.

   b. If Clyde confesses, Bonnie can lower her sentence by confessing.

6. Clyde's dominant strategy is to confess.

   a. If Bonnie remains silent, Clyde can go free by confessing.

   b. If Bonnie confesses, Clyde can lower his sentence by confessing.

7. If they had both remained silent, they would have been better off collectively (with a sentence of only one year instead of eight). But, by each pursuing his or her own self-interests, the two prisoners together reach an outcome that is worse for both of them.

8. Cooperation between the two prisoners is difficult to maintain, because cooperation is individually irrational.

Murder By Numbers, Chapters 20-21. Two high school students are suspected in a gruesome murder. They are brought to the station and interrogated separately. This scene is a classic example of the prisoners' dilemma.

C. Oligopolies as a Prisoners' Dilemma

1. Example: Jack and Jill are trying to keep the sale of water low to keep the price high. After reaching an agreement, each person must decide whether to follow the agreement.

2. Suppose that they are faced with the following decision:

Figure 2

		Jack's Decision	
		High Production	Low Production
Jill's Decision	High Production	\$1,600 profit for Jack \$1,600 profit for Jill	\$1,500 profit for Jack \$2,000 profit for Jill
	Low Production	\$2,000 profit for Jack \$1,500 profit for Jill	\$1,800 profit for Jack \$1,800 profit for Jill

3. The dominant strategy for Jack is to produce at a high rate.

   a. If Jill produces at a high rate, Jack will earn a higher amount of profit if he too produces at a high rate.

   b. If Jill produces at a low rate, Jack will earn a higher profit if he produces at a high rate as well.

4. For the same reasons, the dominant strategy for Jill is to produce at a high rate.

5. Even though total profit would be highest if both individuals produced at a low rate, self-interest will encourage them to produce at a high rate.

6. *Case Study: OPEC and the World Oil Market*

   a. Much of the world's oil is produced by a few countries. These countries have formed a cartel called the Organization of Petroleum Exporting Countries (OPEC).

   b. OPEC tries to raise the price of its product through a coordinated reduction in the quantity of oil produced.

   c. Like any oligopoly, the member nations face the dilemma between cooperation and self-interest.

   d. OPEC was fairly successful in maintaining cooperation and high prices from 1973 to 1985.

   e. In the early 1980s, member countries began arguing over production levels.

   f. In recent years, the cartel has been largely unsuccessful at reaching and enforcing agreements. (The rise in oil prices has been largely because of an increase in the demand.)

D. Other Examples of the Prisoners' Dilemma

1. Arms Races

Figure 3

a. The decision matrix could look like this:

		Decision of United States (U.S.)	
		Arm	Disarm
Decision of Soviet Union (USSR)	Arm	U.S. at risk USSR at risk	U.S. at risk and weak USSR safe and powerful
	Disarm	U.S. safe and powerful USSR at risk and weak	U.S. safe USSR safe

b. The dominant strategy for each country in this example is to arm.

2. Common Resources

Figure 4

a. The decision matrix could look like this:

		Exxon's Decision	
		Drill two wells	Drill one well
Texaco's Decision	Drill two wells	$4 million profit for Exxon $4 million profit for Texaco	$3 million profit for Exxon $6 million profit for Texaco
	Drill one well	$6 million profit for Exxon $3 million profit for Texaco	$5 million profit for Exxon $5 million profit for Texaco

b. The dominant strategy for both firms will be to drill two wells.

E. The Prisoners' Dilemma and the Welfare of Society

1. In some cases, the noncooperative equilibrium is bad from society's standpoint.

   a. In the arms race example, both countries end up at risk.

   b. In the common resources game, the extra wells dug are wasteful.

2. However, in the case of a cartel trying to maintain monopoly profits, the noncooperative solution is an improvement from the standpoint of society.

F. Why People Sometimes Cooperate

1. While cooperation is difficult to maintain, it is not impossible.

2. Cooperation is easier to enforce if the game is repeated.

3. *Case Study: The Prisoners' Dilemma Tournament*
   a. Political scientist Robert Axelrod held a tournament in which people entered by sending computer programs designed to play repeated prisoners' dilemma games.

   b. The winner was the program that received the fewest total years in jail.

   c. The winning strategy, called "tit-for-tat," occurred where a player would start out cooperating and then do whatever the other player did during the previous time period. In other words, the strategy starts out friendly, penalizes unfriendly players, and then forgives them if warranted.

V. Public Policy toward Oligopolies

A. Restraint of Trade and the Antitrust Laws

1. The Sherman Act of 1890 elevated agreements among oligopolists from an unenforceable contract to a criminal conspiracy.

2. The Clayton Act of 1914 strengthened the Sherman Act and allowed individuals the right to sue to recover three times the damages sustained from an illegal agreement to restrain trade.

3. *Case Study: An Illegal Phone Call*

   a. In the early 1980s, Howard Putnam, the president of Braniff Airways, taped a telephone call from Robert Crandall, the president of American Airlines.

   b. In the phone conversation, Crandall suggested to Putnam that they each raise their fares.

   c. Putnam turned the tape over to the Justice Department, which filed suit against Crandall.

B. Controversies over Antitrust Policy

1. Business practices that appear to reduce competition may in fact have legitimate purposes.

2. Resale Price Maintenance

   a. Resale price maintenance is a restriction by a manufacturer on the price that sellers can charge for a product, usually used to keep the price from being lower at one retailer than another.

   b. Economists have argued that this policy has a legitimate goal. Customers often go to one store with good service, knowledgeable sales people, and higher prices for information on a product and then buy the product at a discount superstore. Resale price maintenance limits the superstore's ability to "free ride" on the service provided by other retailers.

3. Predatory Pricing

a. When firms with monopoly power are faced with new competition, they may cut prices drastically to drive the new competition out of business and restore their monopoly power.

b. This behavior is called *predatory pricing*.

c. Economists doubt whether this strategy is used often, because it would mean that the monopoly would have to sustain large losses. It is also difficult to expect that courts are able to determine which price cuts are competitive and which are predatory.

4. Tying

   a. Tying occurs when two products are sold together.

   b. Economists do not believe this to be a problem because people will not be willing to pay more for two products sold together than they would be willing to pay for the goods separately. Thus, this practice cannot change market power.

   c. Instead, tying may simply be a form of price discrimination. Profits may rise if a firm charges a combined price closer to the buyers' total willingness to pay.

5. *Case Study: The Microsoft Case*

   a. In 1998, the U.S. Justice Department filed suit against Microsoft Corporation.

   b. A central issue in the case involved the tying of Microsoft's Internet browser to its Windows operating system.

   c. In November 1999, a judge issued a ruling that Microsoft had a great amount of monopoly power and had illegally abused this power.

   d. In June 2000, the judge ordered that Microsoft be broken up into two companies, one that sold the operating system and one that sold applications software. An appeals court overturned the verdict and handed the case to a new judge.

   e. In September 2001, the Justice Department announced that it no longer sought a breakup of the company and wanted to settle the case quickly. A settlement was reached in November 2002.

   f. In recent years, Microsoft has contended with several private antitrust lawsuits as well as lawsuits brought by the European Union.

6. *In the News: The Next Big Antitrust Target?*

   a. Google is now attracting the attention of government lawyers.

   b. This is an article from *The Washington Post* detailing the government's interest in the growth of this search engine.

SOLUTIONS TO TEXT PROBLEMS:

Quick Quizzes

1. If the members of an oligopoly could agree on a total quantity to produce, they would choose to produce the monopoly quantity, acting in collusion as if they were a monopoly.

   If the members of the oligopoly make production decisions individually, self-interest induces them to produce a greater quantity than the monopoly quantity.

2. The prisoners' dilemma is the story of two criminals suspected of committing a crime, in which the sentence that each receives depends both on his or her decision whether to confess or remain silent and on the decision made by the other. The following table shows the prisoners' choices:

		Bonnie's Decision	
		Confess	Remain Silent
Clyde's Decision	Confess	Bonnie gets eight years Clyde gets eight years	Bonnie gets 20 years Clyde goes free
	Remain Silent	Bonnie goes free Clyde gets 20 years	Bonnie gets one year Clyde gets one year

The likely outcome is that both will confess, since that is a dominant strategy for both.

The prisoners' dilemma teaches us that oligopolies have trouble maintaining the cooperative outcome of low production, high prices, and monopoly profits because each oligopolist has an incentive to cheat.

3. It is illegal for businesses to make an agreement about reducing output or raising prices.

Antitrust laws are controversial because some business practices may appear anti-competitive while in fact having legitimate business purposes. An example is resale price maintenance.

Questions for Review

1. If a group of sellers could form a cartel, they would try to set quantity and price like a monopolist. They would set quantity at the point where marginal revenue equals marginal cost, and set price at the corresponding point on the demand curve.

2. Firms in an oligopoly produce a quantity of output that is greater than the level produced by monopoly. They sell the product at a price that is lower than the monopoly price.

3. Firms in an oligopoly produce a quantity of output that is less than the level produced by a perfectly competitive market. They sell the product at a price that is greater than the perfectly competitive price.

4. As the number of sellers in an oligopoly grows larger, an oligopolistic market looks more and more like a competitive market. The price approaches marginal cost, and the quantity produced approaches the socially efficient level.

5. The prisoners' dilemma is a game between two people or firms that illustrates why it is difficult for opponents to cooperate even when cooperation would make them all better off. Each player has a great incentive to cheat on any cooperative agreement to make himself or itself better off. Thus, firms in an oligopoly have a difficult time maintaining a cooperative agreement.

6. The arms race and common resources are some examples of how the prisoners' dilemma helps to explain behavior. In the arms race during the Cold War, the United States and the Soviet Union could not agree on arms reductions because each was fearful that after cooperating for a while, the other country would cheat. When two companies share a common resource, they would be better off sharing it. But, fearful that the other company will use more of the common resource, each company ends up overusing it.

7. Antitrust laws prohibit firms from trying to monopolize a market. They are used to prevent mergers that would lead to excessive market power in any firm and to keep oligopolists from acting together in ways that would make the market less competitive.

8. Resale price maintenance occurs when a wholesaler sets a minimum price that retailers can charge. This might seem to be anticompetitive because it prevents retailers from competing on price. But that is doubtful because: (1) if the wholesaler has market power, it can exercise such power through the wholesale price; (2) wholesalers have no incentive to discourage competition among retailers because doing so reduces the quantity sold; and (3) maintaining a minimum price may be valuable in that it provides incentives to retailers to provide customers with good service.

Problems and Applications

1. a. If there were many suppliers of diamonds, price would equal marginal cost ($1,000), so the quantity would be 12,000.

   b. With only one supplier of diamonds, quantity would be set where marginal cost equals marginal revenue. The following table derives marginal revenue:

Price (thousands of dollars)	Quantity (thousands)	Total Revenue (millions of dollars)	Marginal Revenue (millions of dollars)
8	5	40	----
7	6	42	2
6	7	42	0
5	8	40	–2
4	9	36	–4
3	10	30	–6
2	11	22	–8
1	12	12	–10

   With marginal cost of $1,000 per diamond, or $1 million per thousand diamonds, the monopoly will maximize profits at a price of $7,000 and a quantity of 6,000. Additional production beyond this point would lead to a situation where marginal revenue is lower than marginal cost.

   c. If Russia and South Africa formed a cartel, they would set price and quantity like a monopolist, so the price would be $7,000 and the quantity would be 6,000. If they split the market evenly, they would share total revenue of $42 million and costs of $6 million, for a total profit of $36 million. So each would produce 3,000 diamonds and get a profit of $18 million. If Russia produced 3,000 diamonds and South Africa produced 4,000, the price would decline to $6,000. South Africa's revenue would rise to $24 million, costs would be $4 million, so profits would be $20 million, which is an increase of $2 million.

d. Cartel agreements are often not successful because one party has a strong incentive to cheat to make more profit. In this case, each could increase profit by $2 million by producing an extra 1,000 diamonds. However, if both countries did this, profits would decline for both of them.

2. a. OPEC members were trying to reach an agreement to cut production so they could raise the price.

   b. They were unable to agree on cutting production because each country has an incentive to cheat on any agreement. The turmoil is a decline in the price of oil because of increased production.

   c. OPEC would like Norway and Britain to join their cartel so that they could act as a monopoly.

3. a. Buyers who are oligopolists try to decrease the prices of goods they buy.

   b. The owners of baseball teams would like to keep players' salaries low. This goal is difficult to achieve because each team has an incentive to cheat on any agreement, because they will be able to attract better players by offering higher salaries.

   c. The salary cap would have formalized the collusion on salaries and helped to prevent any team from cheating.

4. a. If Mexico imposes low tariffs, then the United States is better off with high tariffs, because it gets $30 billion with high tariffs and only $25 billion with low tariffs. If Mexico imposes high tariffs, then the United States is better off with high tariffs, because it gets $20 billion with high tariffs and only $10 billion with low tariffs. So the United States has a dominant strategy of high tariffs.

   If the United States imposes low tariffs, then Mexico is better off with high tariffs, because it gets $30 billion with high tariffs and only $25 billion with low tariffs. If the United States imposes high tariffs, then Mexico is better off with high tariffs, because it gets $20 billion with high tariffs and only $10 billion with low tariffs. So Mexico has a dominant strategy of high tariffs.

   b. A Nash equilibrium is a situation in which economic actors interacting with one another each choose their best strategy given the strategies others have chosen. The Nash equilibrium in this case is for each country to have high tariffs.

   c. The NAFTA agreement represents cooperation between the two countries. Each country reduces tariffs and both are better off as a result.

   d. The payoffs in the upper left and lower right parts of the box do reflect a nation's welfare. Trade is beneficial and tariffs are a barrier to trade. However, the payoffs in the upper right and lower left parts of the box are not valid. A tariff hurts domestic consumers and helps domestic producers, but total surplus declines, as we saw in Chapter 9. So it would be more accurate for these two areas of the box to show that *both* countries' welfare will decline if they imposed high tariffs, whether or not the other country had high or low tariffs.

5. a. Synergy does not have a dominant strategy. If Synergy believes that Dynaco will go with a large budget, it will also choose a large budget. However, if Synergy believes that Dynaco will go with a small budget, it will want a small budget as well.

   b. Yes, Dynaco has a dominant strategy of going with a large budget. It is the best strategy for Dynaco to follow no matter what Synergy chooses.

   c. The Nash equilibrium is that both firms will choose a large budget. Dynaco will follow its dominant strategy so Synergy will choose a large budget as well.

6. a. The payoffs are:

		Your Decision	
		Work	Shirk
Classmate's Decision	Work	You get 15 units of happiness Classmate gets 15 units of happiness	You get 30 units of happiness Classmate gets 5 units of happiness
	Shirk	You get 5 units of happiness Classmate gets 30 units of happiness	You get 10 units of happiness Classmate gets 10 units of happiness

   b. The likely outcome is that both of you will shirk. If your classmate works, you're better off shirking, because you would rather have 30 units of happiness rather than 15. If your classmate shirks, you are better off shirking because you would rather have 10 units of happiness rather than 5. So your dominant strategy is to shirk. Your classmate faces the same payoffs, so he or she will also shirk.

   c. If you are likely to work with the same person again, you have a greater incentive to work, so that your classmate will work, and you will both be better off. In repeated games, cooperation is more likely.

   d. The payoff matrix would become:

		Your Decision	
		Work	Shirk
Classmate's Decision	Work	You get 15 units of happiness Classmate gets 65 units of happiness	You get 30 units of happiness Classmate gets 25 units of happiness
	Shirk	You get 5 units of happiness Classmate gets 50 units of happiness	You get 10 units of happiness Classmate gets 10 units of happiness

Work is a dominant strategy for this new classmate. Therefore, the Nash equilibrium will be for you to shirk and your classmate to work. You would get a B and thus would prefer this classmate to the first. However, he would prefer someone with a dominant strategy of working as well so that he could get an A.

7. a. The decision box for this game is:

		Braniff's Decision	
		Low Price	High Price
American's Decision	Low Price	Low profits for Braniff Low profits for American	Very low profits for Braniff High Profits for American
	High Price	High profits for Braniff Very low profits for American	Medium profits for Braniff Medium profits for American

b. If Braniff sets a low price, American will set a low price. If Braniff sets a high price, American will set a low price. So American has a dominant strategy to set a low price.

If American sets a low price, Braniff will set a low price. If American sets a high price, Braniff will set a low price. So Braniff has a dominant strategy to set a low price.

Because both have a dominant strategy to set a low price, the Nash equilibrium is for both to set a low price.

c. A better outcome would be for both airlines to set a high price; they would both get higher profits. That outcome could only be achieved by cooperation (collusion). If that happened, consumers would lose because prices would be higher and quantity would be lower.

8. a. The playoff matrix for this game is:

		Player One's Decision	
		Take Drug	Don't Take Drug
Player Two's Decision	Take Drug	Player 1 gets 5,000 – X Player 2 gets 5,000 – X	Player 1 gets 0 Player 2 gets 10,000 – X
	Don't Take Drug	Player 1 gets 10,000 – X Player 2 gets 0	Player 1 gets 5,000 Player 1 gets 5,000

b. Taking the drug will be a dominant strategy for each player as long as X is less than 5,000.

c. Making the drug safer (lowering X) raises the likelihood of taking the drug because it increases the payoff.

9. a. If Kona enters, Big Brew would want to maintain a high price. If Kona does not enter, Big Brew would want to maintain a high price. Thus, Big Brew has a dominant strategy of maintaining a high price.

If Big Brew maintains a high price, Kona would enter. If Big Brew maintains a low price, Kona would not enter. Kona does not have a dominant strategy.

Because Big Brew has a dominant strategy of maintaining a high price, Kona should enter.

b. There is only one Nash equilibrium. Big Brew will maintain a high price and Kona will enter.

c. Little Kona should not believe this threat from Big Brew because it is not in Big Brew's interest to carry out the threat. If Little Kona enters, Big Brew can set a high price, in which case it makes \$3 million, or Big Brew can set a low price, in which case it makes \$1 million. Thus the threat is an empty one, which Little Kona should ignore; Little Kona should enter the market.

d. If the two firms could successfully collude, they would agree that Big Brew would maintain a high price and Kona would remain out of the market. They could then split a profit of \$7 million.

10. a. Using Table 1 in the chapter, if 80 gallons are produced, the price would be \$40 and profit would be \$3,200. Divided three ways, John would get \$3,200/3 = \$1,066.67. Each seller would sell 80/3 = 26.67 gallons.

b. If Jack and Jill stick to the agreement, John will benefit from increasing output by 10 units. The price would fall to \$30. Jack's total profit would increase to (36.67)(\$30) = \$1,100.10.

c. The Nash equilibrium will be $(n + 1)/n$ = 3/4 of the competitive output. Thus, output will be 90 gallons, which is greater than the output when there were only two sellers. The price will now be \$30.