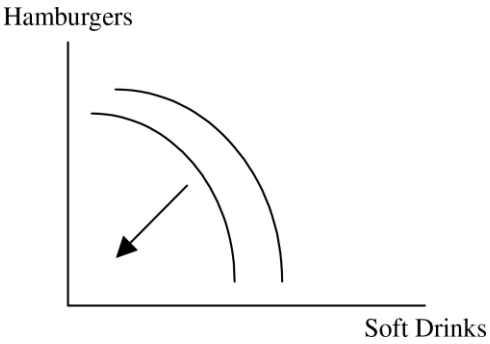
ECON2103 Microeconomics

Chapter 3 Exercises

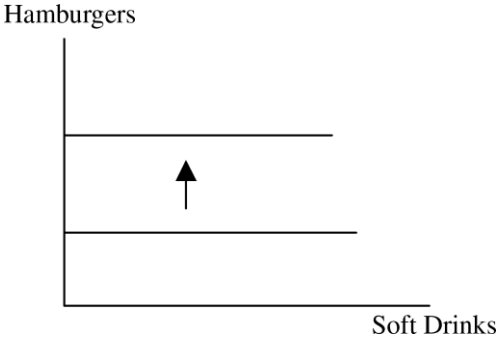
Solutions

1.

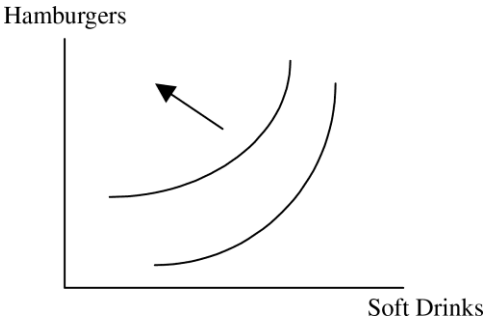
a. Since Joe dislikes both goods, he prefers less to more, and his satisfaction is increasing in the direction of the origin. Convexity of preferences implies his indifference curves will have the normal shape in that they are bowed towards the direction of increasing satisfaction. Convexity also implies that given any two bundles between which Joe is indifferent, any linear combination of the two bundles will be in the preferred set, or will leave him at least as well off. This is true of the indifference curves shown in the diagram below.



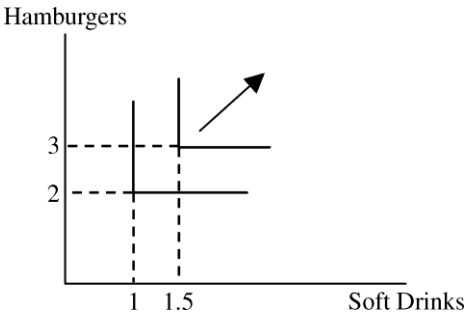
b. Since Jane can freely dispose of the soft drink if it is given to her, she considers it to be a neutral good. This means she does not care about soft drinks one way or the other. With hamburgers on the vertical axis, her indifference curves are horizontal lines. Her satisfaction increases in the upward direction.



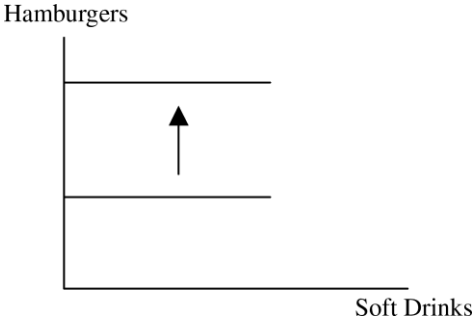
c. Since Bob will drink the soft drink in order to be polite, it can be thought of as a "bad." When served another soft drink, he will require more hamburgers at the same time in order to keep his satisfaction constant. More soft drinks without more hamburgers will worsen his utility. More hamburgers and fewer soft drinks will increase his utility, so his satisfaction increases as we move upward and to the left.



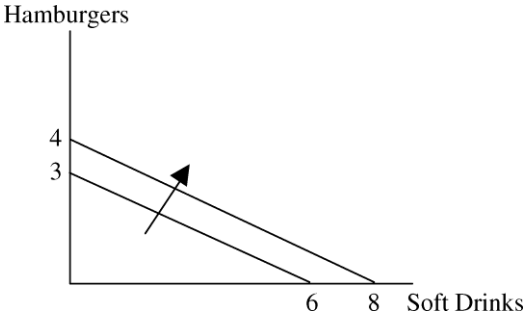
d. Molly wants to consume the two goods in a fixed proportion so her indifference curves are L-shaped. For a fixed amount of one good, she gets no extra satisfaction from having more of the other good. She will only increase her satisfaction if she has more of both goods.



e. Like Jane, Bill considers soft drinks to be a neutral good. Since he does not care about soft drinks one way or the other we can assume that no matter how many he has, his utility will be the same. His level of satisfaction depends entirely on how many hamburgers he has, so his satisfaction increases in the upward direction only.

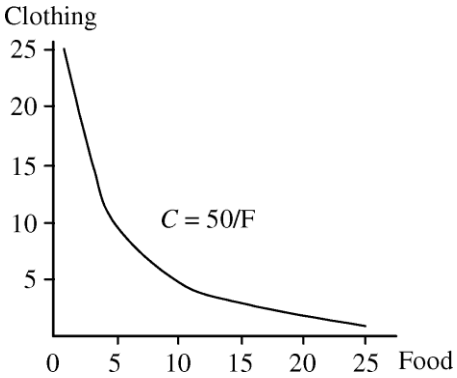


f. How much extra satisfaction Mary gains from an extra hamburger or soft drink tells us something about the marginal utilities of the two goods and about her *MRS*. If she always receives twice the satisfaction from an extra hamburger then her marginal utility from consuming an extra hamburger is twice her marginal utility from consuming an extra soft drink. Her *MRS*, with hamburgers on the vertical axis, is 1/2 because she will give up one hamburger only if she receives two soft drinks. Her indifference curves are straight lines with a slope of −1/2.



2.

a. The bundle (10,5) contains 10 units of food and 5 of clothing. Bridget receives a utility of 10(10)(5) = 500 from this bundle. Thus, her indifference curve is represented by the equation $10FC = 500$ or $C = 50/F$. Some bundles on this indifference curve are (5,10), (10,5), (25,2), and (2,25). It is plotted in the diagram below. Erin receives a utility of $0.2(10^2)(5^2) = 500$ from the bundle (10,5). Her indifference curve is represented by the equation $0.2F^2C^2 = 500$, or $C = 50/F$. This is the same indifference curve as Bridget. Both indifference curves have the normal, convex shape.

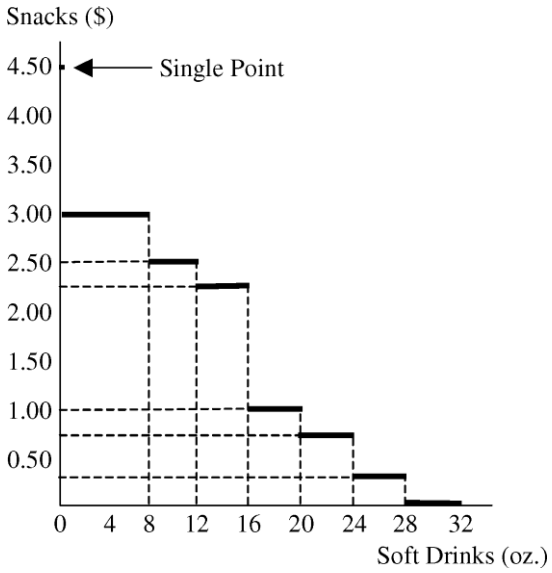


b. For each person, plug $F = 15$ and $C = 8$ into their respective utility functions. For Bridget, this gives her a utility of 1200, so her indifference curve is given by the equation $10FC = 1200$, or

$C = 120/F$. Some bundles on this indifference curve are (12,10), (10,12), (3,40), and (40,3). The indifference curve will lie above and to the right of the curve diagrammed in part a. This bundle gives Erin a utility of 2880, so her indifference curve is given by the equation $0.2F^2C^2 = 2880$, or $C = 120/F$. This is the same indifference curve as Bridget.

c. They have the same preferences because their indifference curves are identical. This means they will rank all bundles in the same order. Note that it is not necessary that they receive the same level of utility for each bundle to have the same set of preferences. All that is necessary is that they rank the bundles in the same order.

3. First notice that as the size of the drink increases, the price per ounce decreases. So, for example, if Debra wants 16 ounces of soft drink, she should buy the 16-ounce size and not two 8-ounce size drinks. Also, if Debra wants 14 ounces, she should buy the 16-ounce drink and dispose of the last 2 ounces. The problem assumes she can do this without cost. As a result, Debra's budget constraint is a single point (0 soft drinks) plus a series of horizontal lines as shown in the diagram below.



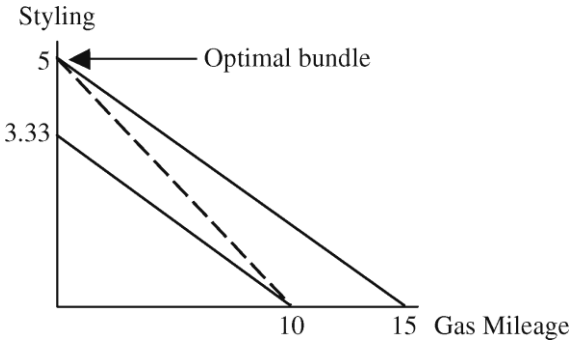
The diagram assumes Debra has a budget of $4.50 to spend on snacks and soft drinks at the movie. Dollars spent on snacks are plotted on the vertical axis and ounces of soft drinks on the horizontal. If Debra wants just an ounce or two of soft drink, she has to purchase the 8-ounce size, which costs $1.50. Thus, she would have $3.00 to spend on snacks. If Debra wants more than 16 ounces of soft drink, she has to purchase more than one drink, and we have to figure out the least-cost way for her to do that. If she wants, say, 20 ounces, she should purchase one 8-ounce and one 12-ounce drink. All of this must be considered in drawing her budget line.

4.

a. For every $5000 she spends on style the index rises by one, so the most she can achieve is a car with a style index of 5. For every $2500 she spends on gas mileage the index rises by one, so the most she can achieve is a car with a gas-mileage index of 10. The slope of her budget line is therefore −1/2 as shown by the dashed line in the diagram for part b.

b. If Brenda always receives three times as much satisfaction from an extra unit of styling as she does from an extra unit of gas mileage, then she is willing to trade one unit of styling for three units of gas mileage and still maintain the same level of satisfaction. Her indifference curves are straight lines with slopes of −1/3. Two are shown in the graph as solid lines. Since her *MRS* is a constant 1/3 and the slope of her budget line is −1/2, Brenda will choose all styling.

You can also compute the marginal utility per dollar for styling and gas mileage and note that the MU/P for styling is always greater, so there is a corner solution. Two indifference curves are shown on the graph as solid lines. The higher one starts with styling of 5 on the vertical axis. Moving down the indifference curve, Brenda gives up one unit of styling for every 3 additional units of gas mileage, so this indifference curve intersects the gas mileage axis at 15. The other indifference curve goes from 3.33 units of styling to 10 of gas mileage. Brenda reaches the highest indifference curve when she chooses all styling and no gas mileage.



c. To find the optimal value of each index, set *MRS* equal to the price ratio of 1/2 and cross multiply to get $S = 2G$. Now substitute into the budget constraint, $5000S + 2500G = 25{,}000$, to get $5000(2G) + 2500G = 25{,}000$ or $12{,}500G = 25{,}000$. Therefore, $G = 2$ and $S = 4$.

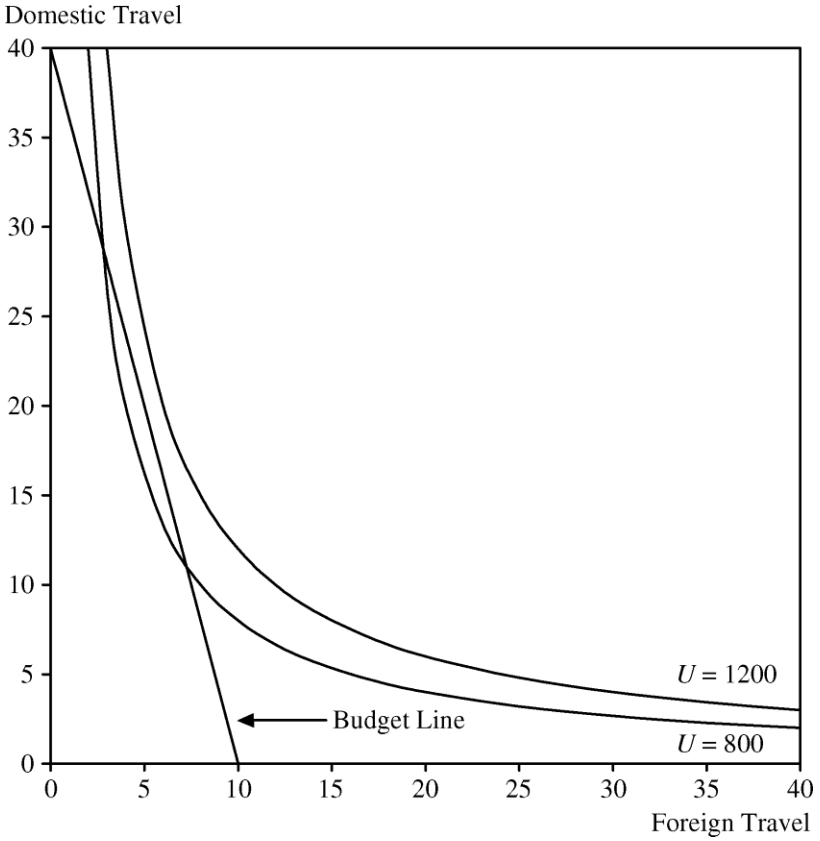
d. Now set her new *MRS* equal to the price ratio of 1/2 and cross multiply to get $G = 6S$. Substitute into the budget constraint, $5000S + 2500G = 25{,}000$, to get $5000S + 2500(6S) = 25{,}000$. Solving, $G = 7.5$ and $S = 1.25$.

5.

a. The indifference curve with a utility of 800 has the equation $10DF = 800$, or $D = 80/F$. Find combinations of D and F that satisfy this equation (such as $D = 8$ and $F = 10$) and plot the

indifference curve, which is the lower of the two on the graph in part b. The indifference curve with a utility of 1200 has the equation $10DF = 1200$, or $D = 120/F$. Find combinations of D and F that satisfy this equation and plot the indifference curve, which is the upper curve on the graph.

b. If Jane spends all of her budget on domestic travel she can afford 40 days. If she spends all of her budget on foreign travel she can afford 10 days. Her budget line is $100D + 400F = 4000$, or $D = 40 - 4F$. This straight line is plotted in the graph below.



c. Jane can afford some of the bundles that give her a utility of 800 because part of the $U = 800$ indifference curve lies below the budget line. She cannot afford any of the bundles that give her a utility of 1200 as this indifference curve lies entirely above the budget line.

d. The optimal bundle is where the ratio of prices is equal to the *MRS*, and Jane is spending her entire income. The ratio of prices is $\frac{P_F}{P_D} = 4$, and $MRS = \frac{MU_F}{MU_D} = \frac{10D}{10F} = \frac{D}{F}$. Setting these two equal and solving for D, we get $D = 4F$.

Substitute this into the budget constraint, $100D + 400F = 4000$, and solve for F. The optimal solution is $F = 5$ and $D = 20$. Utility is 1000 at the optimal bundle, which is on an indifference curve between the two drawn in the graph above.