ANSWERS

1 The Market

1.1. It would be constant at \$500 for 25 apartments and then drop to \$200.

1.2. In the first case, \$500, and in the second case, \$200. In the third case, the equilibrium price would be any price between \$200 and \$500.

1.3. Because if we want to rent one more apartment, we have to offer a lower price. The number of people who have reservation prices greater than p must always increase as p decreases.

1.4. The price of apartments in the inner ring would go up since demand for apartments would not change but supply would decrease.

1.5. The price of apartments in the inner ring would rise.

1.6. A tax would undoubtedly reduce the number of apartments supplied in the long run.

1.7. He would set a price of 25 and rent 50 apartments. In the second case he would rent all 40 apartments at the maximum price the market would bear. This would be given by the solution to $D(p) = 100 - 2p = 40$, which is $p^* = 30$.

1.8. Everyone who had a reservation price higher than the equilibrium price in the competitive market, so that the final outcome would be Pareto efficient. (Of course in the long run there would probably be fewer new apartments built, which would lead to another kind of inefficiency.)

2 Budget Constraint

2.1. The new budget line is given by $2p_1x_1 + 8p_2x_2 = 4m$.

2.2. The vertical intercept (x_2 axis) decreases and the horizontal intercept (x_1 axis) stays the same. Thus the budget line becomes flatter.

2.3. Flatter. The slope is $-2p_1/3p_2$.

2.4. A good whose price has been set to 1; all other goods' prices are measured relative to the numeraire good's price.

2.5. A tax of 8 cents a gallon.

2.6. $(p_1 + t)x_1 + (p_2 - s)x_2 = m - u$.

2.7. Yes, since all of the bundles the consumer could afford before are affordable at the new prices and income.

3 Preferences

3.1. No. It might be that the consumer was indifferent between the two bundles. All we are justified in concluding is that $(x_1, x_2) \succeq (y_1, y_2)$.

3.2. Yes to both.

3.3. It is transitive, but it is not complete—two people might be the same height. It is not reflexive since it is false that a person is strictly taller than himself.

3.4. It is transitive, but not complete. What if A were bigger but slower than B? Which one would he prefer?

3.5. Yes. An indifference curve can cross itself, it just can't cross another distinct indifference curve.

3.6. No, because there are bundles on the indifference curve that have strictly more of both goods than other bundles on the (alleged) indifference curve.

3.7. A negative slope. If you give the consumer more anchovies, you've made him worse off, so you have to take away some pepperoni to get him back on his indifference curve. In this case the direction of increasing utility is *toward* the origin.

3.8. Because the consumer weakly prefers the weighted average of two bundles to either bundle.

3.9. If you give up one \$5 bill, how many \$1 bills do you need to compensate you? Five \$1 bills will do nicely. Hence the answer is -5 or $-1/5$, depending on which good you put on the horizontal axis.

3.10. Zero—if you take away some of good 1, the consumer needs zero units of good 2 to compensate him for his loss.

3.11. Anchovies and peanut butter, scotch and Kool Aid, and other similar repulsive combinations.

4 Utility

4.1. The function $f(u) = u^2$ is a monotonic transformation for positive u, but not for negative u.

4.2. (1) Yes. (2) No (works for v positive). (3) No (works for v negative). (4) Yes (only defined for v positive). (5) Yes. (6) No. (7) Yes. (8) No.

4.3. Suppose that the diagonal intersected a given indifference curve at two points, say (x, x) and (y, y). Then either $x > y$ or $y > x$, which means that one of the bundles has more of *both* goods. But if preferences are monotonic, then one of the bundles would have to be preferred to the other.

4.4. Both represent perfect substitutes.

4.5. Quasilinear preferences. Yes.

4.6. The utility function represents Cobb-Douglas preferences. No. Yes.

4.7. Because the MRS is measured *along* an indifference curve, and utility remains constant along an indifference curve.

5 Choice

5.1. $x_2 = 0$ when $p_2 > p_1$, $x_2 = m/p_2$ when $p_2 < p_1$, and anything between 0 and m/p_2 when $p_1 = p_2$.

5.2. The optimal choices will be $x_1 = m/p_1$ and $x_2 = 0$ if $p_1/p_2 < b$, $x_1 = 0$ and $x_2 = m/p_2$ if $p_1/p_2 > b$, and any amount on the budget line if $p_1/p_2 = b$.

5.3. Let z be the number of cups of coffee the consumer buys. Then we know that $2z$ is the number of teaspoons of sugar he or she buys. We must satisfy the budget constraint

$$2p_1 z + p_2 z = m.$$

Solving for z we have

$$z = \frac{m}{2p_1 + p_2}.$$

5.4. We know that you'll either consume all ice cream or all olives. Thus the two choices for the optimal consumption bundles will be $x_1 = m/p_1$, $x_2 = 0$, or $x_1 = 0$, $x_2 = m/p_2$.

5.5. This is a Cobb-Douglas utility function, so she will spend $4/(1+4) = 4/5$ of her income on good 2.

5.6. For kinked preferences, such as perfect complements, where the change in price doesn't induce any change in demand.

6 Demand

6.1. No. If her income increases, and she spends it all, she must be purchasing more of at least one good.

6.2. The utility function for perfect substitutes is $u(x_1, x_2) = x_1 + x_2$. Thus if $u(x_1, x_2) > u(y_1, y_2)$, we have $x_1 + x_2 > y_1 + y_2$. It follows that $tx_1 + tx_2 > ty_1 + ty_2$, so that $u(tx_1, tx_2) > u(ty_1, ty_2)$.

6.3. The Cobb-Douglas utility function has the property that

$$u(tx_1, tx_2) = (tx_1)^a (tx_2)^{1-a} = t^a t^{1-a} x_1^a x_2^{1-a} = t x_1^a x_2^{1-a} = t u(x_1, x_2).$$

Thus if $u(x_1, x_2) > u(y_1, y_2)$, we know that $u(tx_1, tx_2) > u(ty_1, ty_2)$, so that Cobb-Douglas preferences are indeed homothetic.

6.4. The demand curve.

6.5. No. Concave preferences can only give rise to optimal consumption bundles that involve zero consumption of one of the goods.

6.6. Normally they would be complements, at least for non-vegetarians.

6.7. We know that $x_1 = m/(p_1 + p_2)$. Solving for p_1 as a function of the other variables, we have

$$p_1 = \frac{m}{x_1} - p_2.$$

6.8. False.

7 Revealed Preference

7.1. No. This consumer violates the Weak Axiom of Revealed Preference since when he bought (x_1, x_2) he could have bought (y_1, y_2) and vice versa. In symbols:

$$p_1 x_1 + p_2 x_2 = 1 \times 1 + 2 \times 2 = 5 > 4 = 1 \times 2 + 2 \times 1 = p_1 y_1 + p_2 y_2$$

and

$$q_1y_1 + q_2y_2 = 2 \times 2 + 1 \times 1 = 5 > 4 = 2 \times 1 + 1 \times 2 = q_1x_1 + q_2x_2.$$

7.2. Yes. No violations of WARP are present, since the y-bundle is not affordable when the x-bundle was purchased and vice versa.

7.3. Since the y-bundle was more expensive than the x-bundle when the x-bundle was purchased and vice versa, there is no way to tell which bundle is preferred.

7.4. If both prices changed by the same amount. Then the base-year bundle would still be optimal.

7.5. Perfect complements.

8 Slutsky Equation

8.1. Yes. To see this, use our favorite example of red pencils and blue pencils. Suppose red pencils cost 10 cents a piece, and blue pencils cost 5 cents a piece, and the consumer spends \$1 on pencils. She would then consume 20 blue pencils. If the price of blue pencils falls to 4 cents a piece. she would consume 25 blue pencils, a change which is entirely due to the income effect.

8.2. Yes.

8.3. Then the income effect would cancel out. All that would be left would be the pure substitution effect, which would automatically be negative.

8.4. They are receiving tx' in revenues and paying out tx, so they are losing money.

8.5. Since their old consumption is affordable, the consumers would have to be at least as well-off. This happens because the government is giving them back *more* money than they are losing due to the higher price of gasoline.

9 Buying and Selling

9.1. Her gross demands are $(9, 1)$.

9.2. The bundle $(y_1, y_2) = (3, 5)$ costs more than the bundle $(4, 4)$ at the current prices. The consumer will not necessarily prefer consuming this

bundle, but would certainly prefer to own it, since she could sell it and purchase a bundle that she would prefer.

9.3. Sure. It depends on whether she was a net buyer or a net seller of the good that became more expensive.

9.4. Yes, but only if the U.S. switched to being a net exporter of oil.

9.5. The new budget line would shift outward and remain parallel to the old one, since the increase in the number of hours in the day is a pure endowment effect.

9.6. The slope will be positive.

10 Intertemporal Choice

10.1. According to Table 10.1, \$1 20 years from now is worth 3 cents today at a 20 percent interest rate. Thus \$1 million is worth $.03 \times 1,000,000 = \$30,000$ today.

10.2. The slope of the intertemporal budget constraint is equal to $-(1+r)$. Thus as r increases the slope becomes more negative (steeper).

10.3. If goods are perfect substitutes, then consumers will only purchase the cheaper good. In the case of intertemporal food purchases, this implies that consumers only buy food in one period, which may not be very realistic.

10.4. In order to remain a lender after the change in interest rates, the consumer must be choosing a point that he could have chosen under the old interest rates, but decided not to. Thus the consumer must be worse off. If the consumer becomes a borrower after the change, then he is choosing a previously unavailable point that cannot be compared to the initial point (since the initial point is no longer available under the new budget constraint), and therefore the change in the consumer's welfare is unknown.

10.5. At an interest rate of 10%, the present value of \$100 is \$90.91. At a rate of 5% the present value is \$95.24.

11 Asset Markets

11.1. Asset A must be selling for $11/(1 + .10) = \$10$.

11.2. The rate of return is equal to $(10,000 + 10,000)/100,000 = 20\%$.

11.3. We know that the rate of return on the nontaxable bonds, r, must be such that $(1-t)r_t = r$, *therefore* $(1-.40).10 = .06 = r$.

11.4. The price today must be $40/(1+.10)^{10} = \$15.42$.

12 Uncertainty

12.1. We need a way to reduce consumption in the bad state and increase consumption in the good state. To do this you would have to *sell* insurance against the loss rather than buy it.

12.2. Functions (a) and (c) have the expected utility property (they are affine transformations of the functions discussed in the chapter), while (b) does not.

12.3. Since he is risk-averse, he prefers the expected value of the gamble, \$325, to the gamble itself, and therefore he would take the payment.

12.4. If the payment is \$320 the decision will depend on the form of the utility function; we can't say anything in general.

12.5. Your picture should show a function that is initially convex, but then becomes concave.

12.6. In order to self-insure, the risks must be independent. However, this does not hold in the case of flood damage. If one house in the neighborhood is damaged by a flood it is likely that all of the houses will be damaged.

13 Risky Assets

13.1. To achieve a standard deviation of 2% you will need to invest $x = \sigma_x/\sigma_m = 2/3$ of your wealth in the risky asset. This will result in a rate of return equal to $(2/3).09 + (1-2/3).06 = 8\%$.

13.2. The price of risk is equal to $(r_m - r_f)/\sigma_m = (9-6)/3 = 1$. That is, for every additional percent of standard deviation you can gain 1% of return.

13.3. According to the CAPM pricing equation, the stock should offer an expected rate of return of $r_f + \beta(r_m - r_f) = .05 + 1.5(.10 - .05) = .125$ or 12.5%. The stock should be selling for its expected present value, which is equal to $100/1.125 = \$88.89$.

14 Consumer's Surplus

14.1. The equilibrium price is \$10 and the quantity sold is 100 units. If the tax is imposed, the price rises to \$11, but 100 units of the good will still be sold, so there is no deadweight loss.

14.2. We want to compute the area under the demand curve to the left of the quantity 6. Break this up into the area of a triangle with a base of 6 and a height of 6 and a rectangle with base 6 and height 4. Applying the formulas from high school geometry, the triangle has area 18 and the rectangle has area 24. Thus gross benefit is 42.

14.3. When the price is 4, the consumer's surplus is given by the area of a triangle with a base of 6 and a height of 6; i.e., the consumer's surplus is 18. When the price is 6, the triangle has a base of 4 and a height of 4, giving an area of 8. Thus the price change has reduced consumer's surplus by \$10.

14.4. Ten dollars. Since the demand for the discrete good hasn't changed, all that has happend is that the consumer has had to reduce his expenditure on other goods by ten dollars.

15 Market Demand

15.1. The inverse demand curve is $P(q) = 200 - 2q$.

15.2. The decision about whether to consume the drug at all could well be price sensitive, so the adjustment of market demand on the extensive margin would contribute to the elasticity of the market demand.

15.3. Revenue is $R(p) = 12p - 2p^2$, which is maximized at $p = 3$.

15.4. Revenue is $pD(p) = 100$, regardless of the price, so all prices maximize revenue.

15.5. True. The weighted average of the income elasticities must be 1, so if one good has a *negative* income elasticity, the other good must have an elasticity *greater* than 1 to get the average to be 1.

16 Equilibrium

16.1. The entire subsidy gets passed along to the consumers if the supply curve is flat, but the subsidy is totally received by the producers when the supply curve is vertical.

16.2. The consumer.

16.3. In this case the demand curve for red pencils is horizontal at the price p_b, since that is the most that they would be willing to pay for a red pencil. Thus, if a tax is imposed on red pencils, consumers will end up paying p_b for them, so the entire amount of the tax will end up being borne by the producers (if any red pencils are sold at all—it could be that the tax would induce the producer to get out of the red pencil business).

16.4. Here the supply curve of foreign oil is flat at \$25. Thus the price to the consumers must rise by the \$5 amount of the tax, so that the net price to the consumers becomes \$30. Since foreign oil and domestic oil are perfect substitutes as far as the consumers are concerned, the domestic producers will sell their oil for \$30 as well and get a windfall gain of \$5 per barrel.

16.5. Zero. The deadweight loss measures the value of lost output. Since the same amount is supplied before and after the tax, there is no deadweight loss. Put another way: the suppliers are paying the entire amount of the tax, and everything they pay goes to the government. The amount that the suppliers would pay to avoid the tax is simply the tax revenue the government receives, so there is no excess burden of the tax.

16.6. Zero revenue.

16.7. It raises negative revenue, since in this case we have a net subsidy of borrowing.

17 Auctions

17.1. Since the collectors likely have their own values for the quilts, and don't particularly care about the other bidders' values, it is a private-value auction.

17.2. Following the analysis in the text, there are four equally likely configurations of bidders: (8,8), (8,10), (10,8), and (10,10). With zero reservation price, the optimal bids will be (8,9,9,10), resulting in expected profit of \$9. The only candidate for a reservation price is \$10, which yields expected profit of $30/4 = \$7.50$. Hence zero is a profit-maximizing reservation price in this auction.

17.3. Have each person write down a value, then award the two books to the students with the two highest values, but just charge them the bid of the third highest student.

17.4. It was efficient in the sense that it awarded the license to the firm that valued it most highly. But it took a year for this to happen, which is inefficient. A Vickrey auction or an English auction would have achieved the same result more quickly.

17.5. This is a common-value auction since the value of the prize is the same to all bidders. Normally, the winning bidder overestimates the number of pennies in the jar, illustrating the winner's curse.

18 Technology

18.1. Increasing returns to scale.

18.2. Decreasing returns to scale.

18.3. If $a + b = 1$, we have constant returns to scale, $a + b < 1$ gives decreasing returns to scale, and $a + b > 1$ gives increasing returns to scale.

18.4. $4 \times 3 = 12$ units.

18.5. True.

18.6. Yes.

19 Profit Maximization

19.1. Profits will decrease.

19.2. Profit would increase, since output would go up more than the cost of the inputs.

19.3. If the firm really had decreasing returns to scale, dividing the scale of all inputs by 2 would produce more than half as much output. Thus the subdivided firm would make more profits than the big firm. This is one argument why having everywhere decreasing returns to scale is implausible.

19.4. The gardener has ignored opportunity costs. In order to accurately account for the true costs, the gardener must include the cost of her own time used in the production of the crop, even if no explicit wage was paid.

19.5. Not in general. For example, consider the case of uncertainty.

19.6. Increase.

19.7. The use of x_1 does not change, and profits will increase.

19.8. May not.

20 Cost Minimization

20.1. Since profit is equal to total revenue minus total costs, if a firm is not minimizing costs then there exists a way for the firm to increase profits; however, this contradicts the fact that the firm is a profit maximizer.

20.2. Increase the use of factor 1 and decrease the use of factor 2.

20.3. Since the inputs are identically priced perfect substitutes, the firm will be indifferent between which of the inputs it uses. Thus the firm will use any amounts of the two inputs such that $x_1 + x_2 = y$.

20.4. The demand for paper either goes down or stays constant.

20.5. It implies that $\sum_{i=1}^{n} \Delta w_i \Delta x_i \leq 0$, where $\Delta w_i = w_i^t - w_i^s$ and $\Delta x_i = x_i^t - x_i^s$.

21 Cost Curves

21.1. True, true, false.

21.2. By simultaneously producing more output at the second plant and reducing production at the first plant, the firm can reduce costs.

21.3. False.

22 Firm Supply

22.1. The inverse supply curve is $p = 20y$, so the supply curve is $y = p/20$.

22.2. Set $AC = MC$ to find $10y + 1000/y = 20y$. Solve to get $y^* = 10$.

22.3. Solve for p to get $P_s(y) = (y - 100)/20$.

22.4. At 10 the supply is 40 and at 20 the supply is 80. The producer's surplus is composed of a rectangle of area 10×40 plus a triangle of area $\frac{1}{2} \times 10 \times 40$, which gives a total change in producer's surplus of 600. This is the same as the change in profits, since the fixed costs don't change.

22.5. The supply curve is given by $y = p/2$ for all $p \geq 2$, and $y = 0$ for all $p \leq 2$. At $p = 2$ the firm is indifferent between supplying 1 unit of output or not supplying it.

22.6. Mostly technical (in more advanced models this could be market), market, could be either market or technical, technical.

22.7. That all firms in the industry take the market price as given.

22.8. The market price. A profit-maximizing firm will set its output such that the marginal cost of producing the last unit of output is equal to its marginal revenue, which in the case of pure competition is equal to the market price.

22.9. The firm should produce zero output (with or without fixed costs).

22.10. In the short run, if the market price is greater than the average variable cost, a firm should produce some output even though it is losing money. This is true because the firm would have lost more had it not produced since it must still pay fixed costs. However, in the long run there are no fixed costs, and therefore any firm that is losing money can produce zero output and lose a maximum of zero dollars.

22.11. The market price must be equal to the marginal cost of production for all firms in the industry.

23 Industry Supply

23.1. The inverse supply curves are $P_1(y_1) = 10 + y_1$ and $P_2(y_2) = 15 + y_2$. When the price is below 10 neither firm supplies output. When the price is 15 firm 2 will enter the market, and at any price above 15, both firms are in the market. Thus the kink occurs at a price of 15.

23.2. In the short run, the consumers pay the entire amount of the tax. In the long run it is paid by the producers.

23.3. False. A better statement would be: convenience stores can charge high prices because they are near the campus. Because of the high prices the stores are able to charge, the landowners can in turn charge high rents for the use of the convenient location.

23.4. True.

23.5. The profits or losses of the firms that are currently operating in the industry.

23.6. Flatter.

23.7. No, it does not violate the model. In accounting for the costs we failed to value the rent on the license.

24 Monopoly

24.1. No. A profit-maximizing monopolist would never operate where the demand for its product was inelastic.

24.2. First solve for the inverse demand curve to get $p(y) = 50 - y/2$. Thus the marginal revenue is given by $MR(y) = 50 - y$. Set this equal to marginal cost of 2, and solve to get $y = 48$. To determine the price, substitute into the inverse demand function, $p(48) = 50 - 48/2 = 26$.

24.3. The demand curve has a constant elasticity of -3. Using the formula $p[1 + 1/\epsilon] = MC$, we substitute to get $p[1 - 1/3] = 2$. Solving, we get $p = 3$. Substitute back into the demand function to get the quantity produced: $D(3) = 10 \times 3^{-3}$.

24.4. The demand curve has a constant elasticity of -1. Thus marginal revenue is zero for all levels of output. Hence it can never be equal to marginal cost.

24.5. For a linear demand curve the price rises by half the change in cost. In this case, the answer is \$3.

24.6. In this case $p = kMC$, where $k = 1/(1 - 1/3) = 3/2$. Thus the price rises by \$9.

24.7. Price will be two times marginal cost.

24.8. A subsidy of 50 percent, so the marginal costs facing the monopolist are half the actual marginal costs. This will ensure that price equals marginal cost at the monopolist's choice of output.

24.9. A monopolist operates where $p(y) + y\Delta p/\Delta y = MC(y)$. Rearranging, we have $p(y) = MC(y) - y\Delta p/\Delta y$. Since demand curves have a negative slope, we know that $\Delta p/\Delta y < 0$, which proves that $p(y) > MC(y)$.

24.10. False. Imposing a tax on a monopolist may cause the market price to rise more than, the same as, or less than the amount of the tax.

24.11. A number of problems arise, including: determining the true marginal costs for the firm, making sure that all customers will be served, and ensuring that the monopolist will not make a loss at the new price and output level.

24.12. Some appropriate conditions are: large fixed costs and small marginal costs, large minimum efficient scale relative to the market, ease of collusion, etc.

25 Monopoly Behavior

25.1. Yes, if it can perfectly price discriminate.

25.2. $p_i = \epsilon_i c/(1+\epsilon_i)$ for $i = 1, 2$.

25.3. If he can perfectly price discriminate, he can extract the entire consumers' surplus; if he can charge for admission, he can do the same. Hence, the monopolist does equally well under either pricing policy. (In practice, it is much easier to charge for admission than to charge a different price for every ride.)

25.4. This is third-degree price discrimination. Apparently the Disneyland administrators believe that residents of Southern California have more elastic demands than other visitors to their park.

26 Factor Markets

26.1. Sure. A monopsonist can produce at any level of supply elasticity.

26.2. Since the demand for labor would exceed the supply at such a wage, we would presumably see unemployment.

26.3. We find the equilibrium prices by substituting into the demand functions. Since $p = a - by$, we can use the solution for y to find

$$p = \frac{3a + c}{4}.$$

Since $k = a - 2bx$, we can use the solution for x to find

$$k = \frac{a + c}{2}.$$

27 Oligopoly

27.1. In equilibrium each firm will produce $(a-c)/3b$, so the total industry output is $2(a-c)/3b$.

27.2. Nothing. Since all firms have the same marginal cost, it doesn't matter which of them produces the output.

27.3. No, because one of the choices open to the Stackelberg leader is to choose the level of output it would have in the Cournot equilibrium. So it always has to be able to do at least this well.

27.4. We know from the text that we must have $p[1 - 1/n|\epsilon|] = MC$. Since $MC > 0$, and $p > 0$, we must have $1 - 1/n|\epsilon| > 0$. Rearranging this inequality gives the result.

27.5. Make $f_2(y_1)$ steeper than $f_1(y_2)$.

27.6. In general, no. Only in the case of the Bertrand solution does price equal the marginal cost.

28 Game Theory

28.1. The second player will defect in response to the first player's (mistaken) defection. But then the first player will defect in response to that, and each player will continue to defect in response to the other's defection! This example shows that tit-for-tat may not be a very good strategy when players can make mistakes in either their actions or their perceptions of the other player's actions.

28.2. Yes and no. A player prefers to play a dominant strategy regardless of the strategy of the opponent (even if the opponent plays her own dominant strategy). Thus, if all of the players are using dominant strategies then it is the case that they are all playing a strategy that is optimal given the strategy of their opponents, and therefore a Nash equilibrium exists. However, not all Nash equilibria are dominant strategy equilibria; for example, see Table 28.2.

28.3. Not necessarily. We know that your Nash equilibrium strategy is the best thing for you to do as long as your opponent is playing her Nash equilibrium strategy, but if she is not then perhaps there is a better strategy for you to pursue.

28.4. Formally, if the prisoners are allowed to retaliate the payoffs in the game may change. This could result in a Pareto efficient outcome for the game (for example, think of the case where the prisoners both agree that they will kill anyone who confesses, and assume death has a very low utility).

28.5. The dominant Nash equilibrium strategy is to defect in every round. This strategy is derived via the same backward induction process that was used to derive the finite 10-round case. The experimental evidence using

much smaller time periods seems to indicate that players rarely use this strategy.

28.6. The equilibrium has player B choosing left and player A choosing top. Player B prefers to move first since that results in a payoff of 9 versus a payoff of 1. (Note, however, that moving first is not always advantageous in a sequential game. Can you think of an example?)

29 Game Applications

29.1. In a Nash equilibrium, each player is making a best response to the other player's best response. In a dominant strategy equilibrium, each player's choice is a best response to any choice the other player makes.

29.2. No, because when $r = 1/3$ there is an infinity of best responses, not a single one, as is required for the mathematical definition of a function.

29.3. Not necessarily; it depends on the payoffs of the game. In chicken if both choose to drive straight they receive the worst payoff.

29.4. It is row's expected payoff in the equilibrium strategy of kicking to the left with probability .7, while column jumps to the left with probability .6. We have to sum the payoffs to row over four events: the probability row kicks left and column defends left $\times$ row's payoff in this case + probability row kicks right and column defends left $\times$ row's payoff in this case, and so on. The numbers are $(.7)(.6)50 + (.7)(.4)80 + (.3)(.6)90 + (.3)(.4)20 = 62$.

29.5. He means that he will bid low in order to get the contract, but then charge high prices subsequently for any changes. The client has to go along, since it is costly for him to switch in the middle of a job.

30 Behavioral Economics

30.1. The first group is more likely to buy, due to the "framing effect."

30.2. The "bracketing effect" makes it likely that the meals chosen by Mary will have more variety.

30.3. From the viewpoint of classical consumer theory, more choice is better. But it is certainly possible that too much choice could confuse the employees, so 10 might be a safer choice. If you did decide to offer 50 mutual funds, it would be a good idea to group them into a relatively small number of categories.

30.4. The probability of heads coming up 3 times in a row is $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8} = .125$. The probability of tails coming up in a row is also .125, so the probability of a run of 3 heads or tails is .25.

30.5. It is called "time inconsistency."

31 Exchange

31.1. Yes. For example, consider the allocation where one person has everything. Then the other person is worse off at this allocation than he would be at an allocation where he had something.

31.2. No. For this would mean that at the allegedly Pareto efficient allocation there is some way to make everyone better off, contradicting the assumption of Pareto efficiency.

31.3. If we know the contract curve, then any trading should end up somewhere on the curve; however, we don't know where.

31.4. Yes, but not without making someone else worse off.

31.5. The value of excess demand in the remaining two markets must sum to zero.

32 Production

32.1. Giving up 1 coconut frees up $6 worth of resources that could be used to produce 2 pounds (equals $6 worth) of fish.

32.2. A higher wage would produce a steeper isoprofit line, implying that the profit maximizing level for the firm would occur at a point to the left of the current equilibrium, entailing a lower level of labor demand. However, under this new budget constraint Robinson will want to supply more than the required level of labor (why?) and therefore the labor market will not be in equilibrium.

32.3. Given a few assumptions, an economy that is in competitive equilibrium is Pareto efficient. It is generally recognized that this is a good thing for a society since it implies that there are no opportunities to make any individual in the economy better off without hurting someone else. However, it may be that the society would prefer a different distribution of welfare; that is, it may be that society prefers making one group better off at the expense of another group.

32.4. He should produce more fish. His marginal rate of substitution indicates that he is willing to give up two coconuts for an additional fish. The

marginal rate of transformation implies that he only has to give up one coconut to get an additional fish. Therefore, by giving up a single coconut (even though he would have been willing to give up two) he can have an additional fish.

32.5. Both would have to work 9 hours per day. If they both work for 6 hours per day (Robinson producing coconuts, and Friday catching fish) and give half of their total production to the other, they can produce the same output. The reduction in the hours of work from 9 to 6 hours per day is due to rearranging production based on each individual's comparative advantage.

33 Welfare

33.1. The major shortcoming is that there are many allocations that cannot be compared—there is no way to decide between any two Pareto efficient allocations.

33.2. It would have the form: $W(u_1, \ldots, u_n) = \max\{u_1, \ldots, u_n\}$.

33.3. Since the Nietzschean welfare function cares only about the best off individual, welfare maxima for this allocation would typically involve one person getting everything.

33.4. Suppose that this is not the case. Then each individual envies someone else. Let's construct a list of who envies whom. Person A envies someone—call him person B. Person B in turn envies someone—say person C. And so on. But eventually we will find someone who envies someone who came earlier in the list. Suppose the cycle is "C envies D envies E envies C." Then consider the following swap: C gets what D has, D gets what E has, and E gets what C has. Each person in the cycle gets a bundle that he prefers, and thus each person is made better off. But then the original allocation couldn't have been Pareto efficient!

33.5. First vote between **x** and **z**, and then vote between the winner (**z**) and **y**. First pair **x** and **y**, and then vote between the winner (**x**) and **z**. The fact that the social preferences are intransitive is responsible for this agenda-setting power.

34 Externalities

34.1. True. Usually, efficiency problems can be eliminated by the delineation of property rights. However, when we impose property rights we are also imposing an endowment, which may have important distributional consequences.

34.2. False.

34.3. Come on, your roommates aren't all bad ...

34.4. The government could just give away the optimal number of grazing rights. Another alternative would be to sell the grazing rights. (Question: how much would these rights sell for? Hint: think about rents.) The government could also impose a tax, t per cow, such that $f(c^*)/c^* + t = a$.

35 Information Technology

35.1. They should be willing to pay up to \$50, since this is the present value of the profit they can hope to get from that customer in the long run.

35.2. Users would gravitate toward packages with the most users, since that would make it more convenient for them to exchange files and information about how to use the program.

35.3. In this case the profit maximization conditions are identical. If two people share a video, the producer would just double the price and make exactly the same profits.

36 Public Goods

36.1. It will *not* be the highest value. Rather, it will be the *second* highest value plus a dollar. The person who is *willing* to bid the highest gets the good, but he only has to pay the price of the second highest bidder plus a small amount.

36.2. The argument is similar to the argument for the Clarke tax. Consider increasing your bid above your true value. If you were the high bidder anyway, you don't change your chances of getting the good. If you were not the high bidder, then if you increase your bid enough to exceed the actual high bidder, you will get the good, but have to pay the price bid by the second highest bidder—which is more than the value of the good to you. A similar argument can be made for underbidding.

36.3. We want the sum of the marginal rates of substitution to equal the marginal cost of providing the public good. The sum of the MRSs is 20 $(= 10 \times 2)$, and the marginal cost is $2x$. Thus we have the equation $2x = 20$, which implies that $x = 10$. So the Pareto efficient number of streetlights is 10.

37 Asymmetric Information

37.1. Since only the low-quality cars get exchanged in equilibrium and there is a surplus of \$200 per transaction, the total surplus created is $50 \times 200 = \$10,000$.

37.2. If the cars were assigned randomly, the average surplus per transaction would be the average willingness to pay, \$1800, minus the average willingness to sell, \$1500. This gives an average surplus of \$300 per transaction and there are 100 transactions, so we get a total surplus of \$30,000, which is much better than the market solution.

37.3. We know from the text that the optimal incentive plan takes the form $s(x) = wx + K$. The wage w must equal the marginal product of the worker, which in this case is 1. The constant K is chosen so that the worker's utility at the optimal choice is $\overline{u} = 0$. The optimal choice of x occurs where price, 1, equals marginal cost, x, so $x^* = 1$. At this point the worker gets a utility of $x^* + K - c(x^*) = 1 + K - 1/2 = 1/2 + K$. Since the worker's utility must equal 0, it follows that $K = -1/2$.

37.4. We saw in the last answer that the profits at the optimal level of production are $1/2$. Since $\overline{u} = 0$, the worker would be willing to pay $1/2$ to rent the technology.

37.5. If the worker is to achieve a utility level of 1, the firm would have to give the worker a lump-sum payment of $1/2$.