PARKIN ECONOMICS

SOLUTIONS TO ODD-NUMBERED PROBLEMS

CHAPTER 1

1. The opportunity cost of the extra 10 points is the movie forgone when you stayed home to study.

3. The opportunity cost of going to school is $9,600 of goods and services.

   The opportunity cost of going to school this summer is the highest-valued activity that you will give up so that you can go to summer school. In going to summer school, you will forgo all the goods and services that you could have bought with the income from your summer job ($6,000) plus the expenditure on tuition ($2,000), textbooks ($200), and living expenses ($1,400).

5. No, parking at this mall is not free. Yes, you did impose a cost on Harry.

   Finding a parking space takes about 30 minutes, so you incur an opportunity cost when you park your car. The opportunity cost is the highest-valued activity that you forgo by spending 30 minutes parking your car. If you would have spent those 30 minutes studying, then the opportunity cost of parking at this mall is 30 minutes of studying.

   The cost that you imposed on Harry is the additional 30 minutes that Harry will have to spend searching for a parking space.

APPENDIX TO CHAPTER 1

1a. To make a time-series graph, plot the year on the *x*-axis and the inflation rate on the *y*-axis. The graph will be a line joining all the points.

1b. (i) 1991 (ii) 1998 (iii) 1995, 1996, 1999, 2000 (iv) 1992, 1994, 1997, 1998, 2001 (v) 2000 (vi) 1992

1c. Inflation has had a fairly flat trend through these years. The line is close to horizontal.

3. To make a scatter diagram, plot the inflation rate on the *x*-axis and the interest rate on the *y*-axis. The graph will be a set of dots. The pattern made by the dots tells us that as the inflation rate increases, the interest rate usually increases.

5a. To make a graph that shows the relationship between *x* and *y*, plot *x* on the *x*-axis and *y* on the *y*-axis. The relationship is positive because *x* and *y* move in the same direction: As *x* increases, *y* increases.

5b. The slope increases as *x* increases. Slope is equal to the change in *y* divided by the change in *x* as we move along the curve. When *x* increases from1 to 2 (a change of 1), *y* increases from 1 to 4 (a change of 3), so the slope is 3. But when *x* increases from 4 to 5 (a change of 1), *y* increases from 16 to 25 (a change of 9), so the slope is 9.

5c. The taller the building, the bigger is the cost of building it. The higher the unemployment rate, the higher is the crime rate. The longer the flight, the larger is the amount of fuel used.

7. The slope equals 8.

   The slope of the curve at the point where *x* is 4 is equal to the slope of the tangent to the curve at that point. Plot the points of the relationship and then draw a nice smooth curve through those points. Now draw the tangent line at the point where *x* is 4 and *y* is 16. Now calculate the slope of this tangent line. To do this, you must find another point on the tangent. The tangent line will cut the *x*-axis at 2, so another point is *x* equals 2 and *y* equals 0. Slope equals rise/run. The rise is 16 and the run is 2, so the slope is 8.

9. The slope is 7.

   The slope of the relationship across the arc when *x* increases from 3 to 4 is equal to the slope of the straight line joining the points on the curve at *x* equals 3 and *x* equals 4. In the graph, draw this straight line. When *x* increases from 3 to 4, *y* increases from 9 to 16. Slope equals rise/run. The rise is 7 (16 minus 9) and the run is 1 (4 minus 3), so the slope across the arc is 7.

11. The slope is −5/4.

    The curve is a straight line, so its slope is the same at all points on the curve. Slope equals the change in the variable on the *y*-axis divided by the change in the variable on the *x*-axis. To calculate the slope, you must select two points on the line. One point is at 10 on the *y*-axis and 0 on the *x*-axis, and another is at 8 on the *x*-axis and 0 on the *y*-axis. The change in *y* from 10 to 0 is associated with the change in *x* from 0 to 8. Therefore the slope of the curve equals −10/8, which equals −5/4.

13a. The slope at point *a* is −2, and the slope at point *b* is −0.75.

   To calculate the slope at a point on a curved line, draw the tangent to the line at the point. Then find a second point on the tangent and calculate the slope of the tangent.

   The tangent at point *a* cuts the *y*-axis at 10. The slope of the tangent equals the change in *y* divided by the change in *x*. The change in *y* equals 4 (10 minus 6) and the change in *x* equals −2 (0 minus 2). The slope at point *a* is 4/−2, which equals −2.

   Similarly, the slope at point *b* is −0.75. The tangent at point *b* cuts the *x*-axis at 8. The change in *y* equals 1.5, and the change in *x* equals −2. The slope at point *b* is −0.75.

13b. The slope across the arc *AB* is −1.125.

   The slope across an arc *AB* equals the change in *y*, which is

4.5 (6.0 minus 1.5) divided by the change in *x*, which equals −4 (2 minus 6). The slope across the arc *AB* equals 4.5/−4, which is −1.125.

15a. The relationship is a set of curves, one for each different temperature.

To draw a graph of the relationship between the price and the number of rides, keep the temperature at 50°F and plot the data in that column against the price. The curve that you draw is the relationship between price and number of rides when the temperature is 50°F. Now repeat the exercise but keep the temperature at 70°F. Then repeat the exercise but keep the temperature at 90°F.

15b. The relationship is a set of curves, one for each different price.

To draw a graph of the relationship between the temperature and the number of rides, keep the price at $5.00 a ride and plot the data in that row against the temperature. The curve shows the relationship between temperature and the number of rides when the price is $5.00 a ride. Now repeat the exercise but keep the price at $10.00 a ride. Repeat the exercise again and keep the price at $15.00 a ride and then at $20.00 a ride.

15c. The relationship is a set of curves, one for each different number of rides.

To draw a graph of the relationship between the temperature and price, keep the number of rides at 32 and plot the data along the diagonal in the table. The curve is the relationship between temperature and price at which 32 rides are taken. Now repeat the exercise and keep the number of rides at 27. Repeat the exercise again and keep the number of rides at 18 and then at 40.

CHAPTER 2

1a. Wendell's opportunity cost of an hour of tennis is 2.5 percentage points.

When Wendell increases the time he plays tennis from 4 hours to 6 hours, his grade in economics falls from 75 percent to 70 percent. His opportunity cost of 2 hours of tennis is 5 percentage points. So his opportunity cost of 1 hour of tennis is 2.5 percentage points.

1b. Wendell's opportunity cost of an hour of tennis is 5 percentage points.

When Wendell increases the time he plays tennis from 6 hours to 8 hours, his grade in economics falls from 70 percent to 60 percent. His opportunity cost of 2 hours of tennis is 10 percentage points. So his opportunity cost of 1 hour of tennis is 5 percentage points.

3. Wendell's opportunity cost of playing tennis increases as he spends more time on tennis.

When Wendell increases the time he plays tennis from 4 hours to 6 hours, his opportunity cost is 5 percentage points. But when he increases the time he plays tennis from 6 hours to 8 hours, his opportunity cost is 10 percentage points. Wendell's opportunity cost of playing tennis increases as he spends more time on tennis.

5a. Wendell's grade in economics is 66 percent.

When Wendell increases the time he plays tennis from 4 hours to 6 hours, his opportunity cost of the additional 2 hours of tennis is 5 percentage points. So his opportunity cost of an additional 1 hour is 2.5 percentage points. So plot this opportunity cost at 5 hours on the graph (the midpoint between 4 and 6 hours). When he increases the time he plays tennis from 6 hours to 8 hours, his opportunity cost of the additional 2 hours of tennis is 10 percentage points. So his opportunity cost of the additional 1hour of tennis is 5 percentage points. So plot this opportunity cost at 7 hours on the graph (the midpoint between 6 and 8 hours). When he increases the time he plays tennis from 8 hours to 10 hours, his opportunity cost of the additional 2 hours of tennis is 20 percentage points. So his opportunity cost of the additional 1hour of tennis is 10 percentage points. So plot this opportunity cost at 9 hours on the graph (the midpoint between 8 and 10 hours). Wendell's opportunity cost of playing tennis increases as he spends more time on tennis. Join up the points plotted. This curve is Wendell's marginal cost of a additional hour of tennis.

Wendell uses his time efficiently if he plays tennis for 7 hours a week—marginal benefit from tennis equals its marginal cost. Wendell's marginal benefit is 5 percentage points and his marginal cost is 5 percentage points. When Wendell plays 7 hours of tennis, his grade in economics (from his *PPF*) is 65 percent.

5b. If Wendell studied for enough hours to get a higher grade, he would have fewer hours to play tennis. Wendell's marginal benefit from tennis would be greater than his marginal cost, so he would be more efficient (better off) if he played more hours of tennis and took a lower grade.

7a. Sunland's *PPF* is a straight line.

To make a graph of Sunland's *PPF* measure the quantity of one good on the *x*-axis and the quantity of the other good on the *y*-axis. Then plot the quantities in each row of the table and join up the points.

7b. The opportunity cost of 1 pound of food is 1/2 gallon of sunscreen.

The opportunity cost of the first 100 pounds of food is 50 gallons of sunscreen. To find the opportunity cost of the first 100 pounds of food, increase the quantity of food from 0 pounds to 100 pounds. In doing so, Sunland's production of sunscreen decreases from 150 gallons to 100 gallons. The opportunity cost of the first 100 pounds of food is 50 gallons of sunscreen. Similarly, the opportunity costs of producing the second 100 pounds and the third 100 pounds of food are 50 gallons of sunscreen.

The opportunity cost of 1 gallon of sunscreen is 2 pounds of food. The opportunity cost of producing the first 50 gallons of sunscreen is 100 pounds of food. To calculate this opportunity cost, increase the quantity of sunscreen from 0 gallons to 50 gallons. Sunland's production of food decreases from 300 pounds to 200 pounds. Similarly, the opportunity cost of producing the second 50 gallons and the third 50 gallons of sunscreen are 100 pounds of food.

9a. The marginal benefit curve slopes downward.

To draw the marginal benefit from sunscreen, plot the quantity of sunscreen on the *x*-axis and the willingness to

pay for sunscreen (that is, the number of pounds of food that they are willing to give up to get a gallon of sunscreen) on the *y*-axis.

9b. The efficient quantity is 75 gallons a month.

The efficient quantity to produce is such that the marginal benefit from the last gallon equals the opportunity cost of producing it. The opportunity cost of a gallon of sunscreen is 2 pounds of food. The marginal benefit of the 75th gallon of sunscreen is 2 pounds of food. And the marginal cost of the 75th gallon of sunscreen is 2 pounds of food.

Busyland's opportunity cost of a pound of food is 2 gallons of sunscreen, and its opportunity cost of a gallon of sunscreen is 1/2 pound of food.

When Busyland increases the food it produces by 50 pounds a month, it produces 100 gallons of sunscreen less. The opportunity cost of 1 pound of food is 2 gallons of sunscreen. Similarly, when Busyland increases the sunscreen it produces by 100 gallons a month, it produces 50 pounds of food less. The opportunity cost of 1 gallon of sunscreen is 1/2 pound of food.

11. Busyland's opportunity cost of a pound of food is 2 gallons of sunscreen, and its opportunity cost of a gallon of sunscreen is 0.5 pound of food.

When Busyland increases the food it produces by 50 pounds a month, it produces 100 gallons of sunscreen less. The opportunity cost of 1 pound of food is 2 gallons of sunscreen. Similarly, when Busyland increases the sunscreen it produces by 100 gallons a month, it produces 50 pounds of food less. The opportunity cost of 1 gallon of sunscreen is 0.5 pound of food.

13a. Sunland sells food and buys sunscreen.

Sunland sells the good in which it has a comparative advantage and buys the other good from Busyland. Sunland's opportunity cost of 1 pound of food is 1/2 gallon of sunscreen, while Busyland's opportunity cost of 1 pound of food is 2 gallons of sunscreen. Sunland's opportunity cost of food is less than Busyland's, so Sunland has a comparative advantage in producing food.

Sunland's opportunity cost of 1 gallon of sunscreen is 2 pounds of food, while Busyland's opportunity cost of 1 gallon of sunscreen is 1/2 pound of food. Busyland's opportunity cost of sunscreen is less than Sunland's, so Busyland has a comparative advantage in producing sunscreen.

13b. The gains from trade for each country are 50 pounds of food and 50 gallons of sunscreen.

With specialization and trade, together they can produce 300 pounds of food and 300 gallons of sunscreen. So each will get 150 pounds of food and 150 gallons of sunscreen—an additional 50 pounds of food and 50 gallons of sunscreen.

CHAPTER 3

1a. The price of an audiotape will rise, and the quantity of audiotapes sold will increase.

CDs and audiotapes are substitutes. If the price of a CD rises, people will buy more audiotapes and fewer CDs. The demand for audiotapes will increase. The price of an audiotape will rise, and more audiotapes will be sold.

1b. The price of an audiotape will fall, and fewer audiotapes will be sold.

Walkmans and audiotapes are complements. If the price of a Walkman rises, fewer Walkmans will be bought. The demand for audiotapes will decrease. The price of an audiotape will fall, and people will buy fewer audiotapes.

1c. The price of an audiotape will fall and fewer audiotapes will be sold.

The increase in the supply of CD players will lower the price of a CD player. With CD players cheaper than they were, some people will buy CD players. The demand for CDs will increase, and the demand for audiotapes will decrease. The price of an audiotape will fall, and people will buy fewer audiotapes.

1d. The price of an audiotape will rise, and the quantity sold will increase.

An increase in consumers' income will increase the demand for audiotapes. As a result, the price of an audiotape will rise and the quantity bought will increase.

1e. The price of an audiotape will rise, and the quantity sold will decrease.

If the workers who make audiotapes get a pay raise, the cost of making an audiotape increases and the supply of audiotapes decreases. The price will rise, and people will buy fewer audiotapes.

1f. The quantity sold will decrease, but the price might rise, fall, or stay the same.

Walkmans and audiotapes are complements. If the price of a Walkman rises, fewer Walkmans will be bought and so the demand for audiotapes will decrease. The price of an audiotape will fall, and people will buy fewer audiotapes. If the wages paid to workers who make audiotapes rise, the supply of audiotapes decreases. The quantity of audiotapes sold will decrease, and the price of an audiotape will rise. Taking the two events together, the quantity sold will decrease, but the price might rise, fall, or stay the same.

3a. (ii) and (iii) and (iv)

The demand for gasoline will change if the price of a car changes, all speed limits on highways are abolished, or robot production cuts the cost of producing a car. If the price of a car rises, the quantity of cars bought decrease. So the demand for gasoline decreases. If all speed limits on highways are abolished, people will drive faster and use more gasoline. The demand for gasoline increases. If robot production plants lower the cost of producing a car, the supply of cars will increase. With no change in the demand for cars, the price of a car will fall and more cars will be bought. The demand for gasoline increases.

3b. (i)

The supply of gasoline will change if the price of crude oil changes. If the price of crude oil rises, the cost of producing gasoline will rise. So the supply of gasoline decreases.

3c. (i)

If the price of crude oil (a resource used to make gasoline) rises, the cost of producing gasoline will rise. So the supply of gasoline decreases. The demand for gasoline does not change, so the price of gasoline will rise and there is a movement up the demand curve for gasoline. The quantity demanded of gasoline decreases.

3d. (ii) and (iii) and (iv)

If the price of a car rises, the quantity of cars bought decrease. So the demand for gasoline decreases. The supply of gasoline does not change, so the price of gasoline falls and there is a movement down the supply curve of gasoline. The quantity supplied of gasoline decreases.

If all speed limits on highways are abolished, people will drive faster and use more gasoline. The demand for gasoline increases. The supply of gasoline does not change, so the price of gasoline rises and there is a movement up along the supply curve. The quantity supplied of gasoline increases.

If robot production plants lower the cost of producing a car, the supply of cars will increase. With no change in the demand for cars, the price of a car will fall and more cars will be bought. The demand for gasoline increases. The supply of gasoline does not change, so the price of gasoline rises and the quantity of gasoline supplied increases.

5a. The demand curve is the curve that slopes down toward to the right. The supply curve is the curve that slopes up toward to the right.

5b. The equilibrium price is $14 a pizza, and the equilibrium quantity is 200 pizzas a day.

Market equilibrium is determined at the intersection of the demand curve and supply curve.

7a. The equilibrium price is 50 cents a pack, and the equilibrium quantity is 120 million packs a week.

The price of a pack adjusts until the quantity demanded equals the quantity supplied. At 50 cents a pack, the quantity demanded is 120 million packs a week and the quantity supplied is 120 million packs a week.

7b. At 70 cents a pack, there will be a surplus of gum and the price will fall.

At 70 cents a pack, the quantity demanded is 80 million packs a week and the quantity supplied is 160 million packs a week. There is a surplus of 80 million packs a week. The price will fall until market equilibrium is restored—50 cents a pack.

9a. The supply curve has shifted leftward.

As the number of gum-producing factories decreases, the supply of gum decreases. There is a new supply schedule, and the supply curve shifts leftward.

9b. There has been a movement along the demand curve.

The supply of gum decreases, and the supply curve shifts leftward. Demand does not change, so the price rises along the demand curve.

9c. The equilibrium price is 60 cents, and the equilibrium quantity is 100 million packs a week.

Supply decreases by 40 millions packs a week. That is, the quantity supplied at each price decreases by 40 million packs. The quantity supplied at 50 cents is now 80 million packs, and there is a shortage of gum. The price rises to 60 cents a pack, at which the quantity supplied equals the quantity demanded (100 million packs a week).

11. The new price is 70 cents a pack, and the quantity is 120 million packs a week.

The demand for gum increases, and the demand curve shifts rightward. The quantity demanded at each price increases by 40 million packs. The result of the fire is a price of 60 cents a pack. At this price, there is now a shortage of gum. The price of gum will rise until the shortage is eliminated.

CHAPTER 4

1a. The price elasticity of demand is 1.25.

The price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in the price. The price rises from $4 to $6 a box, a rise of $2 a box. The average price is $5 a box. So the percentage change in the price equals $2 divided by $5, which equals 40 percent.

The quantity decreases from 1,000 to 600 boxes, a decrease of 400 boxes. The average quantity is 800 boxes. So the percentage change in quantity equals 400 divided by 800, which equals 50 percent.

The price elasticity of demand for strawberries equals 50 divided by 40, which is 1.25.

1b. The price elasticity of demand exceeds 1, so the demand for strawberries is elastic.

3a. The price elasticity of demand is 2.

When the price of a videotape rental rises from $3 to $5, the quantity demanded of videotapes decreases from 75 to 25 a day. The price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in the price.

The price increases from $3 to $5, an increase of $2 a videotape. The average price is $4 a videotape. So the percentage change in the price equals $2 divided by $4, which equals 50 percent.

The quantity decreases from 75 to 25 videotapes, a decrease of 50 videotapes. The average quantity is 50 videotapes. So the percentage change in quantity equals 50 divided by 50, which equals 100 percent.

The price elasticity of demand for videotape rentals equals 100 divided by 50, which is 2.

3b. The price elasticity of demand equals 1 at $3 a videotape.

The price elasticity of demand equals 1 at the price halfway between the origin and the price at which the demand curve hits the *y*-axis. That price is $3 a videotape.

5. The demand for dental services is unit elastic.

The price elasticity of demand for dental services equals the percentage change in the quantity of dental services demanded divided by the percentage change in the price of dental services.

The price elasticity of demand equals 10 divided by 10, which is 1. The demand is unit elastic.

7a. Total revenue increases.

When the price of a chip is $400, 30 million chips are sold and total revenue equals $12,000 million. When the price of a chip falls to $350, 35 million chips are sold and total revenue is $12,250 million. Total revenue increases when the price falls.

7b. Total revenue decreases.

When the price is $350 a chip, 35 million chips are sold and total revenue is $12,250 million. When the price of a chip is $300, 40 million chips are sold and total revenue decreases to $12,000 million. Total revenue decreases as the price falls.

7c. Total revenue is maximized at $350 a chip.

When the price of a chip is $300, 40 million chips are sold and total revenue equals $12,000 million. When the price is $350 a chip, 35 million chips are sold and total revenue equals $12,250 million. Total revenue increases as the price rises from $300 to $350 a chip. When the price is $400 a chip, 30 million chips are sold and total revenue equals $12,000 million. Total revenue decreases as the price rises from $350 to $400 a chip. Total revenue is maximized when the price is $350 a chip.

7d. The demand for chips is unit elastic.

The total revenue test says that if the price changes and total revenue remains the same, the demand is unit elastic at the average price. For an average price of $350 a chip, cut the price from $400 to $300 a chip. When the price of a chip falls from $400 to $300, total revenue remains at $12,000 million. So at the average price of $350 a chip, demand is unit elastic.

9. The demand for chips is inelastic.

The total revenue test says that if the price falls and total revenue falls, the demand is inelastic. When the price falls from $300 to $200 a chip, total revenue decreases from $12,000 million to $10,000 million. So at an average price of $250 a chip, demand is inelastic.

11. The cross elasticity of demand between orange juice and apple juice is 1.17.

The cross elasticity of demand is the percentage change in the quantity demanded of one good divided by the percentage change in the price of another good. The rise in the price of orange juice resulted in an increase in the quantity demanded of apple juice. So the cross elasticity of demand is the percentage change in the quantity demanded of apple juice divided by the percentage change in the price of orange juice. The cross elasticity equals 14 divided by 12, which is 1.17.

13. Income elasticity of demand for (i) bagels is 1.33 and (ii) donuts is −1.33.

Income elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in income. The change in income is $2,000 and the average income is $4,000, so the percentage change in income equals 50 percent.

(i) The change in the quantity demanded is 4 bagels and the average quantity demanded is 6 bagels, so the percentage change in the quantity demanded equals 66.67 percent. The income elasticity of demand for bagels equals 66.67/50, which is 1.33.

(ii) The change in the quantity demanded is −6 donuts and the average quantity demanded is 9 donuts, so the percentage change in the quantity demanded is −66.67. The income elasticity of demand for donuts equals −66.67/50, which is −1.33.

15a. The elasticity of supply is 1.

The elasticity of supply is the percentage change in the quantity supplied divided by the percentage change in the price. When the price falls from 40 cents to 30 cents, the change in the price is 10 cents and the average price is 35 cents. The percentage change in the price is 28.57.

When the price falls from 40 cents to 30 cents, the quantity supplied decreases from 800 to 600 calls. The change in the quantity supplied is 200 calls, and the average quantity is 700 calls, so the percentage change in the quantity supplied is 28.57.

The elasticity of supply equals 28.57/28.57, which equals 1.

15b. The elasticity of supply is 1.

The formula for the elasticity of supply calculates the elasticity at the average price. So to find the elasticity at an average price of 20 cents a minute, change the price such that 20 cents is the average price—for example, a fall in the price from 30 cents to 10 cents a minute.

When the price falls from 30 cents to 10 cents, the change in the price is 20 cents and the average price is 20 cents. The percentage change in the price is 100. When the price falls from 30 cents to 10 cents, the quantity supplied decreases from 600 to 200 calls. The change in the quantity supplied is 400 calls and the average quantity is 400 calls. The percentage change in the quantity supplied is 100.

The elasticity of supply is the percentage change in the quantity supplied divided by the percentage change in the price. The elasticity of supply is 1.

CHAPTER 5

1a. Equilibrium price is $1.00 a floppy disc, and the equilibrium quantity is 3 floppy discs a month.

1b. Consumers paid $3.

The amount paid equals quantity bought multiplied by the price paid. That is, the amount paid equals 3 floppy discs multiplied by $1.00 a disc.

1c. The consumer surplus is $2.25.

The consumer surplus is the area of the triangle under the demand curve above the market price. The market price is $1.00 a disc. The area of the triangle equals (2.50 – 1.00)/2 multiplied by 3, which is $2.25.

1d. Producer surplus is $0.75.

The producer surplus is the area of the triangle above the supply curve below the price. The price is $1.00 a disc. The area of the triangle equals (1.00 – 0.50)/2 multiplied by 3, which is $0.75.

1e. The cost of producing the discs sold is $2.25.

The cost of producing the discs is the amount received minus the producer surplus. The amount received is $1.00 a disc for 3 discs, which is $3.00. Producer surplus is $0.75, so the cost of producing the discs sold is $2.25.

1f. The efficient quantity is 3 floppy discs a month.

The efficient quantity is the quantity that makes the marginal benefit from the last disc equal to the marginal cost of producing the last disc. The demand curve shows the marginal benefit and the supply curve shows the marginal cost. Only if 3 floppy discs are produced is the quantity produced efficient.

3a. The maximum price that consumers will pay is $3.

The demand schedule shows the maximum price that consumers will pay for each sandwich. The maximum price that consumers will pay for the 250th sandwich is $3.

3b. The minimum price that producers will accept is $5.

The supply schedule shows the minimum price that producers will accept for each sandwich. The minimum price that produces will accept for the 250th sandwich is $5.

3c. 250 sandwiches exceed the efficient quantity.

The efficient quantity is such that marginal benefit from the last sandwich equals the marginal cost of producing it. The efficient quantity is the equilibrium quantity—200 sandwiches an hour.

3d. Consumer surplus is $400.

The equilibrium price is $4. The consumer surplus is the area of the triangle under the demand curve above the price. The area of the triangle is (8 − 4)/2 multiplied by 200, which is $400.

3e. Producer surplus is $400.

The producer surplus is the area of the triangle above the supply curve below the price. The price is $4. The area of the triangle is (4 − 0)/2 multiplied by 200, which is $400.

3f. The deadweight loss is $50.

Deadweight loss is the sum of the consumer surplus and producer surplus that is lost because the quantity produced is not the efficient quantity. The deadweight loss equals the quantity (250 – 200) multiplied by (5 − 3)/2, which is $50.

5a. Ben's consumer surplus is $122.50. Beth's consumer surplus is $22.50, and Bo's consumer surplus is $4.50.

Consumer surplus is the area under the demand curve above the price. At 40 cents, Ben will travel 350 miles, Beth will travel 150 miles, and Bo will travel 30 miles. To find Ben's consumer surplus extend his demand schedule until you find the price at which the quantity demanded by Ben is zero—the price at which Ben's demand curve cuts the *y*-axis. This price is 110 cents. So Ben's consumer surplus equals (110 − 40)/2 multiplied by 350, which equals $122.50. Similarly, Beth's consumer surplus equals (70 − 40)/2 multiplied by 150, which equals $22.50. And Bo's consumer surplus equals (70 − 40)/2 multiplied by 30, which equals $4.50.

5b. Ben's consumer surplus is the largest because he places a higher value on each unit of the good than the other two do.

5c. Ben's consumer surplus falls by $32.50. Beth's consumer surplus falls by $12.50, and Bo's consumer surplus falls by $2.50.

At 50 cents a mile, Ben travels 300 miles and his consumer surplus is $90. Ben's consumer surplus equals (110 − 50)/2 multiplied by 300, which equals $90. Ben's consumer surplus decreases from $122.50 to $90, a decrease of $32.50. Beth travels 100 miles and her consumer surplus is $10, a decrease of $12.50. Bo travels 20 miles and her consumer surplus is $2.00, a decrease of $2.50.

CHAPTER 6

1a. Equilibrium price is $200 a month and the equilibrium quantity is 10,000 housing units.

1b. The quantity rented is 5,000 housing units.

The quantity of housing rented is equal to the quantity supplied at the rent ceiling.

1c. The shortage is 10,000 housing units.

At the rent ceiling, the quantity of housing demanded is 15,000 but the quantity supplied is 5,000, so there is a shortage of 10,000 housing units.

1d. The maximum price that someone is willing to pay for the 5,000th unit available is $300 a month.

The demand curve tells us the maximum price willingly paid for the 5,000th unit.

3a. The equilibrium wage rate is $4 an hour, and employment is 2,000 hours a month.

3b. Unemployment is zero. Everyone who wants to work for $4 an hour is employed.

3c. They work 2,000 hours a month.

A minimum wage rate is the lowest wage rate that a person can be paid for an hour of work. Because the equilibrium wage rate exceeds the minimum wage rate, the minimum wage is ineffective. The wage rate will be $4 an hour and employment is 2,000 hours.

3d. There is no unemployment.

The wage rate rises to the equilibrium wage—the quantity of labor demanded equals the quantity of labor supplied. So there is no unemployment.

3e. At $5 an hour, 1,500 hours a month are employed and 1,000 hours a month are unemployed.

The quantity of labor employed equals the quantity demanded at $5 an hour. Unemployment is equal to the quantity of labor supplied at $5 an hour minus the quantity of labor demanded at $5 an hour. The quantity supplied is 2,500 hours a month, and the quantity demanded is 1,500 hours a month. So 1,000 hours a month are unemployed.

3f. The wage rate is $5 an hour, and unemployment is 500 hours a month.

At the minimum wage of $5 an hour, the quantity demanded is 2,000 hours a month and the quantity supplied is 2,500 hours a month. So 500 hours a month are unemployed.

5a. With no tax on brownies, the price is 60 cents a brownie and 4 million a day are consumed.

5b. The price is 70 cents a brownie, and 3 million brownies a day are consumed. Consumers and producers each pay 10 cents of the tax on a brownie.

The tax decreases the supply of brownies and raises the price of a brownie. With no tax, producers are willing to sell 3 million brownies a day at 50 cents a brownie. But with a 20 cent tax, they are willing to sell 3 million brownies a day only if the price is 20 cents higher at 70 cents a brownie.

7. With a subsidy on rice, the price is $1.20 a box, the marginal cost $1.50 a box, and the quantity produced is 3,000 boxes a week.

   The subsidy of $0.30 lowers the price at which each quantity in the table is supplied. For example, rice farmers will supply 3,000 boxes a week if the price is $1.50 minus $0.30, which is $1.20. With a subsidy, the market equilibrium occurs at $1.20 a box. At this price, the quantity demanded is 3,000 boxes and the quantity supplied is 3,000 boxes. The marginal cost of producing rice is given by the supply schedule. The marginal cost of supplying 3,000 boxes a week is $1.50 a box.

CHAPTER 7

1a. To draw a graph of Jason's total utility from rock CDs, plot the number of CDs on the *x*-axis and Jason's utility from CDs on the *y*-axis. The curve will look similar to Fig. 7.2(a). To draw a graph of Jason's total utility from spy novels, repeat the above procedure but use the spy novel data.

1b. Jason gets more utility from any number of rock CDs than he does from the same number of spy novels.

1c. To draw a graph of Jason's marginal utility from rock CDs plot the number of CDs on the *x*-axis and Jason's marginal utility from CDs on the *y*-axis. The curve will look similar to Fig. 7.2(b). To draw a graph of Jason's marginal utility from spy novels, repeat the above procedure but use the spy novel data.

   Jason's marginal utility from rock CDs is the increase in total utility he gets from one additional rock CD. Similarly, Jason's marginal utility from spy novels is the increase in total utility he gets from one additional spy novel.

1d. Jason gets more marginal utility from an additional rock CD than he gets from an additional spy novel when he has the same number of each.

1e. Jason buys 5 rock CDs and 1 spy novel.

   When Jason buys 5 rock CDs and 1 spy novel he spends $60. Jason maximizes his utility when he spends all of his money and the marginal utility per dollar spent on rock CDs and spy novels is the same. When Jason buys 5 rock CDs his marginal utility per dollar spent is 2 units per dollar and when Jason buys 1 spy novel his marginal utility per dollar spent is 2 units per dollar.

3. To maximize his utility, Max windsurfs for 3 hours and snorkels for 1 hour.

   Max will spend his $35 such that all of the $35 is spent and that the marginal utility per dollar spent on each activity is the same. When Max windsurfs for 3 hours and snorkels for 1 hour, he spends $30 renting the windsurfing equipment and $5 renting the snorkeling equipment—a total of $35.

   The marginal utility from the third hour of windsurfing is 80 and the rent of the windsurfing equipment is $10 an hour, so the marginal utility per dollar spent on windsurfing is 8. The marginal utility from the first hour of snorkeling is 40 and the rent of the snorkeling equipment is $5 an hour, so the marginal utility per dollar spent on snorkeling is 8. The marginal utility per dollar spent on windsurfing equals the marginal utility per dollar spent on snorkeling.

5a. Max's consumption possibilities line is a straight line that runs from 5.5 hours windsurfing and 0 hours snorkeling to 11 hours snorkeling and 0 hours windsurfing.

   Max's possibilities line shows the various combinations of hours spent snorkeling and hours spent windsurfing that has a total expenditure of $55. Windsurfing is $10 an hour, so if Max spends all his money on windsurfing, he can windsurf for 5.5 hours.

   Snorkeling is $5 an hour, so if Max spends all his money on snorkeling, he can snorkel for 5.5 hours.

5b. To maximize his utility, Max windsurfs for 4 hours and snorkels for 3 hour.

   Max will spend his $55 such that all of the $55 is spent and that the marginal utility per dollar spent on each activity is the same. When Max windsurfs for 4 hours and snorkels for 3 hours, he spends $40 renting the windsurfing equipment and $15 renting the snorkeling equipment—a total of $55.

   The marginal utility from the fourth hour of windsurfing is 60 and the rent of the windsurfing equipment is $10 an hour, so the marginal utility per dollar spent on windsurfing is 6. The marginal utility from the third hour of snorkeling is 30 and the rent of the snorkeling equipment is $5 an hour, so the marginal utility per dollar spent on snorkeling is 6. The marginal utility per dollar spent on windsurfing equals the marginal utility per dollar spent on snorkeling.

7. To maximize his utility, Max windsurfs for 6 hours and snorkels for 5 hours. Max will spend his $55 such that all of the $55 is spent and that the marginal utility per dollar spent on each activity is the same. When Max windsurfs for 6 hours and snorkels for 5 hours, he spends $30 renting the windsurfing equipment and $25 renting the snorkeling equipment—a total of $55.

   The marginal utility from the sixth hour of windsurfing is 12 and the rent of the windsurfing equipment is $5 an hour, so the marginal utility per dollar spent on windsurfing is 2.4. The marginal utility from the fifth hour of snorkeling is 12 and the rent of the snorkeling equipment is $5 an hour, so the marginal utility per dollar spent on snorkeling is 2.4. The marginal utility per dollar spent on windsurfing equals the marginal utility per dollar spent on snorkeling.

9. To maximize his utility, Max windsurfs for 5 hours and snorkels for 1 hour.

   Because the equipment is free, Max does not have to allocate his *income* between the two activities; instead, he allocates his *time* between the two activities. Max spends 6 hours on these activities. Max allocates the 6 hours such that the marginal utility from each activity is the same. When Max windsurfs for 5 hours and snorkels for 1 hour,

he spends 6 hours. His marginal utility from the fifth hour of windsurfing is 40 and his marginal utility from the first hour of snorkeling is 40—so the marginal utilities are equal.

11. The market demand curve passes through the following points: 90 cents and 3 cartons; 70 cents and 6 cartons; 50 cents and 10 cartons; 30 cents and 14 cartons; and 10 cents and 18 cartons.

    At each price, the quantity demand by the market is equal to the sum of the cartons of popcorn that Shirley demands and the cartons of popcorn that Dan demands. For example, at 50 cents a carton, the quantity demanded by Shirley and Dan is 10, the sum of Shirley's 6 and Dan's 4.

CHAPTER 8

1a. Sara's real income is 4 cans of cola.

Sara's real income in terms of cans of cola is equal to her money income divided by the price of a can of cola. Sara's money income is $12, and the price of cola is $3 a can. Sara's real income is $12 divided by $3 a can of cola, which is 4 cans of cola.

1b. Sara's real income is 4 bags of popcorn.

Sara's real income in terms of popcorn is equal to her money income divided by the price of a bag of popcorn, which is $12 divided by $3 a bag or 4 bags of popcorn.

1c. The relative price of cola is 1 bag per can.

The relative price of cola is the price of cola divided by the price of popcorn. The price of cola is $3 a can and the price of popcorn is $3 a bag, so the relative price of cola is $3 a can divided by $3 a bag, which equals 1 bag per can.

1d. The opportunity cost of a can of cola is 1 bag of popcorn.

The opportunity cost of a can of cola is the quantity of popcorn that must be forgone to get a can of cola. The price of cola is $3 a can and the price of popcorn is $3 a bag, so to buy one can of cola Sara must forgo 1 bag of popcorn.

1e. The equation that describes Sara's budget line is

$$Q_P = 4 - Q_C$$

Call the price of popcorn P_P and the quantity of popcorn Q_P, the price of cola P_C and the quantity of cola Q_C, and income y. Sara's budget equation is

$$P_P Q_P + P_C Q_C = y.$$

If we substitute $3 for the price of popcorn, $3 for the price of cola, and $12 for the income, the budget equation becomes

$$\$3 \times Q_P + \$3 \times Q_C = \$12.$$

Dividing both sides by $3 and subtracting Q_C from both sides gives

$$Q_P = 4 - Q_C.$$

1f. To draw a graph of the budget line, plot the quantity of cola on the x-axis and the quantity of popcorn on the y-axis. The budget line is a straight line running from 4 bags on the y-axis to 4 cans on the x-axis.

1g. The slope of the budget line, when cola is plotted on the x-axis is minus 1. The magnitude of the slope is equal to the relative price of cola.

The slope of the budget line is "rise over run." If the quantity of cola decreases from 4 to 0, the quantity of popcorn increases from 0 to 4. The rise is 4 and the run is −4. Therefore the slope equals 4/−4, which is −1.

3a. Sara buys 2 cans of cola and 2 bags of popcorn.

Sara buys the quantities of cola and popcorn that gets her onto the highest indifference curve, given her income and the prices of cola and popcorn. The graph shows Sara's indifference curves. So draw Sara's budget line on the graph. The budget line is tangential to indifference curve I_0 at 2 cans of cola and 2 bags of popcorn. The indifference curve I_0 is the highest indifference curve that Sara can get onto.

3b. Sara's marginal rate of substitution is 1.

The marginal rate of substitution is the magnitude of the slope of the indifference curve at Sara's consumption point, which equals the magnitude of the slope of the budget line. The slope of Sara's budget line is −1, so the marginal rate of substitution is 1.

5a. Sara buys 6 cans of cola and 1 bag of popcorn.

Draw the new budget line on the graph with Sara's indifference curves. The budget line now runs from 8 cans of cola on the x-axis to 4 bags of popcorn on the y-axis. The new budget line is tangential to indifference curve I_1 at 6 cans of cola and 1 bag of popcorn. The indifference curve I_1 is the highest indifference curve that Sara can now get onto.

5b. Two points on Sara's demand for cola are the following: At $3 a can of cola, Sara buys 2 cans of cola. At $1.50 a can of cola, Sara buys 6 cans.

5c. The substitution effect is 2 cans of cola.

To divide the price effect into a substitution effect and an income effect, take enough income away from Sara and gradually move her new budget line back toward the origin until it just touches Sara's indifference curve I_0. The point at which this budget line just touches indifference curve I_0 is 4 cans of cola and 0.5 bag of popcorn. The substitution effect is the increase in the quantity of cola from 2 cans to 4 cans along the indifference curve I_0. The substitution effect is 2 cans of cola.

5d. The income effect is 2 cans of cola.

The income effect is the change in the quantity of cola from the price effect minus the change from the substitution effect. The price effect is 4 cans of cola (6 cans minus the initial 2 cans). The substitution effect is an increase in the quantity of cola from 2 cans to 4 cans. So the income effect is 2 cans of cola.

5e. Cola is a normal good for Sara because the income effect is positive. An increase in income increases the quantity of cola she buys from 4 to 6 cans.

7a. Pam can still buy 30 cookies and 5 comic books.

When Pam buys 30 cookies at $1 each and 5 comic books at $2 each, she spends $40 a month. Now that the price of a cookie is 50 cents and the price of a comic book is $5, 30 cookies and 5 comic books will cost $40. So Pam can still buy 30 cookies and 5 comic books.

7b. Pam will not want to buy 30 cookies and 5 comic books because the marginal rate of substitution does not equal the relative price of the goods. Pam will move to a point on the highest indifference curve possible where the marginal rate of substitution equals the relative price.

7c. Pam prefers cookies at 50 cents each and comic books at $5 each because she can get onto a higher indifference curve than when cookies are $1 each and comic books are $2 each.

7d. Pam will buy more cookies and fewer comic books.

The new budget line and the old budget line pass through the point at 30 cookies and 5 comic books. If comic books are plotted on the *x*-axis, the marginal rate of substitution at this point on Pam's indifference curve is equal to the relative price of a comic book at the original prices, which is 2. The new relative price of a comic book is $5/50 cents, which is 10. That is, the budget line is steeper than the indifference curve at 30 cookies and 5 comic books. Pam will buy more cookies and fewer comic books.

7e. There will be a substitution effect and an income effect.

A substitution effect arises when the relative price changes and the consumer moves along the *same* indifference curve to a new point where the marginal rate of substitution equals the new relative price. An income effect arises when the consumer moves from one indifference curve to another, keeping the relative price constant.

CHAPTER 9

1. Explicit costs are $30,000. Explicit costs are all the costs for which there is a payment. Explicit costs are the sum the wages paid ($20,000) and the goods and services bought from other firms ($10,000).

Implicit costs are the sum of the costs that do not involve a payment. Implicit costs are the sum of the interest forgone on the $50,000 put into the firm; the $30,000 income forgone by Jack not working at his previous job; $15,000, which is the value of 500 hours of Jill's leisure (10 hours a week for 50 weeks); and the economic depreciation of $2,000 ($30,000 minus $28,000).

3a. All methods other than "pocket calculator with paper and pencil" are technologically efficient.

To use a pocket calculator with paper and pencil to complete the tax return is not a technologically efficient method because it takes the same number of hours as it would with a pocket calculator but it uses more capital.

3b. The economically efficient method is to use (i) a pocket calculator, (ii) a pocket calculator, (iii) a PC.

The economically efficient method is the technologically efficient method that allows the task to be done at least cost.

When the wage rate is $5 an hour: Total cost with a PC is $1,005, total cost with a pocket calculator is $70, and total cost with paper and pencil is $81. Total cost is least with a pocket calculator.

When the wage rate is $50 an hour: Total cost with a PC is $1,050, total cost with a pocket calculator is $610, and the total cost with paper and pencil is $801. Total cost is least with a pocket calculator.

When the wage rate is $500 an hour: Total cost with a PC is $1,500, total cost with a pocket calculator is $6,010, and total cost with pencil and paper is $8,001. Total cost is least with a PC.

5a. Methods *A*, *B*, *C*, and *D* are technologically efficient. Compare the amount of labor and capital used by the four methods. Start with method *A*. Moving from *A* to *B* to *C* to *D*, the amount of labor increases and the amount of capital decreases in each case.

5b. The economically efficient method in (i) is method *D*, in (ii) is methods *C* and *D*, and in (iii) is method *A*.

The economically efficient method is the technologically efficient method that allows the 100 shirts to be washed at least cost.

(i) Total cost with method *A* is $1,001, total cost with method *B* is $805, total cost with method *C* is $420, and total cost with method *D* is $150. Method *D* has the lowest total cost.

(ii) Total cost with method *A* is $505, total cost with method *B* is $425, total cost with method *C* is $300, and total cost with method *D* is $300. Methods *C* and *D* have the lowest total cost.

(iii) Total cost with method *A* is $100, total cost with method *B* is $290, total cost with method *C* is $1,020, and total cost with method *D* is $2,505. Method *A* has the lowest total cost.

7a. The four-firm concentration ratio is 60.49.

The four-firm concentration ratio equals the ratio of the total sales of the largest four firms to the total industry sales expressed as a percentage. The total sales of the largest four firms is $450 + $325 + $250 + $200, which equals $1,225. Total industry sales equal $1,225 + $800, which equals $2,025. The four-firm concentration ratio equals ($1,225/$2,025) × 100, which is 60.49 percent.

7b. This industry is highly concentrated because the four-firm concentration ratio exceeds 60 percent.

9a. The Herfindahl-Hirschman Index is 1,800.

The Herfindahl-Hirschman Index equals the sum of the squares of the market shares of the 50 largest firms or of all firms if there are less than 50 firms. The Herfindahl-Hirschman Index equals $15^2 + 10^2 + 20^2 + 15^2 + 25^2 + 15^2$, which equals 1,800.

9b. This industry is moderately competitive because the Herfindahl-Hirschman Index lies in the range 1,000 to 1,800.

CHAPTER 10

1a. To draw the total product curve measure *labor* on the *x*-axis and output on the *y*-axis. The total product curve is upward sloping.

1b. The average product of *labor* is equal to total product divided by the quantity of *labor* employed. For example, when 3 workers are employed, they produce 6 boats a week, so the average product is 2 boats per worker.

The average product curve is upward sloping when the number of workers is between 1 and 8, but it becomes downward sloping when 9 and 10 workers are employed.

1c. The marginal product of *labor* is equal to the increase in total product when an additional worker is employed. For example, when 3 workers are employed, total product is 6 boats a week. When a fourth worker is employed, total product increases to 10 boats a week. The marginal product of going from 3 to 4 workers is 4 boats.

The marginal product curve is upward sloping when up to 5.5 workers a week are employed and downward sloping when more than 5.5 workers a week are employed.

1d. (i) When Rubber Dinghies produces fewer than 30 boats a week, it employs fewer than 8 workers a week. With fewer than 8 workers a week, marginal product exceeds average product and average product is increasing. Up to an output of 30 boats a week, each additional worker adds more to output than the average. Average product increases.

(ii) When Rubber Dinghies produces more than 30 boats a week, it employs more than 8 workers a week. With more than 8 workers a week, average product exceeds marginal product and average product is decreasing. For outputs greater than 30 boats a week, each additional worker adds less to output than average. Average product decreases.

3a. Total cost is the sum of the costs of all the inputs that Rubber Dinghies uses in production. Total variable cost is the total cost of the variable inputs. Total fixed cost is the total cost of the fixed inputs.

For example, the total variable cost of producing 10 boats a week is the total cost of the workers employed, which is 4 workers at $400 a week, which equals $1,600. Total fixed cost is $1,000, so the total cost of producing 10 boats a week is $2,600.

To draw the short-run total cost curves, plot output on the *x*-axis and the total cost on the *y*-axis. The total fixed cost curve is a horizontal line at $1,000. The total variable cost curve and the total cost curve have shapes similar to those in Fig. 10.4, but the vertical distance between the total variable cost curve and the total cost curve is $1,000.

3b. Average fixed cost is total fixed cost per unit of output. Average variable cost is total variable cost per unit of output. Average total cost is the total cost per unit of output.

For example, when the firm makes 10 boats a week: Total fixed cost is $1,000, so average fixed cost is $100 per boat; total variable cost is $1,600, so average variable cost is $160 per boat; and total cost is $2,600, so average total cost is $260 per boat.

Marginal cost is the increase in total cost divided by the increase in output. For example, when output increases from 3 to 6 boats a week, total cost increases from $1,800 to $2,200, an increase of $400. That is, the increase in output of 3 boats increases total cost by $400. Marginal cost is equal to $400 divided by 3 boats, which is $133.33 a boat.

The short-run average and marginal cost curves are similar to those in Fig. 10.5.

3c. The following table sets out the data to use to draw the curves.

Labor (workers)	Output (boats)	*AP* (boats per worker)	*MP* (boats per worker)	*TC* (dollars)	*MC* (dollars per boat)	*AVC* (dollars per boat)
1	1	1.00		1,000		400.00
			2.00		200.00	
2	3	1.50		1,400		266.67
			3.00		133.33	
3	6	2.00		1,800		200.00
			4.00		100.00	
4	10	2.50		2,200		160.00
			5.00		80.00	
5	15	3.00		2,600		133.33
			6.00		66.67	
6	21	3.50		3,000		114.29
			5.00		80.00	
7	26	3.71		3,400		107.69
			4.00		100.00	
8	30	3.75		3,800		106.67
			3.00		133.33	
9	33	3.67		4,200		109.09
			2.00		200.00	
10	35	3.50		4,600		114.29

5. The increase in total fixed cost increases total cost but does not change total variable cost. Average fixed cost is total fixed cost per unit of output. The average fixed cost curve shifts upward. Average total cost is total cost per unit of output. The average total cost curve shifts upward. Marginal cost and average variable cost do not change.

7a. Total cost is the cost of all the inputs. For example, when 3 workers are employed they now produce 12 boats a week. With 3 workers, the total variable cost is $1,200 a week and the total fixed cost is $2,000 a week. The total cost is $3,200 a week. The average total cost of producing 12 boats is $266.67.

7b. The long-run average cost curve is made up the lowest parts of the firm's short-run average total cost curves when the firm operates 1 plant and 2 plants. The long-run average cost curve is similar to Fig. 10.8.

7c. It is efficient to operate the number of plants that has the lower average total cost of a boat. It is efficient to operate one plant when output is less than 27 boats a week, and it is efficient to operate two plants when the output is more than 27 boats a week.

Over the output range 1 to 27 boats a week, average total cost is less with one plant than with two, but if output exceeds 27 boats a week, average total cost is less with two plants than with one.

9a. For example, the average total cost of producing a balloon ride when Bonnie rents 2 balloons and employs 4 workers equals the total cost ($1,000 rent for the balloons plus $1,000 for the workers) divided by the 20 balloon rides produced. The average total cost equals $2,000/20, which is $100 a ride.

The average total cost curve is U-shaped, as in Fig. 10.5.

9b. The long-run average cost curve is similar to that in Fig. 10.8.

9c. Bonnie's minimum efficient scale is 13 balloon rides when Bonnie rents 1 balloon.

The minimum efficient scale is the smallest output at which the long-run average cost is a minimum. To find the minimum efficient scale, plot the average total cost curve for each plant and then check which plant has the lowest minimum average total cost.

9d. Bonnie will choose the plant (number of balloons to rent) that gives her minimum average total cost for the normal or average number of balloon rides that people buy.

CHAPTER 11

1a. Quick Copy's profit-maximizing quantity is 80 pages an hour.

Quick Copy maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. In perfect competition, marginal revenue equals price, which is 10 cents a page. Marginal cost is 10 cents when Quick Copy produces 80 pages an hour.

1b. Quick Copy's profit is $2.40 an hour.

Profit equals total revenue minus total cost. Total revenue equals $8.00 an hour (10 cents a page multiplied by 80 pages). The average total cost of producing 80 pages is 7 cents a page, so total cost equals $5.60 an hour (7 cents multiplied by 80 pages). Profit equals $8.00 minus $5.60, which is $2.40 an hour.

1c. The price will fall in the long run to 6 cents a page.

At a price of 10 cents a page, firms make economic profit. In the long run, the economic profit will encourage new firms to enter the copying industry. As they do, the price will fall and economic profit will decrease. Firms will enter until economic profit is zero, which occurs when the price is 6 cents a copy (price equals minimum average total cost).

3a. (i) At $14 a pizza, Pat's profit-maximizing output is 4 pizzas an hour and economic profit is $10 an hour.

Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. In perfect competition, marginal revenue equals price, which is $14 a pizza. Marginal cost is the change in total cost when output is increased by 1 pizza an hour. The marginal cost of increasing output from 3 to 4 pizzas an hour is $13 ($54 minus $41). The marginal cost of increasing output from 4 to 5 pizzas an hour is $15 ($69 minus $54). So the marginal cost of the fourth pizza is half-way between $13 and $15, which is $14. Marginal cost equals marginal revenue when Pat produces 4 pizzas an hour.

Economic profit equals total revenue minus total cost. Total revenue equals $64 ($14 multiplied by 4). Total cost is $54, so economic profit is $10.

(ii) At $12 a pizza, Pat's profit-maximizing output is 3 pizzas an hour and economic profit is −$5.

Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. Marginal revenue equals price, which is $12 a pizza. Marginal cost of increasing output from 2 to 3 pizzas an hour is $11 ($41 minus $30). The marginal cost of increasing output from 3 to 4 pizzas an hour is $13. So the marginal cost of the third pizza is half-way between $11 and $13, which is $12. Marginal cost equals marginal revenue when Pat produces 3 pizzas an hour.

Economic profit equals total revenue minus total cost. Total revenue equals $36 ($12 multiplied by 3). Total cost is $41, so economic profit is −$5.

(iii) At $10 a pizza, Pat's profit-maximizing output is 2 pizzas an hour and economic profit is −$10.

Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. Marginal revenue equals price, which is $10 a pizza. Marginal cost of increasing output from 1 to 2 pizzas an hour is $9 ($30 minus $21). The marginal cost of increasing output from 2 to 3 pizzas an hour is $11. So the marginal cost of the second pizza is half-way between $9 and $11, which is $10. Marginal cost equals marginal revenue when Pat produces 2 pizzas an hour.

Economic profit equals total revenue minus total cost. Total revenue equals $20 ($10 multiplied by 2). Total cost is $30, so economic profit is −$10.

3b. Pat's shutdown point is at a price of $10 a pizza.

The shutdown point is the price that equals minimum average variable cost. To calculate total variable cost, subtract total fixed cost ($10, which is total cost at zero output) from total cost. Average variable cost equals total variable cost divided by the quantity produced. For example, the average variable cost of producing 2 pizzas is $10 a pizza. Average variable cost is a minimum when marginal cost equals average variable cost. The marginal cost of producing 2 pizzas is $10. So the shutdown point is a price of $10 a pizza.

3c. Pat's supply curve is the same as the marginal cost curve at prices equal to or above $10 a pizza and the *y*-axis at prices below $10 a pizza.

3d. Pat will exit the pizza industry if in the long run the price is less than $13 a pizza.

Pat's Pizza Kitchen will leave the industry if it incurs an economic loss in the long run. To incur an economic loss, the price will have to be below minimum average total cost. Average total cost equals total cost divided by the quantity produced. For example, the average total cost of producing 2 pizzas is $15 a pizza. Average total cost is a minimum when it equals marginal cost. The average total cost of 3 pizzas is $13.67, and the average total cost of 4 pizzas is $13.50. Marginal cost when Pat's produces 3 pizzas is $12 and marginal cost when Pat's produces 4 pizzas is $14. At 3 pizzas, marginal cost is less than average total cost; at 4 pizzas, marginal cost exceeds average total cost. So minimum average total cost occurs between 3 and 4 pizzas—$13 at 3.5 pizzas an hour.

5a. The market price is $8.40 a cassette.

The market price is the price at which the quantity demanded equals the quantity supplied. The firm's supply curve is the same as its marginal cost curve at prices above minimum average variable cost. Average variable cost is a minimum when marginal cost equals average variable cost. Marginal cost equals average variable cost at the quantity 250 cassettes a week. So the firm's supply curve is the same

as the marginal cost curve for the outputs equal to 250 cassettes or more. When the price is $8.40 a cassette, each firm produces 350 cassettes and the quantity supplied by the 1,000 firms is 350,000 cassettes a week. The quantity demanded at $8.40 is 350,000 a week.

5b. The industry output is 350,000 cassettes a week.

5c. Each firm produces 350 cassettes a week.

5d. Each firm incurs an economic loss of $581 a week.

Each firm produces 350 cassettes at an average total cost of $10.06 a cassette. The firm can sell the 350 cassettes for $8.40 a cassette. The firm incurs a loss on each cassette of $1.66 and incurs an economic loss of $581a week.

5e. In the long run, some firms exit the industry because they are incurring economic losses.

5f. The number of firms in the long run is 750.

In the long run, as firms exit the industry, the price rises. In long-run equilibrium, the price will equal the minimum average total cost. When output is 400 cassettes a week, marginal cost equals average total cost and average total cost is a minimum at $10 a cassette. In the long run, the price is $10 a cassette. Each firm remaining in the industry produces 400 cassettes a week. The quantity demanded at $10 a cassette is 300,000 a week. So the number of firms is 300,000 cassettes divided by 400 cassettes per firm, which is 750 firms.

7a. The market price is $7.65 a cassette.

When the price is $7.65 a cassette, each firm produces 300 cassettes and the quantity supplied by the 1,000 firms is 300,000 cassettes a week. The quantity demanded at $7.65 is 300,000 a week.

7b. The industry output is 300,000 cassettes a week.

7c. Each firm produces 300 cassettes a week.

7d. Each firm makes an economic loss of $834 a week.

Each firm produces 300 cassettes at an average total cost of $10.43 a cassette. The firm can sell the 300 cassettes for $7.65 a cassette. The firm incurs a loss on each cassette of $2.78 and incurs an economic loss of $834 a week.

7e. In the long run, some firms exit the industry because they are incurring economic losses.

7f. The number of firms in the long run is 500.

In the long run, as firms exit the industry, the price rises. Each firm remaining in the industry produces 400 cassettes a week. The quantity demanded at $10 a cassette is 200,000 a week. So the number of firms is 200,000 cassettes divide by 400 cassettes per firm, which is 500 firms.

CHAPTER 12

1a. Minnie's total revenue schedule lists the total revenue at each quantity sold. For example, Minnie's can sell 1 bottle for $8 a bottle, which is $8 of total revenue at the quantity 1 bottle.

1b. Minnie's marginal revenue schedule lists the marginal revenue that results from increasing the quantity sold by 1 bottle. For example, Minnie's can sell 1 bottle for a total revenue of $8. Minnie's can sell 2 bottles for $6 each, which is $12 of total revenue at the quantity 2 bottles. So by increasing the quantity sold from 1 bottle to 2 bottles, marginal revenue is $4 a bottle ($12 minus $8).

3a. Marginal cost is the increase in total cost that results from increasing output by 1 unit. When Minnie's increases output from 1 bottle to 2 bottles, total cost increases by $4, so the marginal cost is $4 a bottle.

3b. Minnie's profit-maximizing output is 1.5 bottles.

The marginal cost of increasing the quantity from 1 bottle to 2 bottles is $4 a bottle ($7 minus $3). That is, the marginal cost of the 1.5 bottles is $4 a bottle. The marginal revenue of increasing the quantity sold from 1 bottle to 2 bottles is $4 ($12 minus $8). So the marginal revenue from 1.5 bottles is $4 a bottle. Profit is maximized when the quantity produced makes the marginal cost equal to marginal revenue. The profit-maximizing output is 1.5 bottles.

Minnie's profit-maximizing price is $7 a bottle.

The profit-maximizing price is the highest price that Minnie's can sell the profit-maximizing output of 1.5 bottles. Minnie's can sell 1 bottle for $8 and 2 bottles for $6, so it can sell 1.5 bottles for $7 a bottle.

3c. Minnie's economic profit is $5.50.

Economic profit equals total revenue minus total cost. Total revenue equals price ($7 a bottle) multiplied by quantity (1.5 bottles), which is $10.50. Total cost of producing 1 bottle is $3 and the total cost of producing 2 bottles is $7, so the total cost of producing 1.5 bottles is $5. Profit equals $10.50 minus $5, which is $5.50.

3d. Minnie's is inefficient. Minnie's charges a price of $7 a bottle, so consumers get a marginal benefit of $7 a bottle. Minnie's marginal cost is $4 a bottle. That is, the marginal benefit of $7 a bottle exceeds Minnie's marginal cost.

5a. The profit-maximizing quantity is 150 newspapers a day and price is 70 cents a paper.

Profit is maximized when the firm produces the output at which marginal cost equals marginal revenue. Draw in the marginal revenue curve. It runs from 100 on the *y*-axis to 250 on the *x*-axis. The marginal revenue curve cuts the marginal cost curve at the quantity 150 newspapers a day.

The highest price that the publisher can sell 150 newspapers a day is read from the demand curve.

5b. The daily total revenue is $105 (150 papers at 70 cents each).

5c. Demand is elastic.

Along a straight-line demand curve, demand is elastic at all prices above the midpoint of the demand curve. The price at the midpoint is 50 cents. So at 70 cents a paper, demand is elastic.

5d. The consumer surplus is $22.50 a day and the deadweight loss is $15 a day.

Consumer surplus is the area under the demand curve above the price. The price is 70 cents, so consumer surplus equals (100 cents minus 70 cents) multiplied by 150/2 papers a day, which is $22.50 a day.

Deadweight loss arises because the publisher does not produce the efficient quantity. Output is restricted to 150,

and the price is increased to 70 cents. The deadweight loss equals (70 cents minus 40 cents) multiplied by 100/2.

5e. The newspaper will not want to price discriminate unless it can find a way to prevent sharing and resale of the newspaper from those who are charged a lower price to those who are charged a higher price.

7a. The firm will produce 2 cubic feet a day and sell it for 6 cents a cubic foot. Deadweight loss will be 4 cents a day.

Draw in the marginal revenue curve. It runs from 10 on the *y*-axis to 2.5 on the *x*-axis. The profit-maximizing output is 2 cubic feet at which marginal revenue equals marginal cost. The price charged is the highest that people will pay for 2 cubic feet a day, which is 6 cents a cubic foot. The efficient output is 4 cubic feet, at which marginal cost equals price (marginal benefit). So the deadweight loss is (4 minus 2 cubic feet) multiplied by (6 minus 2 cents)/2.

7b. The firm will produce 3 cubic feet a day and charge 4 cents a cubic foot. Deadweight loss is 1 cent a day.

If the firm is regulated to earn only normal profit, it produces the output at which price equals average total cost—at the intersection of the demand curve and the *ATC* curve.

7c. The firm will produce 4 cubic feet a day and charge 2 cents a cubic foot. There is no deadweight loss.

If the firm is regulated to be efficient, it will produce the quantity at which price (marginal benefit) equals marginal cost—at the intersection of the demand curve and the marginal cost curve.

CHAPTER 13

1a. Lite and Kool produces 100 pairs a week.

To maximize profit, Lite and Kool produces the quantity at which marginal revenue equals marginal cost.

1b. Lite and Kool charges $20 a pair.

To maximize profit, Lite and Kool charges the highest price for the 100 pairs of shoes, as read from the demand curve.

1c. Lite and Kool makes a profit of $500 a week.

Economic profit equals total revenue minus total cost. The price is $20 a pair and the quantity sold is 100 pairs, so total revenue is $2,000. Average total cost is $15 a pair, so total cost equals $1,500. Economic profit equals $2,000 minus $1,500, which is $500 a week.

3a. (i) The firm produces 100 pairs.

To maximize profit, the firm produces the quantity at which marginal cost equals marginal revenue. Marginal cost is $20 a pair. The firm can sell 200 pairs at $20 a pair, so the marginal revenue is $20 at 100 pairs. (Marginal revenue curve lies halfway between the *y*-axis and the demand curve.)

(ii) The firm sells them for $60 a pair.

The firm sells the 100 pairs at the highest price that consumers will pay, which is read from the demand curve. This price is $60 a pair.

(iii) The firm's economic profit is zero.

The firm produces 100 pairs and sells them for $60 a pair, so total revenue is $6,000. Total cost is the sum of total fixed cost plus total variable cost of 100 pairs. Total cost equals $4,000 plus ($20 multiplied by 100), which is $6,000. The firm's profit is zero.

3b. (i) The firm produces 200 pairs.

To maximize profit, the firm produces the quantity at which marginal cost equals marginal revenue. Marginal cost is $20 a pair. At $20 a pair, the firm can sell 400 pairs (twice the number with no advertising), so the marginal revenue is $20 at 200 pairs. (The marginal revenue curve lies halfway between the *y*-axis and the demand curve.)

(ii) The firm sells them for $60 a pair.

The firm sells the 200 pairs at the highest price that consumers will pay—read from the demand curve. This price is $60 a pair.

(iii) The firm makes an economic profit of $1,000.

The firm produces 200 pairs and sells them for $60 a pair, so total revenue is $12,000. Total cost is the sum of total fixed cost plus the advertising cost plus total variable cost of 200 pairs. Total cost equals $4,000 plus $3,000 plus ($20 multiplied by 200), which is $11,000. The firm makes an economic profit of $1,000.

3c. The firm will spend $3,000 advertising because it makes more economic profit than when it does not advertise.

5. The firm will not change the quantity it produces or the price it charges. The firm makes less economic profit.

The firm maximizes profit by producing the output at which marginal cost equals marginal revenue. An increase in fixed cost increases total cost, but it does not change marginal cost. So the firm does not change its output or the price it charges. The firm's total costs have increased and its total revenue has not changed, so the firm makes less economic profit.

7a. The price rises, output increases, and economic profit increases.

The dominant firm produces the quantity and sets the price such that it maximizes its profit. When demand increases, marginal revenue increases, so the firm produces a larger output. The highest price at which the dominant firm can sell its output increases. Because price exceeds marginal cost, economic profit increases.

7b. The price rises, output increases, and economic profit increases.

The small firms are price takers, so the price they charge rises. Because these firms are price takers, the price is also marginal revenue. Because marginal revenue increases, the small firms move up along their marginal cost curves (supply curves) and increase the quantity they produce. Because price exceeds marginal cost, economic profit increases.

9a. The game has 2 players (*A* and *B*), and each player has 2 strategies: to answer honestly or to lie. There are 4 payoffs: Both answer honestly; both lie; *A* lies, and *B* answers honestly; and *B* lies, and *A* answers honestly.

9b. The payoff matrix has the following cells: Both answer honestly: *A* gets $100, and *B* gets $100; both lie: *A* gets $50, and *B* gets $50; *A* lies and *B* answers honestly: *A* gets $500, and *B* gets $0; *B* lies and *A* answers honestly: *A* gets $0, and *B* gets $500.

9c. Equilibrium is that each player lies and gets $50.

If *B* answers honestly, the best strategy for *A* is to lie because he would get $500 rather than $100. If *B* lies, the best strategy for *A* is to lie because he would get $50 rather than $0. So *A*'s best strategy is to lie, no matter what *B* does. Repeat the exercise for *B*. *B*'s best strategy is to lie, no matter what *A* does.

11a. The best strategy for each firm is to cheat.

(i) Each firm makes a zero economic profit or normal profit.

If both firms cheat, each firm will lower the price in an attempt to gain market share from the other firm. In the process, the price will be driven down until each firm is making normal profit.

(ii) If Suddies abides by the agreement, the best strategy for Soapy is to cheat because it would make a profit of $1.5 million rather than $1 million. If Suddies cheats, the best strategy for Soapy is to cheat because it would make a profit of $0 (the competitive outcome) rather than incur a loss of $0.5 million. So Soapy's best strategy is to cheat, no matter what Suddies does. Repeat the exercise for Suddies. Suddies's best strategy is to cheat, no matter what Soapy does.

(iii) The payoff matrix has the following cells: Both abide by the agreement: Soapy makes $1 million profit, and Suddies makes $1 million profit; both cheat: Soapy makes $0 profit, and Suddies makes $0 profit; Soapy cheats and Suddies abides by the agreement: Soapy makes $1.5 million profit, and Suddies incurs a $0.5 million loss; Suddies cheats and Soapy abides by the agreement: Suddies makes $1.5 million profit, and Soapy incurs $0.5 million loss.

(iv) The equilibrium is that both firms cheat and each makes normal profit.

11b. Each firm can adopt a tit-for-tat strategy or a trigger strategy. Page 307 gives descriptions of these strategies.

CHAPTER 14

1a. The price is 30 cents a bottle.

Elixir Springs is a natural monopoly. It produces the quantity that makes marginal revenue equal to marginal cost, and it charges the highest price it can for the quantity produced. The marginal revenue curve is twice as steep as the demand curve, so it runs from 50 on the *y*-axis to 1.25 on the *x*-axis. Marginal revenue equals marginal cost at 1 million bottles a year. The highest price at which Elixir can sell 1 million bottles a year is 30 cents a bottle, read from the demand curve.

1b. Elixir Springs sells 1 million bottles a year.

1c. Elixir maximizes producer surplus.

If Elixir maximizes total surplus, it would produce the quantity that makes price equal to marginal cost. That is, it would produce 2 million bottles a year and sell them for 10 cents a bottles. Elixir is a natural monopoly, and it maximizes its producer surplus.

3a. The price is 10 cents a bottle.

Marginal cost pricing regulation sets the price equal to marginal cost, 10 cents a bottle.

3b. Elixir sells 2 million bottles.

With the price set at 10 cents, Elixir maximizes profit by producing 2 million bottles—at the intersection of the demand curve (which shows price) and the marginal cost curve.

3c. Elixir incurs an economic loss of $150,000 a year.

Economic profit equals total revenue minus total cost. Total revenue is $200,000 (2 million bottles at 10 cents a bottle). Total cost is $350,000 (total variable cost of $200,000 plus total fixed cost of $150,000). So Elixir incurs an economic loss of $150,000 (a revenue of $200,000 minus $350,000).

3d. Consumer surplus is $400,000 a year.

Consumer surplus is the area under the demand curve above the price. Consumer surplus equals 40 cents a bottle (50 cents minus 10 cents) multiplied by 2 million bottles divided by 2, which is $400,000.

3e. The regulation is in the public interest because total surplus is maximized. The outcome is efficient.

The outcome is efficient because marginal benefit (or price) equals marginal cost. When the outcome is efficient, total surplus is maximized.

5a. The price is 20 cents a bottle.

Average cost pricing regulation sets the price equal to average total cost. Average total cost equals average fixed cost plus average variable cost. Because marginal cost is constant at 10 cents, average variable cost equals marginal cost. Average fixed cost is total fixed cost ($150,000) divided by the quantity produced. For example, when Elixir produces 1.5 million bottles, average fixed cost is 10 cents, so average total cost is 20 cents. The price at which Elixir can sell 1.5 million bottles a year is 20 cents a bottle.

5b. Elixir sells 1.5 million bottles.

5c. Elixir makes zero economic profit.

Economic profit equals total revenue minus total cost. Total revenue is $300,000 (1.5 million bottles at 20 cents a bottle). Total cost is $300,000 (1.5 million bottles at an average total cost of 20 cents). So Elixir makes zero economic profit.

5d. Consumer surplus is $225,000 a year.

Consumer surplus is the area under the demand curve above the price. Consumer surplus equals 30 cents a bottle (50 cents minus 20 cents) multiplied by 1.5 million bottles divided by 2, which is $225,000.

5e. The regulation creates a deadweight loss, so the outcome is inefficient. The regulation is not in the social interest.

7a. The price is $500 a trip, and the quantity is 2 trips a day.

Regulation in the social interest is marginal cost pricing. Each airline charges $500 a trip and produces the quantity at which price equals marginal cost. Each airline makes 1 trip a day.

7b. The price is $750 a trip, and the number of trips is 1 trip a day (one by each airline on alternate days).

If the airlines capture the regulator, the price will be the same as the price that an unregulated monopoly would charge. An unregulated monopoly produces the quantity and charges the price that maximizes profit—that is, the quantity that makes marginal revenue equal to marginal cost. This quantity is 1 trip a day, and the highest price that the airlines can charge for that trip (read from the demand curve) is $750.

7c. Deadweight loss is $125 a day.

Deadweight loss arises because the number of trips is cut from 2 to 1 a day and the price is increased from $500 to $750. Deadweight loss equals (2 minus 1) trip multiplied by ($750 minus $500) divided by 2. Deadweight loss is $125 a day.

7d. If there are only a few large producers and many consumers, public choice theory predicts that regulation will protect the producer's interest and politicians will be rewarded with campaign contributions. But if there is a significant number of small producers with large costs or if the cost of organizing consumers is low, regulation will be in the social interest.

9. Regulation consists of rules administered by government agency to influence economic activity by determining prices, product standards and types, and the conditions under which new firms may enter an industry. Antitrust law regulates or prohibits price fixing and the attempt to monopolize. Regulation applies mainly to natural monopoly and antitrust law to oligopoly. Regulation of electric utilities is an example of regulation. The ruling against Microsoft is an example of the application of the antitrust law.

CHAPTER 15

1a. 5 tons per week are produced and the marginal cost falling on the trout farmer is $167 a ton.

When 5 tons a week are produced, the pesticide producer's marginal cost is $75 a ton and the marginal benefit of pesticide is $75 a ton. At this quantity, the trout farmer's *MC* from pesticide production is $167 a ton.

1b. 3 tons per week are produced and the pesticide producer pays the farmer $100 a ton = $300 a week.

The efficient quantity is 3 tons at which marginal social cost equals marginal benefit. If the trout farmer owns the lake, the cost of pollution can be forced back onto the pesticide producer, who when has the incentive to produce the efficient quantity.

1c. 3 tons per week; the rent is $1,000 minus $300 = $700 a week.

The efficient quantity is 3 tons at which marginal social cost equals marginal benefit. If the pesticide producer owns the lake, the cost of pollution is born by the pesticide producer in the form of a decreased rent from the trout farmer.

1d. Quantities in 1b and 1c are equal because the Coase theorem applies.

3a. $100 a ton.

3b. The pollution tax equals the marginal external cost—it is a Pigovian tax.

5a. 3 tons a week.

5b. $300 a permit. Pesticide producer buys permit from trout farmer for $300.

5c. The same as amount paid by producer to farmer with property rights—Pigovian tax.

7a. If schools are competitive, 30,000 students enroll and tuition is $4,000 a year.

In a competitive market, schools maximize profit. They produce the quantity at which the marginal benefit of the last student enrolled equals the marginal cost of educating the last student enrolled. Tuition is $4,000 a student.

7b. Efficient number of places is 50,000, and tuition is $4,000 a student.

The efficient number of places is such that the marginal social benefit of education equals the marginal cost of education. The marginal social benefit equals the marginal private benefit plus the external benefit. For example, the marginal social benefit of 50,000 places equals the marginal private benefit of $2,000 plus the external benefit of $2,000, which is $4,000.

CHAPTER 16

1a. The capacity that achieves maximum net benefit is 2.5 million gallons a day.

Net benefit is maximized at the capacity where marginal benefit equals marginal cost, which is 2.5 million gallons a day.

1b. $62.50 per person.

The efficient capacity is the one that maximizes net benefit. Total cost of the sewerage system is the sum of the marginal cost of each additional gallon of capacity. That is, total cost is the area under the marginal cost curve up to 2.5 million gallons, which equals $62.5 million. The population is 1 million, so each person will have to pay $62.50.

1c. The political equilibrium will be a sewerage system that has a capacity of 2.5 million gallons.

If voters are well informed, the political equilibrium will be the efficient capacity.

1d. Bureaucrats will provide a capacity of 5 million gallons.

With voters rationally ignorant, bureaucrats will maximize the budget. That is, they will increase the capacity until net benefit is zero. The total benefit from a capacity of 5 million gallons is $250 million. The total cost of a capacity of 5 million gallons is $250 million. So the net benefit from a capacity of 5 million gallons is zero.

3a. The marginal private benefit of each fishing boat is the average catch per boat. The table shows the marginal private benefit (*MPB*) of each boat.

Number of boats	Value of catch (thousands of dollars)	*MPB* (thousands of dollars)
0	0	
10	2,000	200
20	3,500	175
30	4,500	150
40	4,800	120
50	5,000	100
60	4,800	80
70	4,200	60
80	2,400	30

3b. The marginal social cost is $70,000.

The marginal social cost is the same as the marginal cost of operating a boat because there are no external costs.

3c. With no regulation, the number of boats will be 65 and the catch will be $4,500,000.

The number of boats will increase until the marginal private benefit of a boat equals the marginal cost of a boat. The marginal cost is $70,000 a boat and with 65 boats the marginal private benefit is $70,000 per boat. The 65 boats will take a catch that is valued at $4,500,000.

3d. The equilibrium is an overfishing equilibrium because fewer boats can take a larger catch—the maximum catch occurs with 50 boats.

3e. The marginal social benefit of each fishing boat is the increase in the value of the catch that results from one additional fishing boat. The following table shows the marginal social benefit (*MSB*) of each boat.

Number of boats	Value of cod caught (thousands of dollars)	*MSB* (thousands of dollars)
0	0	
		200
10	2,000	
		150
20	3,500	
		100
30	4,500	
		30
40	4,800	
		20
50	5,000	
		–20
60	4,800	
		–60
70	4,200	
		–180
80	2,400	

3f. The efficient number of boats, ignoring the value placed on the cod stock by concerned citizens, is about 30.

The number of boats is efficient if marginal social benefit from operating boats equals the marginal cost of operating that number of boats. The marginal cost is $70,000. The marginal social benefit is $70,000 when about 30 boats are used.

But there is an externality. The marginal external benefit is −$100,000 per boat. Taking account of this externality, the efficient number of boats is about 10. The efficient number of boats is such that the sum of the marginal social benefit from the catch and the marginal external benefit equals the marginal cost of operating a boat. With 10 boats, the marginal social benefit ($175,000) plus the marginal external benefit (−$100,000) is $75,000. So the efficient number of boats is about 10.

3g. The efficient value of the catch is about $2,000,000 a month—the catch of 10 boats.

3h. The concerned citizens and the industry do not agree on the cod catch. The industry wants to catch $4,500,000 of cod a month, but concerned citizens would like the catch to be $2,000,000 a month.

3i. The price of an ITQ would be $130,000.

The price of the ITQ that would deliver the efficient number of boats equals the marginal private benefit per boat when about 10 boats operate minus the cost of operating a boat. That is, the price of the ITQ would be $200,000 minus $70,000, which equals $130,000.

CHAPTER 17

1a. The wage rate is $6 an hour. The wage rate adjusts to make the quantity of labor demanded equal to the quantity supplied.

1b. The number of pickers hired is 400 a day. At a wage rate of $6 an hour, 400 pickers a day are hired.

1c. The income received by blueberry pickers is $2,400 an hour. Income equals the wage rate ($6 an hour) multiplied by the number of pickers (400).

3a. Marginal product of labor is the increase in total product that results from hiring one additional student. For example, if Wanda increases the number of students hired from 4 to 5, total product (the quantity of fish packed) increases from 120 to 145 pounds. The marginal product of increasing the number of students from 4 to 5 is 25 pounds of fish.

To plot the marginal product curve, the marginal product is plotted at the mid-point. For example, when the number of students increases from 4 to 5 a day, marginal product is 25 pounds of fish. The 25 pounds of fish is plotted at 4.5 students a day.

3b. Marginal revenue product of labor is the increase in total revenue that results from hiring one additional student. For example, if Wanda hires 4 students, they produce 120 pounds of fish. Wanda sells the fish for 50 cents a pound, so total revenue is $60. If Wanda increases the number of students hired from 4 to 5, total product increases to 145 pounds. Total revenue from the sale of this fish is $72.50. Marginal revenue product resulting from hiring the fifth student is $12.50 ($72.50 minus $60). Alternatively, marginal revenue product equals marginal product multiplied by marginal revenue (price). Marginal revenue product of hiring the fifth student is $12.50, which is 25 pounds of fish she sells at 50 cents a pound.

3c. One point on Wanda's demand for labor curve: At a wage rate of $12.50 an hour, Wanda will hire 4.5 students. The demand for labor curve is the same as the marginal revenue product curve.

3d. Wanda hires 6.5 students a day.

Wanda hires the number of students that makes the marginal revenue product equals to the wage rate of $7.50 an hour. When Wanda increases the number of students from 6 to 7, marginal product is 15 pounds of fish an hour, which Wanda sells for 50 cents a pound. Marginal revenue product is $7.50—the same as the wage rate. Remember

SOLUTIONS TO ODD-NUMBERED PROBLEMS 17

the marginal revenue product is plotted at the mid-point between 6 and 7 students a day—6.5 students a day.

5a. Marginal product does not change. If Wanda hires 5.5 students a day, marginal product is still 25 pounds of fish.

5b. Marginal revenue product decreases.

If Wanda hires 5.5 students a day, marginal product is 25 pounds of fish. Now Wanda sells the fish for 33.33 cents, so marginal revenue product is now $8.33, down from $12.50.

5c. Wanda's demand for labor decreases, and her demand for labor curve shifts leftward. Wanda is willing to pay the students their marginal revenue product, and the fall in the price of fish has lowered their marginal revenue product.

5d. Wanda will hire fewer students. At the wage rate of $7.50, the number of students Wanda hires decreases as the demand for labor curve shifts leftward.

7a. Marginal revenue product does not change. If Wanda hires 5.5 students an hour, marginal product is 25 pounds of fish, which she sells at 50 cents a pound. So marginal revenue product remains at $12.50.

7b. Wanda's demand for labor remains the same because marginal revenue product has not changed.

7c. Wanda will hire fewer students. At the wage rate of $10 an hour, Wanda hires the number of students that makes marginal revenue product equal to $10 an hour. Wanda now hires 5.5 students an hour—down from 6.5 students an hour. The marginal product of 5.5 students is 20 pounds of fish an hour, and Wanda sells this fish for 50 cents a pound. Marginal revenue product is $10 an hour.

9. Wanda maximizes her profit when marginal revenue product equals the wage rate and when marginal revenue equals marginal cost.

When the wage rate is $7.50 an hour, Wanda hires 6.5 students an hour. Marginal revenue product is marginal product (15 pounds of fish an hour) multiplied by the price of fish (50 cents a pound), which equals $7.50 an hour.

Marginal revenue resulting from selling an additional pound of fish is 50 cents. The cost a student is $7.50 an hour and the marginal product of 15 pounds of fish, so the marginal cost of an additional pound of fish is $7.50 an hour divided by 15 pounds of fish, which is 50 cents. So when Wanda hires 6.5 students an hour, marginal revenue equals marginal cost and profit is maximized.

11. To answer this problem, we need to know the interest rate and the price that Greg expects next year. If he expects the price to rise by a percentage that exceeds the interest rate, he pumps none and waits for the higher price. If he expects the price to rise by a percentage less than the interest rate, he pumps it all now. If he expects the price to rise by a percentage equal to the interest rate, he doesn't mind how much he pumps.

13a. Income of $2,400 a day is divided between opportunity cost and economic rent. Economic rent is the area above the supply curve below the wage rate. To show the economic rent on the graph, extend the supply curve until it touches the *y*-axis. Shade in the area above the supply curve up to the wage rate $6 an hour.

13b. Opportunity cost is the area under the supply curve. To show the opportunity cost on the graph, shade in the area under the supply curve up to 400 pickers on the *x*-axis.

APPENDIX TO CHAPTER 17

1a. The wage rate is $10 a day.

The monopsony firm maximizes its profit by hiring the quantity of labor that makes the marginal cost of labor equal to the marginal revenue product of labor (see Fig. A14.2). The marginal product of the fifth worker is 10 grains per day. Gold sells for $1.40 per grain, so the marginal revenue product of the fifth worker is $14 a day. The marginal cost of the fifth worker a day equals the total labor cost of 5 workers a day minus the total labor cost of 4 workers a day. The supply of labor tells us that to hire 5 workers a day, the gold company must pay $10 a day, so the total labor cost is $50 a day. The supply of labor also tells us that to hire 4 workers a day, the gold company must pay $9 a day, so the total labor cost is $36 a day. So the marginal cost of the fifth worker is $14 a day ($50 minus $36).

The profit-maximizing quantity of labor is 5 workers because the marginal cost of the fifth worker equals the marginal revenue product of the fifth worker. The monopsony pays the 5 workers the lowest wage possible: the wage rate at which the 5 workers are willing to supply their labor. The supply of labor schedule tells us that 5 workers are willing to supply their labor for $10 a day.

1b. The gold company hires 5 workers a day.

1c. The marginal revenue product of the fifth worker is $14 a day.

CHAPTER 18

1a. Money income equals market income (wages, interest, and rent) plus cash payments from the government.

1b. To draw the Lorenz curve, plot the cumulative percentage of households on the *x*-axis and the cumulative percentage of income on the *y*-axis. Make the scale on the two axes the same. The Lorenz curve will pass through the following points: 20 percent on the *x*-axis and 4 percent on the *y*-axis; 40 percent on the *x*-axis and 14.8 percent on the *y*-axis; 60 percent on the *x*-axis and 32.1 percent on the *y*-axis; 80 percent on the *x*-axis and 56.3 percent on the *y*-axis; and 100 percent on the *x*-axis and 100 percent on the *y*-axis.

1c. U.S. money income is distributed more equally in 1967 than in 2001.

The line of equality shows an equal distribution of income. The closer the Lorenz curve is to the line of equality, the more equal is the income distribution. The Lorenz curve for the U.S. economy in 1967 lies closer to the Line of equality than does the Lorenz curve in 2001.

1d. The biggest difference in the distribution of income in the United States in 1967 and 2001 is the share of income received by the highest 20 percent. This share increased from 43.7 percent to 50.1 percent. Smaller differences are the shares received by the four other groups, each of which

decreased. The most likely explanation for these differences (and the one provided in the chapter) is that the information technologies of the 1990s are substitutes for low-skilled labor and complements of high-skilled labor. The demand for low-skilled labor has decreased relative to the supply of low-skilled labor and the wage rate of low-skilled labor has increased more slowly than the average. The demand for high-skilled labor has increased relative to the supply of high-skilled labor and the wage rate of high-skilled labor has increased faster than the average.

3a. The wage rate of low-skilled workers is $5 an hour.

The wage rate adjusts to make the quantity of labor demanded equal to the quantity supplied.

3b. Firms employ 5,000 hours of low-skilled workers a day. At a wage rate of $5 an hour, 5,000 hours are employed each day.

3c. The wage rate of high-skilled workers is $8 an hour.

Because the marginal product of high-skilled workers is twice the marginal product of low-skilled workers, firms are willing to pay high-skilled workers twice the wage rate that they are willing to pay low-skilled workers. For example, the demand curve for low-skilled workers tells us that firms are willing to hire 6,000 hours of low-skilled workers at a wage rate of $4 an hour. So with high-skilled workers twice as productive as low-skilled workers, firms are willing to hire 6,000 hours of high-skilled workers at $8 an hour. That is, the demand curve for high-skilled labor lies above the demand curve for low-skilled workers such that at each quantity of workers the wage rate for high-skilled workers is double that for low-skilled workers.

The supply of high-skilled workers lies above the supply of low-skilled workers such that the vertical distance between the two supply curves equals the cost of acquiring the high skill—$2 an hour. That is, high-skilled workers will supply 6,000 hours a day if the wage rate is $8 an hour.

Equilibrium in the labor market for high-skilled workers occurs at a wage rate of $8 an hour.

3d. Firms employ 6,000 hours of high-skilled workers a day.

5a. Market income is the income earned by factors of production in the marketplace. Labor earns wages, capital earns interest, land earns rent and entrepreneurship earns profit.

5b. To draw the Lorenz curve, plot the cumulative percentage of households on the *x*-axis and the cumulative percentage of market income on the *y*-axis. Make the scale on the two axes the same. The Lorenz curve will pass through the following points: 20 percent on the *x*-axis and 1.1 percent on the *y*-axis; 40 percent on the *x*-axis and 8.2 percent on the *y*-axis; 60 percent on the *x*-axis and 22.1 percent on the *y*-axis; 80 percent on the *x*-axis and 44.9 percent on the *y*-axis; and 100 percent on the *x*-axis and 100 percent on the *y*-axis.

5c. U.S. money income is distributed more equally in than market income in 2001.

The Lorenz curve for the U.S. money income in 2001 lies closer to the Line of equality than does the Lorenz curve for U.S. market income in 2001. Money income is distributed more equally than market income because money income includes cash payments to poor household, which increases their income.

CHAPTER 19

1a. Lee's expected income is $2,000 a month.

Lee's expected income is (0.5)($4,000) + (0.5)($0) = $2,000 a month.

1b. Lee's utility is 50 units.

When Lee's income is $4,000, her utility is 100. When Lee's income is $0, her utility is 0. So Lee's expected utility is (0.5)(100) + (0.5)(0) = 50.

1c. Lee would have to be offered about $1,300 a month with certainty to persuade her not to take the risky job.

Lee would have to be offered the income that would give her with certainty 50 units of utility. This income is read from the graph at the 50 units on the y-axis.

3a. Zenda is more risk adverse.

Zenda is more risk adverse than Jimmy because Zenda's marginal utility of wealth decreases more quickly than does Jimmy's. The table sets out their marginal utility of wealth.

Wealth	Jimmy's utility	Jimmy's marginal utility	Zenda's utility	Zenda's marginal utility
0	0		0	
		2.00		5.12
100	200		512	
		1.00		1.28
200	300		640	
		0.50		0.32
300	350		672	
		0.25		0.06
400	375		678	
		0.12		0.03
500	387		681	
		0.06		0.02
600	393		683	
		0.03		0.01
700	396		684	

5. Lee is willing to pay up to $4,500 for insurance.

Lee's expected wealth is 0.75 ($0) + 0.25 ($5,000), which equals $1,250. With $1,250 of expected wealth, Lee's expected utility is 0.75 (0) + 0.25 (105), which equals 26 units. Her guaranteed wealth is $500, the wealth at which her utility is 26 units. The maximum amount Lee is willing to pay for insurance is $5,000 minus $500, which is $4,500.

7. The search problem is the same as set out on pp. 441–442. Lee is searching for information about the prices of cars and the quality of cars. She searches for it by visiting car dealers. She sets a reservation price (and quality) and buys when she finds a price (and quality) equal to her reservation price (and quality).

9a. Zaneb is well known for her honesty and integrity, so she creates no moral hazard or adverse selection problems for the car dealer or for the bank.

9b. The car dealer creates a moral hazard and adverse selection problems for Zaneb because the car might be a lemon.

9c. Warranties are designed to help cope with the moral hazard and adverse selection problems on cars. The bank has

information on Zaneb's income and reputation, so doesn't face moral hazard and adverse selection problems.

CHAPTER 20

Data Graphing in MyEconLab allows students to plot the time-series graph or scatter diagram based on the data. To answer problems that involve more than one country, use the International Comparisons dataset and not the individual country datasets. After plotting the graph, students can print it, and then use the printed graph to answer the questions.

1a. The growth rate of real GDP in 2002 was highest in Canada.

1b. The unemployment rate in 2002 was highest in Canada.

1c. The inflation rate in 2002 was lowest in the United Kingdom.

1d. The government budget deficit in 2002 was largest in the United States.

3a. India's economic growth rate was positive in every year from 1989 to 1996. Its economic growth rate was fastest in 1989.

3b. Pakistan's economic growth rate was not negative during this period. Its economic growth rate was slowest in 1993.

3c. From 1989 to 1993, when India's economic growth rate increased, Pakistan's decreased. But from 1993 to 1995, both economic growth rates increased. In 1996, they were the same.

5a. Germany had one recession in the third and fourth quarters of 1992.

A recession is a period during which real GDP decreases for at least two successive quarters. Real GDP decreased in the third and fourth quarters of 1992.

5b. Germany experienced a business cycle peak in the fourth quarter of 1991. A business cycle peak is the upper turning point. A peak occurs when real GDP stops growing and starts to decrease.

5c. Germany experienced a business cycle trough in the fourth quarter of 1992. A business cycle trough is the lower turning point of a business cycle where a recession ends and an expansion begins.

5d. Germany experienced an expansion during the third and fourth quarters of 1991 and from the first quarter of 1993 through the second quarter of 1994. An expansion is a period during which real GDP increases.

7a. In 2002, Japan and the United States had similar large budget deficits as a percentage of GDP.

7b. In 2002, Canada, Japan, and Germany had current account surpluses, while the United States had a current account deficit. Japan had the largest current account surplus.

9a. There is no clear relationship, either positive or negative, between inflation and unemployment.

9b. No, there is no evidence from the data that low unemployment brings an increase in the inflation rate. Low levels of both seem to be consistent with the data.

CHAPTER 21

1a. Aggregate expenditure is $120 million. Aggregate expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. In the figure, *B* is consumption expenditure, *D* is investment, *C* is government purchases, and *E* is net exports. Therefore aggregate expenditure equals $60 million plus $30 million plus $24 million plus $6 million, which is $120 million.

1b. Aggregate income is $120 million.

Aggregate income equals aggregate expenditure, which from 1(a) is $120 million.

1c. GDP is $120 million. GDP equals aggregate expenditure, which from 1(a) is $120 million.

1d. Government budget deficit is $4 million.

Government budget deficit equals government purchases minus net taxes. *C* is government purchases, and *A* is net taxes. So the government budget deficit equals $24 million minus $20 million, which is $4 million.

1e. Household saving is $40 million.

Household saving equals aggregate income minus consumption expenditure minus net taxes. From 1(b), income is $120 million. In the figure, *B* is consumption expenditure and *A* is net taxes. Therefore household saving equals $120 million minus $60 million minus $20 million, which is $40 million.

1f. Government saving is minus $4 million.

Government saving equals net taxes minus government purchases. In the figure, *A* is net taxes and *C* is government expenditure. Therefore government saving equals $20 million minus $24 million, which is minus $4 million.

1g. National saving is $36 million.

National saving equals the sum of household saving and government saving. Household saving is $40 million (see answer 1e). Government saving is minus $2 million (see answer 1f). Therefore national saving equals $40 million minus $4 million, which is $36 million.

1h. Borrowing from the rest of the world is minus $6 million. Borrowing from the rest of the world equals minus net exports. *E* is net exports, and net exports equals $6 million. We are in surplus, so foreigners are in deficit and they must borrow from us to pay for their deficit.

3. Martha's initial capital stock is 10 copiers, depreciation is 1 copier per year, gross investment is 5 copiers, net investment is 4 copiers, and the final capital stock is 14 copiers. Final capital stock equals initial capital stock plus net investment. Net investment equals gross investment minus depreciation.

5a. Ecoland's GDP is $1,100,000.

GDP equals the sum of consumption expenditure plus investment plus government purchases plus exports minus imports. That is, GDP equals $600,000 plus $250,000 plus $200,000 plus $300,000 minus $250,000. GDP equals $1,100,000.

5b. Expenditure approach. Income approach cannot be used because there are no data on interest, rent, depreciation, and indirect taxes and subsidies.

5c. Investment is financed by private saving plus government saving plus borrowing from the rest of the world.

Private saving equals GDP minus consumption expenditure minus net taxes, which is $300,000. Government saving equals the budget surplus, which equals net taxes minus government purchases. Net taxes equal taxes ($250,000) minus transfer payments ($50,000), which is $200,000. Government saving equals net taxes ($200,000) minus government purchases ($200,000), which is zero. Private saving exceeds investment by $50,000 and this amount is lent to the rest of the world.

7a. In 2002, nominal GDP is $7,000. In 2003, nominal GDP is $7,500.

Nominal GDP in 2002 is equal to total expenditure on the goods and services produced by Bananaland in 2002. Expenditure on bananas is 1,000 bunches at $2 a bunch, which is $2,000. Expenditure on sunscreen is 500 bottles at $10 a bottle, which is $5,000. Total expenditure is $7,000. So nominal GDP in 2002 is $7,000.

Nominal GDP in 2003 is equal to total expenditure on the goods and services produced by Bananaland in 2003. Expenditure on bananas is 1,100 bunches at $3 a bunch, which is $3,300. Expenditure on sunscreen is 525 bottles at $8 a bottle, which is $4,200. Total expenditure is $7,500. So nominal GDP in 2002 is $7,500.

7b. Real GDP in 2003 using base-year prices method is $7,450.

The base-year prices method is to calculate the market value of the 2003 quantities at the base-year prices of 2002. To value the 2003 output at 2002 prices, expenditure on bananas is 1,100 bunches at $2 a bunch (which is $2,200), and expenditure on sunscreen is 525 bottles at $10 a bottle (which is $5,250). So real GDP in 2003 using the base-year prices method is $7,450.

9a. The growth rate of real GDP in 2003 is 6.79 percent.

The chain-weighted output index method uses the prices of 2002 and 2003 to calculate the growth rate in 2003.

The value of the 2002 quantities at 2002 prices is $7,000. The value of the 2003 quantities at 2002 prices is $7,450. We now compare these values. The increase in the value is $450. The percentage increase is ($450/$7,000) × 100, which is 6.43 percent.

The value of the 2002 quantities at 2003 prices is $7,000. The value of the 2003 quantities at 2003 prices is $7,500. We now compare these values. The increase in the value is $500. The percentage increase is ($500/$7,000) × 100, which is 7.14 percent.

The chain-weighted output index calculates the growth rate as the average of these two percentage growth rates. That is, the growth rate in 2003 is 6.79 percent

9b. The GDP deflator in 2003 is 100.33.

GDP deflator equals nominal GDP in 2003 divided by real GDP in 2003, multiplied by 100.

Real GDP in 2003 is 6.79 percent higher than real GDP in 2002. Real GDP in 2002 is $7,000, so real GDP in 2003 is $7,475.3.

GDP deflator equals ($7,500/$7,475.3) × 100 = 100.33.

9c. Real GDP in 2003 using the base-year prices method is $7,450. Real GDP in 2003 using the chain-weighted output index method is $7,475.3. The base-year prices method measures real GDP growth as being slower than the chain-weighted index measure.

CHAPTER 22

1a. Unemployment rate is 4.0 percent.

The unemployment rate is the percentage of the labor force that is unemployed. The labor force is the sum of the people unemployed and the people employed. So the number of people who are unemployed is 141,544,000 minus 135,888,000, which is 5,656,000. The unemployment rate equals (the number of people unemployed divided by the labor force) multiplied by 100. That is, (5,656,000/141,544,000) × 100, which is 4.0 percent.

1b. The labor force participation rate is 67.2 percent.

The labor force participation rate is the percentage of the working-age population that is in the labor force. The working-age population is 210,743,000 and the labor force is 141,544,000, so the labor force participation rate equals (141,544,000/210,743,000) ×100, which equals 67.2 percent.

1c. The employment-to-population ratio is 64.5 percent.

The employment-to-population ratio is the percentage of the people of working age who have jobs. The employment-to-population ratio is equal to the number of people employed divided by the working-age population all multiplied by 100. The employment-to-population ratio is (135,888,000/210,743,000) × 100, which is 64.5 percent.

3. Unemployment decreased by 64,000.

The number of people not in the labor force increased by 600,000. During 2000, employment in the United States increased by 1,375,000 and the labor force increased by 1,311,000. The number of unemployed is calculated as the labor force minus the number employed. When the labor force increased by 1,311,000 and employment increased by 1,375,000, unemployment decreased by 64,000.

5a. The number of job losers probably increased.

The number of job leavers probably did not change much. The increase in the unemployment rate is an indication that the economy was slowing and possibly going into recession. Normally, in a recession, the number of job losers increases but the number of job leavers does not change much.

5b. Labor force entrants and re-entrants probably decreased. In a recession, discouraged workers remain outside the labor force. So it is likely that entrants and re-entrants decreased.

7a. The labor force in July is 11,000. It is the number employed plus the number unemployed.

7b. The unemployment rate in July is 9.1 percent. It is the number unemployed as a percentage of the labor force.

7c. The working-age population is 16,000. It is the sum of the labor force and the number of people who are not in the labor force.

7d. The employment-to-population ratio is 62.5. It is the number employed as a percentage of the working-age population.

7e. The number of people who are unemployed at the end of August is 940. It equals the number unemployed in July plus job losers, job leavers, entrants, and reentrants minus hires, recalls, and withdrawals.

7f. The number of people who are employed at the end of August is 10,050. It equals the number employed in July minus job losers and job leavers plus hires and recalls.

7g. The labor force at the end of August is 10,990. It equals the number employed plus the number unemployed.

7h. The unemployment rate at the end of August is 8.6 percent. It equals the number unemployed as a percentage of the labor force.

9a. The CPI basket is 10 bottles of juice and 5 lengths of cloth.

9b. The CPI in the current year is 107.7.

To calculate the CPI, multiply the value of the CPI basket in current year prices by 100 and divide by the base year value of the CPI basket. The value of the CPI basket in current year prices is: ($4 × 10) + ($6 × 5) = $70. The value in base year prices is $40 + $25 (provided in the question), which equals $65. So the CPI is ($70/$65) × 100 = 107.7.

9c. The inflation rate in the current year is 7.7 percent.

The inflation rate equals the CPI in the current year minus the CPI in the base year expressed as a percentage of the base year CPI. Because the base year CPI is 100, the inflation rate is (107.7 – 100) × 100/100 = 7.7 percent.

CHAPTER 23

1a. A deep recession in the world economy decreases aggregate demand, which decreases real GDP and lowers the price level. A sharp rise in oil prices decreases short-run aggregate supply, which decreases real GDP and raises the price level. The expectation of huge losses in the future decreases investment and decreases aggregate demand, which decreases real GDP and lowers the price level.

1b. The combined effect of a deep recession in the world economy, a sharp rise in oil prices, and the expectation of huge losses in the future decreases both aggregate demand and short-run aggregate supply, which decreases real GDP and might raise or lower the price level.

1c. The Toughtimes government might try to increase aggregate demand by increasing its purchases or by cutting taxes and the Toughtimes Fed might increase the quantity of money and lower interest rates. These policies could increase real GDP, but they would also raise the price level.

3a. Make a graph with the price level on the *y*-axis and real GDP on the *x*-axis. Make the price level values run from 80 to 150 in intervals of 10, and make the real GDP values run from 150 to 650 in intervals of 50. Plot the data in the table in the graph. The *AD* curve plots the price level against the quantity of real GDP demanded. The *SAS* curve plots the price level against the quantity of real GDP supplied in the short-run.

3b. Equilibrium real GDP is $400 trillion and the price level is 100. Short-run macroeconomic equilibrium occurs at the intersection of the aggregate demand curve and the short-run aggregate supply curve.

3c. The long-run aggregate supply curve is a vertical line in your graph at real GDP of $500 billion.

5. Make a new table based on that in problem 3. Add a column headed "New real GDP demanded." Enter values in this column that equal the value in the column headed "Real GDP demanded" plus $100 billion. (For example, on the first row of your new column, you have $550 billion.) Now, using the graph that you made to answer problem 3, add a new *AD* curve by plotting the price level against "New quantity of real GDP demanded." The new equilibrium level of real GDP is $450 billion, and the price level is 110.

7. Make a new table based on that in problem 3. Add a column headed "New real GDP supplied in the short run." Enter values in this column that equal the value in the column headed "Real GDP supplied in the short run" minus $100 billion. (For example, on the first row of your new column, you have $250 billion.) Now, using the graph that you made to answer problem 3, add a new *SAS* curve by plotting the price level against "New quantity of real GDP supplied in the short run." The new equilibrium level of real GDP is $350 billion, and the price level is 110.

9a. Point *C*. The aggregate demand curve is the red curve AD_1. The short-run aggregate supply curve is the blue curve SAS_0. These curves intersect at point *C*.

9b. Point *D*. The short-run aggregate supply curve is the red curve SAS_1. The aggregate demand curve is now the red curve AD_1. These curves intersect at point *D*.

9c. Aggregate demand increases if (1) expected future incomes, inflation, or profits increase; (2) the government increases its purchases or reduces taxes; (3) the Fed increases the quantity of money and decreases interest rates; or (4) the exchange rate decreases or foreign income increases.

9d. Short-run aggregate supply decreases if resource prices increase.

CHAPTER 24

1a. The table shows Crusoe's production function. It replaces leisure with labor and labor equals 12 hours a day minus leisure hours. The graph is similar to Fig. 24.1(b) on page 553. It plots labor on the *x*-axis and real GDP on the *y*-axis. As labor increases from zero to 12 hours a day, real GDP increases from $0 to $30 a day.

Crusoe's Production Function

Labor	Real GDP ($ per day)
0	0
2	10
4	18
6	24
8	28
10	30
12	30

The graph is similar to Fig. 24.1(a) on page 553. It plots leisure on the *x*-axis and real GDP on the *y*-axis. As leisure increases from zero to 12 hours a day, real GDP decreases from $30 to $0 a day.

1b. When labor increases from 0 to 2 hours a day, the marginal product of labor is $5. When labor increases from 2 to 4 hours a day, the marginal product of labor is $4. When labor increases from 4 to 6 hours a day, the marginal product of labor is $3. When labor increases from 6 to 8 hours a day, the marginal product of labor is $2. When labor increases from 8 to 10 hours a day, the marginal product of labor is $1. When labor increases from 10 to 12 hours a day, the marginal product of labor is $0. Marginal product is the change in real GDP divided by the change in labor hours.

3a. The demand for labor schedule is the same as the marginal product of labor schedule. The marginal product of labor schedule is described in solution 1(b). The marginal product must be aligned with the midpoint of the change in labor. So, for example, the marginal product of $5 an hour is aligned with 1 hour of work, the midpoint between 0 and 2 hours. The graph plots a marginal product of $5 at 1 hour and a marginal product of $1 at 9 hours of labor and is a straight line between these points. At 2 hours of labor, the marginal product is $4.50.

Crusoe's Demand Schedule

Real wage rate	Quantity of labor demanded
$5.00	1
4.00	3
3.00	5
2.00	7
1.00	9
0.00	11

3b. The table below lists hours of labor from zero to 12 a day. Against each hour, the wage rate at which Crusoe is willing to supply labor is $4.50 an hour. Crusoe's supply curve is horizontal at $4.50 an hour.

Crusoe's Supply Schedule

Real wage rate	Quantity of labor supplied
$4.50	0
4.50	2
4.50	4
4.50	6
4.50	8
4.50	10
4.50	12

3c. The full-employment equilibrium real wage rate is $4.50 an hour, and the quantity of labor employed is 2 hours a day. The full-employment equilibrium real wage rate is $4.50 an hour because Crusoe is willing to work any number of hours at this wage rate. The equilibrium level of employment is 2 hours a day because this is the number of hours at which Crusoe's marginal product of labor is $4.50 an hour.

3d. Potential GDP is $10 a day. Potential GDP is $10 a day because this quantity of real GDP is produced when labor is 2 hours a day.

5a. Yes.

5b. Yes.

5c. No.

The firm receives a total revenue of $17 million. It spends $16 million ($10 million on the plant, $3 million on labor and $3 million on fuel). Before paying interest, the firm has a surplus of $1 million. If the interest rate is 5 percent a year, the interest cost is $0.5 million. If the interest rate is 10 percent a year, the interest cost is $1 million. If the interest rate is 15 percent a year, the interest cost is $1.5 million. So the firm earns a profit at 5 percent, breaks even at 10 percent, and incurs a loss at 15 percent. The firm will not invest to incur a loss.

7a. The graph has saving on the *x*-axis and the interest rate on the *y*-axis. Three points are plotted at $10,000 and 4 percent; $12,500 and 6 percent; and $15,000 and 8 percent. The saving supply curve passes through these points.

7b. Saving decreases, and the saving supply curve shifts leftward.

9a. Potential GDP would decrease.

A crackdown on illegal immigrants and millions of workers returned to their country of origin would decrease the supply of labor. The equilibrium quantity of labor would decrease. Full employment would decrease and potential GDP would decrease.

9b. Employment would decrease.

A crackdown on illegal immigrants and millions of workers returned to their country of origin would decrease the supply of labor. The equilibrium quantity of labor would decrease.

9c. The real wage rate would rise.

When the supply of labor decreases, there is a movement up the demand for labor curve and the real wage rate rises.

11a. Potential GDP would increase.

A increase in investment that increased productivity would increase the demand for labor. The equilibrium quantity of labor would increase. Full employment would increase and potential GDP would increase.

11b. Employment would increase.

An increase in investment that increased productivity would increase the demand for labor. The equilibrium quantity of labor would increase.

11c. The real wage rate would rise.

When the demand for labor increases, there is a movement up the supply of labor curve and the real wage rate rises.

CHAPTER 25

1. No. The economy conforms to a one-half rule.

In this economy, an x percent increase in the capital stock per hour of work leads to a $0.5x$ percent increase in real GDP per hour of work. You can confirm this fact by calculating the percentage change in capital and real GDP at each of the levels provided in the table and then dividing the percentage change in real GDP by the percentage change in capital. For example, when capital increases by 100 percent from $10 to $20, real GDP increases by 50 percent from $3.80 to $5.70.

3a. Yes.

Diminishing returns are present if the marginal product of capital diminishes as capital increases, holding technology constant. You can calculate the marginal product of capital from the schedule provided and see that it does diminish.

The increase in real GDP per hour of work that occurred in the question resulted from an increase in capital and an advance in technology. We know this because to produce $10.29 in 1999 would have required a capital stock of $60 per hour of work, and in 2001, this output can be produced by a capital stock of $50. The change in real GDP divided by the change in capital is not the marginal product of labor because technology is not constant.

3b. $1.04.

This number is calculated as the percentage increase in real GDP that is equal to one half the percentage increase in capital.

3c. $0.94.

This number is calculated as the change in real GDP minus $1.04.

5a. Capital per hour of labor is $40 and real GDP per hour of labor is $15.

This level of real GDP per hour of labor is the subsistence level at which the population is constant.

5b. Real GDP per hour of labor increases to $22.

This level of real GDP per hour of labor is the quantity produced with the new technology at the original quantity of capital per hour of labor.

5c. The population begins to grow.

The reason for the population growth is that real GDP per hour of labor exceeds the subsistence level.

5d. Capital per hour of labor decreases to $20.

This is the quantity of capital per hour of labor produces a real GDP per hour of labor equal to $15, which is the subsistence level at which the population stops growing.

7. When the demand for capital raises the real interest rate above the target rate, the capital stock and real GDP begin to grow and keep on growing. In contrast, in the neoclassical Martha's Island, as the capital stock grows, the real interest rate falls (because of diminishing returns) and growth eventually ends.

CHAPTER 26

1. Of the list, money in the United States includes the quarters inside public telephones and the U.S. dollar bills in your wallet.

Money is composed of currency outside the banks and deposits at financial institutions. Currency inside the cash machines, Visa cards, checks, and loans are not money.

3. M1 increases by $1,000; M2 does not change.

M1 is the sum of currency outside the banks, traveler's checks, and checking deposits. M2 is the sum of M1 plus savings deposits, time deposits, and money market mutual funds and other deposits. The withdrawal of $1,000 from a savings account leaves M2 unchanged because the $1,000 goes into M1 types of money, which is part of M2. The $50 held as cash and the $950 held in a checking account increase M1 by $1,000.

5a. The balance sheet has the following assets: Reserves, $250 million; Loans, $1,000 million; Other assets, $1,250 million. It has the following liabilities: Deposits, $2,000 million; Other liabilities, $500 million.

Assets	
Reserves	$250 million
Loans	1,000 million
Other assets	1,250 million
Total assets	2,500 million
Liabilities	
Deposits	$2,000 million
Other liabilities	500 million
Total liabilities	2,500 million

5b. The reserve ratio is 12.5 peercent.

The reserve ratio is the percentage of deposits that are held as reserves. Reserves are $250 million and deposits are $2,000, so the reserve ratio is 12.5 percent.

5c. The deposit multiplier is 8.

The deposit multiplier equals 1/(required reserve ratio). The required reserve ratio is 12.5 percent, so the deposit multiplier is 8.

7a. The initial increase in the quantity of money is $1,200.

Money is equal to bank deposits and currency outside the banks. Deposits increase by $1,200, so the initial increase in the quantity of money is $1,200.

7b. The initial increase in the quantity of bank deposits is $1,200.

Deposits increase by $1,200 because the immigrant places all the new money on deposit.

7c. The bank initially lends out $1,080.

The bank has a new deposit of $1,200, and it must keep 10 percent of it ($120) as reserves and lends the rest ($1,200 minus $120), which equals $1,080.

7d. The immigrant's bank has loaned $1,080. This amount returns to the banks as new deposits. The banks keep $108 in reserves and lend a further $972.

The banks have now created deposits of $1,200 plus $1,080, which equals $2,280.

7e. The quantity of money has increased by $9,341.05.

The first loan is $1,080, and the quantity of money increases by $1,080. When this money is spent and returned to the bank as a deposit, the banks keep 10 percent of it ($108) as reserves and lend out the rest ($972). The banks create $972 of new money. So, after 2 loans, the quantity of money has increased by $1,200 + $1,080 + $972, which equals $3,252. Similar calculations reveal that after 20 loans the quantity of money increases by $9,341.05.

7f. The quantity of money increases by $12,000. Deposits increase by $12,000. Loans increase by $10,800.

The deposit multiplier is 1/0.1, which equals 10. The deposit multiplier tells us that when reserves increase by $1,200 and the required reserve ratio is 10 percent, deposits will increase by 10 times $1,200, which is $12,000.

The quantity of money increases by the amount of the increase in deposits.

Deposits increase by $12,000 and the reserve ratio is 10 percent, so reserves increase $1,200. Therefore bank loans increase by $12,000 minus $1,200, which is $10,800.

9a. The monetary base is $45 billion.

The monetary base is the sum of the central bank's notes outside the bank, banks' deposits at the central bank, and coins held by households, firms, and banks. There are $30 billion in notes held by households and firms, banks' deposits at the central bank are $10 billion (2/3 of $15 billion), the banks hold other reserves of $5 billion (which are notes), and there are no coins. The monetary base is $45 billion.

9b. The quantity of money is $330 billion.

In Nocoin, deposits are $300 billion and currency is $30 billion, so the quantity of money is $330 billion.

9c. The banks' reserve ratio is 5 percent.

The banks' reserve ratio is the percent of deposits that is held as reserves. In Nocoin, deposits are $300 billion and reserves are $15 billion, so the reserve ratio equals ($15 billion/$300 billion) × 100, which is 5 percent.

9d. The currency drain is 9.09 percent.

The currency drain is the percent of the quantity of money that is held as currency by households and firms. In Nocoin, deposits are $300 billion and currency is $30 billion, so the quantity of money is $330 billion. The currency drain equals ($30 billion/$330 billion) × 100, which is 9.09 percent.

11a. The quantity of money increases to $333.67 billion.

The quantity of money increases by the change in the monetary base multiplied by the money multiplier.

The money multiplier is 7.33 (see 11c), so when the monetary base increases by $0.5 billion, the quantity of money increases by $3.67 billion. Initially, the quantity of money was $330 billion, so the new quantity of money is $333.67 billion.

11b. The change in the quantity of money is not equal to the change in the monetary base because of the multiplier effect. The open market operation increases bank reserves and creates excess reserves, which banks use to make new loans. New loans are used to make payments and some of these loans are placed on deposit in banks. The increase in bank deposits increases banks' reserves and increases desired reserves. But the banks now have excess reserves which they loan out and the process repeats until excess reserves have been eliminated.

11c. The money multiplier is the ratio of the quantity of money to the monetary base, which equals $330 billion divided by $45 billion, which equals 7.33.

CHAPTER 27

1a. People buy bonds, and the interest rate falls.

1b. People sell bonds, and the interest rate rises.

1c. People neither buy nor sell bonds, and the interest rate remains constant at 4 percent a year.

With real GDP of $20 billion ($Y_1$ in the spreadsheet), column C shows the demand for money schedule. The quantity of money supplied is $3 billion, so the equilibrium interest rate is 4 percent a year.

If the interest rate exceeds 4 percent a year, people are holding more money than they demand. So they try to decrease the amount of money held by buying bonds. The prices of bonds rise, and the interest rate falls.

If the interest rate is less than 4 percent a year, people are holding less money than they demand. So they try to increase the amount of money held by selling bonds. The prices of bonds fall, and the interest rate rises.

If the interest rate equals 4 percent a year, people are holding exactly the quantity of money that they demand. So they take no actions to try to change the amount of money held. The interest rate remains constant.

3a. The interest rate rises to 5 percent a year.

3b. The interest rate falls to 3 percent a year.

When real GDP increases in an expansion to $30 billion ($Y_2$ in the spreadsheet), column D shows the demand for money schedule. The quantity of money supplied is $3 billion, so the equilibrium interest rate is 5 percent a year.

When real GDP decreases in a recession to $10 billion ($Y_0$ in the spreadsheet), column B shows the demand for money schedule. The quantity of money supplied is $3 billion, so the equilibrium interest rate is 3 percent a year.

5a. The money supply curve is vertical at 1 trillion 1990 yaks.

When the real money supply is 1 trillion 1990 yaks, the equilibrium interest rate is 3 percent a year at the intersection of the demand for money and supply of money curves.

5b. Must increase the quantity of real money by 0.5 trillion 1990 yaks.

When the quantity of real money increases to 1.5 trillion 1990 yaks, the equilibrium interest rate falls to 2 percent a year.

7. The *AD* and *SAS* curves intersect at a real GDP that exceeds potential GDP and there is an inflationary gap. An open market sale decreases the quantity of money and decreases aggregate demand. The *AD* curve shifts leftward and the inflationary gap shrinks. If the size of the open market sale is appropriate, this monetary policy action can avoid inflation. Real GDP in the long run is determined by potential GDP and the decrease in the quantity of money has no effect on real GDP in the long run.

9a. Aggregate demand increases.

9b. The price level rises and real GDP increases in the short run.

9c. In the long run, real GDP returns to potential GDP and the price level is higher than it otherwise would have been by the same percentage as the percentage increase in the quantity of money.

11a. $40 million.

Because the equation of exchange tells us that $MV = PY$, we know that $M = PY/V$. Then, with $P = 200$, $Y =$ $400 million, and $V = 20$, $M =$ $40 million.

11b. $48 million.

Money grows by 20 percent, which is $8 million.

11c. 240.

Because the quantity theory holds and because the factors that influence real GDP have not changed, the price level rises by the same percentage as the increase in money, which is 20 percent.

11d. $400 billion.

Because the factors that influence real GDP have not changed, real GDP is unchanged.

11e. 20.

Because the factors that influence velocity have not changed, velocity is unchanged.

CHAPTER 28

1a. An increase in the quantity of money, an increase in government expenditures, a tax cut, an increase in exports.

Anything that increases aggregate demand can set off a demand-pull inflation. But to sustain such an inflation, the quantity of money must keep increasing.

1b. Starting out on AD_0 and SAS_0, the price level is 120 and real GDP is at potential GDP of $7 trillion. Aggregate demand increases and the *AD* curve shifts rightward to AD_1. The price level rises and real GDP increases to the intersection of AD_1 and SAS_0. There is now an inflationary gap.

1c. Starting out on AD_1 and SAS_0 with an inflationary gap, the money wage rate rises and short-run aggregate supply decreases. The *SAS* curve starts to shift leftward towards SAS_1. The price level keeps rising, but real GDP now decreases. The process now repeats. *AD* shifts to AD_2, an inflationary gap opens again, the money wage rate rises again, and the *SAS* curve shifts toward SAS_2.

3a. An *anticipated* increase in the quantity of money, an increase in government expenditures, a tax cut, an increase in exports.

Anything that increases aggregate demand can set off an anticipated inflation as long as the event is anticipated. But to sustain such an anticipated inflation, the quantity of money must keep increasing along its anticipated path.

3b. Starting out on AD_0 and SAS_0, the price level is 120 and real GDP is at potential GDP of $7 trillion. Aggregate demand increases, and the *AD* curve shifts rightward to AD_1. The increase in aggregate demand is anticipated so the money wage rate rises and the *SAS* curve shifts to SAS_1. The price level rises, and real GDP remains at potential GDP.

3c. Starting out on AD_1 and SAS_1, a further anticipated increase in aggregate demand occurs. The *AD* curve shifts to AD_2, and because the increase in aggregate demand is anticipated, the money wage rate rises again and the *SAS* curve shifts to SAS_2. Again, the price level rises and real GDP remains at potential GDP.

5a. Both the inflation rate and the unemployment rate have increased. So the expected inflation rate has increased and the natural rate of unemployment might have increased (but has not definitely increased). Any of the events that can increase the expected inflation rate might have occurred. Most likely, the expected growth rate of the money supply has increased. If the natural rate of unemployment has not increased, the economy is in a recession, despite the fact that the inflation rate has increased.

5b. If point *A* is a long-run equilibrium, the *LRPC* is vertical at an unemployment rate of 4 percent. The *SRPC* slopes downward and passes through point *A*. If point *A* is *not* a long-run equilibrium, the *SRPC* still passes through point *A* but the *LRPC* is vertical at whatever unemployment rate is the natural rate.

5c. If point *D* is a long-run equilibrium, the *LRPC* is vertical at an unemployment rate of 8 percent. The *SRPC* slopes downward and passes through point *D*. If point *D* is *not* a long-run equilibrium, the *SRPC* still passes through point *D* but the *LRPC* is vertical at whatever unemployment rate is the natural rate.

7a. The inflation rate rises, then the unemployment rate increases, then the inflation rate falls, and finally the unemployment rate decreases. Initially any of the events that can increase the expected inflation rate might have occurred. Most likely, the expected growth rate of the money supply increased. To stop the inflation, the growth rate of the money supply might be decreased, which brings recession and an increase in the unemployment rate above the natural rate of unemployment. Now the inflation rata begins to fall. Eventually, the expected inflation rate falls and so does the unemployment rate.

7b. The natural unemployment rate is between 4 percent and 8 percent, so draw a vertical *LRPC* at an unemployment rate of 6 percent. The *SRPC* slopes downward and passes through point *A*. Then the *SRPC* shifts upward to pass through *B* and eventually through *D*. When the economy is at point *D*, the expected inflation rate falls and the *SRPC* curve shifts downward to pass through *C* and finally through *A* again..

7c. This sequence of events is most likely an unanticipated demand-pull inflation and deflation.

9a. If the natural unemployment rate and the expected inflation rate remain constant between 1999 and 2003, the *SRPC* is linear and passes through the data points listed in the table provided. Note that one of these points is the natural rate of unemployment (4 percent) and the expected inflation rate (6 percent). The *LRPC* is vertical at an unemployment rate of 4 percent.

9b. If the actual inflation rate rises from 6 percent to 8 percent a year, the unemployment rate decreases from 4 percent to 3 percent. This change would occur if aggregate demand were expected to increase.

CHAPTER 29

1a. The marginal propensity to consume is 0.5.

The marginal propensity to consume is the fraction of a change in disposable income that is consumed. On Heron Island, when disposable income increases by $10 million per year, consumption expenditure increases by $5 million per year. The marginal propensity to consume is 0.5.

1b. The table that shows Heron Island's saving lists disposable income from zero to 40 in increments of 10. Against each level of disposable income are the amounts of saving, which equal disposable income minus consumption expenditure. These amounts run from −5 at zero disposable income to 15 at a disposable income of 40. For each increase in disposable income of $1, saving increases by 50 cents.

1c. The marginal propensity to save is 0.5.

Disposable income (millions of dollars)	Saving (millions of dollars)
0	–5
10	0
20	5
30	10
40	15

The marginal propensity to consume plus the marginal propensity to save equals 1. Because consumption expenditure and saving exhaust disposable income, 0.5 of each dollar increase in disposable income is consumed and the remaining part (0.5) is saved.

3a. Autonomous expenditure is $2 billion.

Autonomous expenditure is expenditure that does not depend on real GDP. Autonomous expenditure equals the value of aggregate planned expenditure when real GDP is zero.

3b. The marginal propensity to consume is 0.6.

When the country has no imports or exports and no income taxes, the slope of the *AE* curve equals the marginal propensity to consume. When income increases from 0 to $6 billion, aggregate planned expenditure increases from $2 billion to $5.6 billion. That is, when real GDP increases by $6 billion, aggregate planned expenditure increases by $3.6 billion. The marginal propensity to consume is $3.6 billion/$6 billion, which is 0.6.

3c. From the graph, aggregate planned expenditure is $5.6 billion when real GDP is $6 billion. Equilibrium expenditure is $4 billion.

Equilibrium expenditure is the level of aggregate expenditure at which aggregate planned expenditure equals real GDP. In terms of the graph, equilibrium expenditure occurs at the intersection of the *AE* curve and the 45° line. Draw in the 45° line, and you'll see that the intersection occurs at $4 billion.

3d. There is no change in inventories.

When the economy is at equilibrium expenditure, inventories equal the planned level and there is no unplanned change in inventories.

3e. Firms are accumulating inventories. That is, unplanned inventory investment is positive.

When real GDP is $6 billion, aggregate planned expenditure is less than real GDP, so firms cannot sell all that they produce. Inventories pile up.

3f. The multiplier is 2.5.

The multiplier equals $1/(1 - MPC)$. The marginal propensity to consume is 0.6, so the multiplier equals $1/(1 - 0.6)$, which equals 2.5.

5a. The consumption function is $C = 100 + 0.9(Y - T)$.

The consumption function is the relationship between consumption expenditure and disposable income, other things remaining the same.

5b. The equation to the *AE* curve is $AE = 600 + 0.9Y$, where Y is real GDP.

Aggregate planned expenditure is the sum of consumption expenditure, investment, government purchases, and net exports. Using the symbol *AE* for aggregate planned expenditure, aggregate planned expenditure is:

$AE = 100 + 0.9(Y - 400) + 460 + 400$

$AE = 100 + 0.9Y - 360 + 460 + 400$

$AE = 600 + 0.9Y$

5c. Equilibrium expenditure is $6,000 billion.

Equilibrium expenditure is the level of aggregate expenditure that occurs when aggregate planned expenditure equals real GDP. That is,

$AE = 600 + 0.9Y$ and $AE = Y$

Solving these two equations for Y gives equilibrium expenditure of $6,000 billion.

5d. Equilibrium real expenditure decreases by $1,000 billion, and the multiplier is 10.

The multiplier equals 1/(1 − the slope of the *AE* curve). The equation of the *AE* curve tells us that the slope of the

AE curve is 0.9. So the multiplier is 1/(1 − 0.9), which is 10. Then, the change in equilibrium expenditure equals the change in investment multiplied by 10.

7a. The quantity demanded increases by $1,000 billion.

The increase in investment shifts the aggregate demand curve rightward by the change in investment times the multiplier. The multiplier is 10 and the change in investment is $100 billion, so the aggregate demand curve shifts rightward by $1,000 billion.

7b. In the short-run, real GDP increases by less than $1,000 billion.

Real GDP is determined by the intersection of the *AD* curve and the *SAS* curve. In the short run, the price level will rise and real GDP will increase but by an amount less than the shift of the *AD* curve.

7c. In the long-run, real GDP will equal potential GDP, so real GDP does not increase.

Real GDP is determined by the intersection of the *AD* curve and the *SAS* curve. After the initial increase in investment, money wages increase, the *SAS* curve shifts leftward, and in the long run, real GDP moves back to potential GDP.

7d. In the short run, the price level rises.

7e. In the long run, the price level rises.

CHAPTER 30

1a. Possible combinations are *A* or *D*, *E* or *G*, and *I* or *K*.

A Keynesian recession results from a decrease in investment caused by a decrease in expected profit. In an extreme case, no prices change, so the move is to *A*, *E*, and *I*. But a more general possibility is that the money wage rate doesn't change but the price level falls, real wage rate rises, and the interest rate falls. In this case, the move is to *D*, *G*, and *K*.

1b. *D*, *G*, and *L*.

A monetarist recession results from a decrease in the quantity of money. The interest rate rises, and investment decreases. Aggregate demand decreases, but the money wage rate doesn't change. Real GDP and the price level decrease, the real wage rate rises, and employment decreases. The move is to *D*, *G*, and *L*.

1c. *D*, *G*, and *I*, *K*, or *L*.

1d. *D*, *G*, and *I*, *K*, or *L*.

Either type of rational expectations recession results from an unanticipated decrease in aggregate demand. Any of several factors could initiate the decrease in aggregate demand, and the interest rate could rise, fall, or remain constant. Aggregate demand decreases, but the money wage rate either doesn't change or doesn't change by enough to maintain full employment. So real GDP and the price level decrease, the real wage rate rises, and employment decreases.

1e. *C*, and *E*, *G*, or *H*, and *K*.

In a real business cycle recession, a decrease in productivity decreases the demand for labor and capital. The interest rate and the real wage rate fall and investment and employment decrease. Aggregate demand and aggregate supply decrease, so real GDP decreases but the price level might fall, rise, or remain unchanged.

3. This recession is consistent with Keynesian or rational expectations theories (see the solutions 1a, 1c, and 1d).

5. This recession is consistent with real business cycle theory (see the solution 1e).

7. This recession is not consistent with any of the theories and is an unlikely combination of events. The price level does not usually rise when the real wage rate rises.

9. This recession is consistent the real business cycle theory (see the solution 1e).

not usually fall when the real wage rate falls.

11. This recession is consistent with monetarist theory (see the solution 1b).

13. This recession is not consistent with any of the theories and is an unlikely combination of events. The real wage rate does not usually fall when the price level falls.

CHAPTER 31

1a. The supply of labor will decrease. The supply of labor curve will shift leftward. The supply of labor decreases because at each real wage rate, the after-tax wage rate received by workers will be lower given an increase in the tax rate on labor income.

1b. The demand for labor will remain the same. The demand for labor depends on the productivity of labor, which remains the same following the increase in the tax rate on labor income.

1c. The equilibrium level of employment will decrease. With the rightward shift in the supply of labor curve, the real wage rate rises, and the quantity of labor demanded decreases along the demand for labor curve. Equilibrium employment decreases.

1d. The equilibrium pre-tax wage rate will increase. The leftward shift of the supply of labor curve leads to movement up along the demand for labor curve.

1e. The equilibrium after-tax wage rate will decrease. The increase in the tax rate on labor income increases the wedge between the pre-tax wage rate and the after-tax wage rate. The pre-tax wage rate increases but not by as much as the increase in tax. So the after-tax wage rate will decrease.

1f. Potential GDP will decrease. The equilibrium level of employment is the full employment. So as full employment decreases, potential GDP decreases along the production function.

1g. The cross-country evidence for the United States, the United Kingdom, and France on marginal income tax rates and employment suggests that tax rates on labor income have a significant effect on the labor market.

3a. Tax revenue is equal to $1,200 billion.

From the circular flow, we know that $I = S + T - G + M - X$.

Re-arranging the equation gives $T = I - S + G - M + X$, which equals $1,200 billion.

3b. The government budget balance is $T - G$, which equals \$1,200 billion − \$1,500 billion or −\$300 billion or, equivalently, the government budget deficit is \$300 billion.

3c. It is exerting a negative influence on investment by decreasing saving supply, which drives up the real interest rate and crowds out investment.

3d. A decrease in the budget deficit by increasing taxes or decreasing government purchases would increase saving supply, which would lower the real interest rate and increase investment. The increase in investment would increase economic growth.

5a. The increase in government expenditures by \$100 billion decreases saving supply, which drives up the real interest rate and crowds out investment.

5b. The stronger the Ricardo-Barro effect, the less the decrease in saving supply as taxpayers increase saving to be able to pay the higher future taxes that will be needed to pay back the principle and interest on the bonds used to finance the current government expenditures.

7a. Given a positive rate of inflation, the true tax rate on capital income would fall because the part of the capital income that is received in compensation for inflation is no longer taxed.

7b. With a lower tax rate on capital income, saving supply would increase as the after-tax real rate of return would increase.

7c. Investment demand would remain the same because it depends on how productive capital is and the productivity of capital does not necessarily change when the tax code changes.

7d. The increase in saving supply, represented by a rightward shift in the saving supply curve, leads to a lower equilibrium real interest rate and a higher equilibrium amount of investment.

9a. Fiscal policy that increases spending or decreases taxes would boost aggregate demand. In terms of automatic fiscal policy, needs-tested spending increases in recessions and induced taxes fall. Congress may also use discretionary policy by passing a new spending bill or a cut in tax rates.

9b. An increase in government purchases with an offsetting increase in taxes would not bring a budget deficit but would increase aggregate demand due to the direct increase in the government purchases component of aggregate expenditure.

9c. The risk of discretionary policy is that, because of time lags, it takes effect too late and ends up moving the economy away from potential GDP.

11a. We know that at least some of the budget deficit in a recession reflects a cyclical deficit as needs-tested spending is higher and induced taxes are lower than at potential GDP. However, some of the budget deficit might be a structural deficit. The structural deficit is the deficit that would exit if real GDP equaled potential GDP and the economy were at full employment.

11b. We know that automatic stabilizers are increasing aggregate demand relative to what it would be otherwise in a recession. That is, aggregate demand decreases in a recession, but it would decrease by more without the increase in needs-tested spending and the decrease in induced taxes that produce the cyclical deficit.

11c. A discretionary increase in government purchases, if not reversed following the end of the recession, will generate a structural deficit unless there was already a larger structural surplus, in which case the increase in government purchases would lower the structural surplus.

CHAPTER 32

1a. Real GDP is \$7 trillion and the price level is 110.

These values are determined at the intersection of AD_0 and SAS_0.

1b. Real GDP falls to \$6 trillion and the price level falls to 105. Then, as aggregate demand returns to AD_0 the price level and real GDP return to their initial levels.

1c. Real GDP falls to \$6 trillion and the price level falls to 105. The Fed increases the quantity of money to boost aggregate demand to AD_0 and the price level and real GDP return to their initial levels. Aggregate demand then increases (because the decrease is temporary), and real GDP rises above potential GDP. An inflationary gap arises. The money wage rate rises and so does the price level. Real GDP moves back toward potential GDP.

1d. Real GDP falls to \$6 trillion, and the price level falls to 105. The economy is stuck at this point until the money wage rate falls, short-run aggregate supply increases, and the economy moves back to potential GDP at an even lower price level. This move will likely take a long time.

1e. Real GDP falls to \$6 trillion, and the price level falls to 105. The Fed increases the quantity of money to boost aggregate demand to AD_0 and the price level and real GDP return to their initial levels. Because the decrease in aggregate demand is permanent, this is the end of the action.

3a. The economy might have gotten into its described state because of a combination of rapid growth of the quantity of money (which brings inflation) and large structural changes (which bring high unemployment and slow productivity growth).

3b. A slowdown in money growth will lower the inflation rate. With a lower inflation rate, inflation will be more predictable. Price level stability might have an indirect positive impact on potential GDP growth by creating a climate that favors a high rate of saving and investment. The Fed is more constrained in its ability to lower unemployment. If the unemployment rate is higher than the natural rate of unemployment, the Fed will face a tradeoff between lowering inflation or lowering unemployment. If the unemployment is at its natural rate, the Fed will be unable to lower unemployment permanently and can only lower it temporarily by pursuing policy that increases inflation.

3c. Lowering the money growth rate lowers the inflation rate by decreasing the speed at which aggregate demand expands over time. Following the quantity theory of money, the lower growth rate corresponds to a lower rate of inflation. The short-run tradeoff between inflation and unemployment is represented by the short-run Phillips curve.

5a. These policy actions were part of a feedback rule. The actions were taken because of the crises.

5b. The required domestic policies all decrease aggregate demand. They lower real GDP and lower the price level (compared with what would have happened).

5c. A possible criticism, and one that some economists have made, is that the countries should have adopted policies to expand real GDP even at the risk of a rise in inflation, rather than adopt policies that decrease aggregate demand.

7a. Anything that slows investment in physical or human capital or slows the pace of technological change will create a productivity growth slowdown. The U.S. productivity growth slowdown of the 1970s corresponded to a slowdown in the pace of technological change.

7b. Monetary policy does not have a direct effect on the growth of potential GDP. Monetary policy can only indirectly help economic growth by pursuing price level stability, which creates a climate that favors a high rate of saving and investment.

CHAPTER 33

1a. 0.10 computer per TV set at 10 TV sets.

1b. 0.40 computer per TV set at 40 TV sets.

1c. 0.70 computer per TV set at 70 TV sets.

1d. The graph shows an upward-sloping line that passes through the three points described in solutions 1a, 1b, and 1c.

The opportunity cost of a TV set is calculated as the decrease in the number of computers produced divided by the increase in the number of TV sets produced as we move along the *PPF*. The opportunity cost of a TV set increases as the quantity of TV sets produced increases.

3a. Virtual Reality exports TV sets to Vital Signs.

At the no-trade production levels, the opportunity cost of a TV set is 0.10 computer in Virtual Reality and 0.30 computer in Vital Signs. Because it costs less to produce a TV set in Virtual Reality, Vital Signs can import TV sets for a lower price that it can produce them. And because a computer costs less in Vital Signs than in Virtual Reality, Virtual Reality can import computers at a lower cost than it can produce them.

3b. Virtual Reality increases the production of TV sets and Vital Signs decreases the production of TV sets. Virtual Reality decreases the production of computers and Vital Signs increases the production of computers.

Virtual Reality increases production of TV sets to export some to Vital Signs and Vital Signs decreases production of TV sets because it now imports some from Virtual Reality.

3c. Each country consumes more of at least one good and possibly of both goods.

Because each country has a lower opportunity cost than the other at producing one of the goods, total production of both goods can increase.

3d. The price of a TV set is greater than 0.10 computer and less than 0.30 computer.

The price will be higher than the no-trade opportunity cost in Virtual Reality (0.10 computer) and lower than the no-trade opportunity cost in Vital Signs (0.30 computer).

5a. Free trade increases the production of at least one good (but not necessarily both goods) in both cases because each country increases the production of the good at which it has a comparative advantage.

5b. In problem 3, the price of a TV set rises in Virtual Reality. In problem 4, it falls.

The reason is that in problem 3, Virtual Reality produces a small number of TV sets with no trade and has the lower opportunity cost per TV set. But in problem 4, Virtual Reality produces a large number of TV sets with no trade and has the higher opportunity cost per TV set. So in problem 3, Virtual Reality becomes an exporter and increases production. The price of a TV set rises. In problem 4, Virtual Reality becomes an importer and decreases production. The price of a TV set falls.

5c. In problem 3, the price of a computer rises in Vital Signs. In problem 4, it falls.

The reason is that in problem 3, Vital Signs produces a small number of computers with no trade and has the lower opportunity cost per computer. But in problem 4, Vital Signs produces a large number of computers with no trade and has the higher opportunity cost per computer. So in problem 3, Vital Signs becomes an exporter of computers and increases production. The price of a computer rises. In problem 4, Vital Signs becomes an importer of computers and decreases production. The price of a computer falls.

7a. $9 per bushel in the importing country and $1 per bushel in the exporting country.

These are the prices at which each country wishes to import and export a zero quantity.

7b. $5 per bushel.

This is the price at which the quantity demanded by the importer equals the quantity supplied by the exporter.

7c. 400 million bushels.

This is the quantity demanded and supplied at the equilibrium price.

7d. Zero.

The balance of trade is zero because the value imported equals the value exported.

9a. $6 per bushel.

The quantity demanded by the importer equals the quantity available under the quota of 300 million bushels at this price.

9b. $600 million.

The price at which the exporters are willing to sell 300 million bushels is $4 a bushel. So there is a profit of $2 a bushel. The total revenue from the quota is 300 million multiplied by $2.

9c. The importing agents to whom the quota is allocated.

CHAPTER 34

1a. A table like Table 34.1 on p. 810 with the numbers provided in the problem.

The current account shows Imports of goods and services −350 billions of grains, Exports of goods and services,

500 billions of grains, Net interest income, unknown, and Net transfers, unknown. You cannot calculate the current account balance from these numbers because of the two unknown items.

The capital account shows Foreign investment in Silecon, 60 billions of grains, Silecon investment abroad, −200 billions of grains, and a capital account balance of −140 billions of grains (a deficit).

The official settlements account balance is −10 billions of grains (minus because it is an increase).

Because the sum of the three balances is zero, you can now calculate the current account balance, 150 billions of grains, a surplus. Exports of goods and services minus imports of goods and services equal 150 billions of grains. So the sum of Net interest income and Net transfers is zero, but we don't know the values of these two items separately.

1b. The Silecon central bank intervenes in the foreign exchange market.

We know that the central bank intervenes in the foreign exchange market because its official reserves changed.

3a. Net exports are −$20 million.

Use the fact that

$$Y = C + I + G + NX$$

and solve for NX as

$$NX = Y - C - I - G,$$

which equals

$$NX = 120 - 72 - 40 - 28 = -20.$$

3b. Saving is $24 million.

Use the fact that

$$Y = C + S + NT$$

and solve for S as

$$S = Y - C - NT,$$

which equals

$$S = 120 - 72 - 24 = 24.$$

3c. National saving and foreign borrowing finance investment.

$$I = S + NT - G - NX,$$

which equals

$$I = 24 + 24 - 28 - (-20) = 40.$$

5a. Imports of goods and services are 26 billion bands.

Use the fact that

$$Y = C + I + G + X - M$$

and solve for M as

$$M = -Y + C + I + G + X,$$

which is

$$M = -100 + 60 + 22 + 24 + 20$$

$$M = 26.$$

5b. The current account balance is – 6 billion bands (assuming that net interest income plus net transfers is zero).

Use the fact that

$$CAB = X - M$$

$$CAB = 20 - 26 = -6.$$

5c. The capital account balance is unknown.

The sum of the current account, capital account, and official settlements account is zero. The capital account balance cannot be calculated unless information is given about the official settlements account.

5d. Net taxes are 20 billion bands.

Use the fact that

$$\text{Gov. budget deficit} = G - NT,$$

so

$$NT = G - \text{Gov. budget deficit},$$

which is

$$NT = 24 - 4 = 20.$$

5e. The private sector balance is –2 billion bands (a deficit).

Use the fact that

$$\text{Private sector surplus} = S - I,$$

with

$$S = Y - C - NT,$$

or

$$\text{Private sector surplus} = Y - C - NT - I,$$

which is

$$\text{Private sector surplus} = 100 - 60 - 20 - 22$$

$$\text{Private sector surplus} = -2.$$

7a. The central bank intervenes in the foreign exchange market to limit upward movement of the exchange rate but not strongly enough to prevent some appreciation.

7b. Nothing. The current account is financed by the capital account and the official settlements account and without information about the capital account balance, we can't tell whether the current account is in surplus or deficit.

7c. The official settlements account balance is negative—an increase in reserves is like investing in other country's assets.