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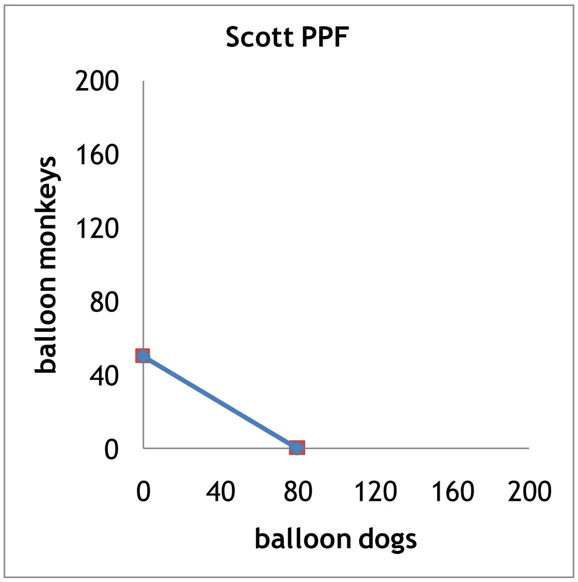
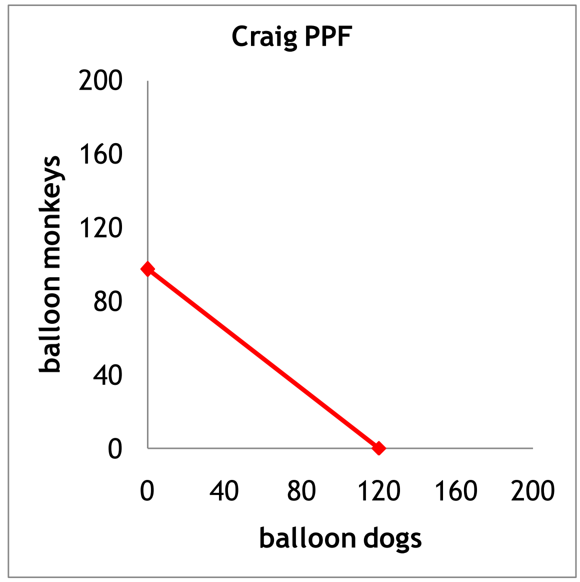
Principles of Microeconomics (200-level course)

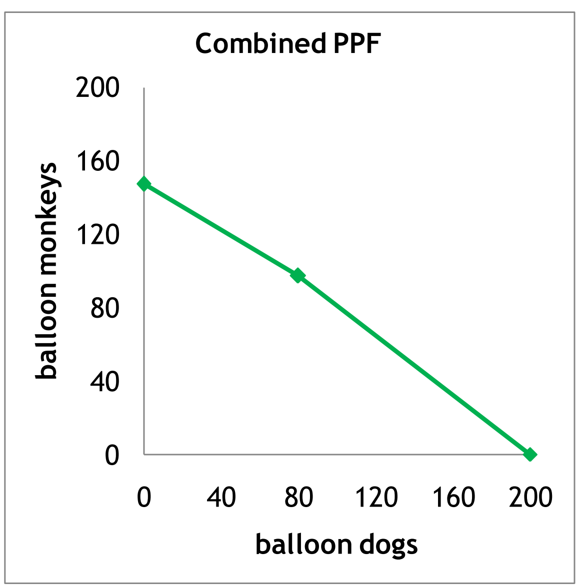
1. Scott and Craig work part time making balloon animals at restaurants and bars. In one hour Scott can make 80 balloon dogs or 50 balloon monkeys or some linear combination of the two. In the same amount of time Craig can make 120 balloon dogs or 97 balloon monkeys or some linear combination of the two.

   a. Graph the production possibilities frontiers of Scott and Craig on the axes given, with balloon dogs on the horizontal axis and balloon monkeys on the vertical axis.





   b. Now graph the aggregate production possibilities frontier—the boundary of the set of all possible combinations of balloon dogs and balloon monkeys that Scott and Craig can make by working together for one hour (again, with balloon dogs on the horizontal axis and balloon monkeys on the vertical axis).



The intercepts are at (200 balloon dogs, 0 balloon monkeys) and (0 balloon dogs, 147 balloon monkeys). The kink point lies at (80 balloon dogs, 97 balloon monkeys).

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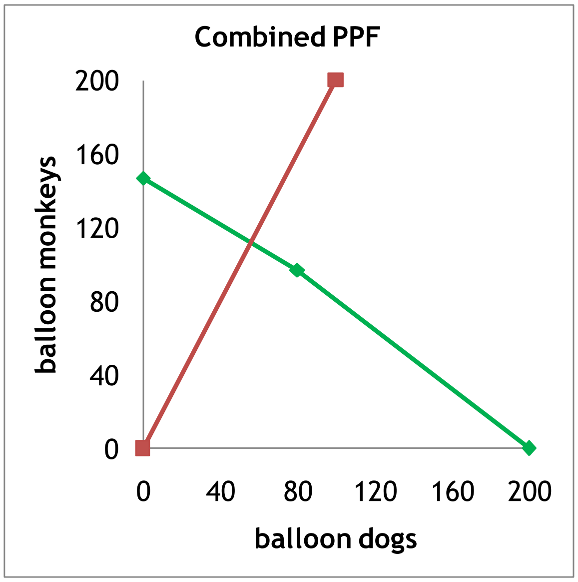
c. Scott and Craig are hired to make balloon dogs and monkeys for one hour at a party. Two-thirds of the guests want only balloon monkeys, while the other third want only balloon dogs. Given the preferences of the guests, how many balloon dogs and balloon monkeys should Scott and Craig make together if they make them as efficiently as possible?

Given the preferences of the guests (and the presumption that they will make balloon animals in equal numbers for the guests), Scott and Craig will make two balloon monkeys for every balloon dog. All of the possible bundles where they produce two balloon monkeys for every balloon dog can be represented on the PPF graph above as a line:



The optimal production point will be where their combined PPF intersects with the line representing the 2:1 ratio of balloon monkeys to balloon dogs. That line is given by the equation:

$$\boldsymbol{m = 2d}$$

The combined PPF is given by the piecewise-linear equation:

$$m = \begin{cases} 147 - \frac{5}{8}d & \text{if } d \leq 80 \\ 161\frac{2}{3} - \frac{97}{120}d & \text{if } d \geq 80 \end{cases}$$

Note that the lines intersect in the upper-left segment of the PPF, that is, where:

$$m = 147 - \frac{5}{8}d$$

Using the first equation to substituting for *m* in the second equation, we have:

$$2d = 147 - \frac{5}{8}d$$
$$\frac{21}{8}d = 147$$
$$d = 147 \cdot \frac{8}{21} = 56 \quad \Rightarrow \quad m = 112$$

balloon dogs, combined	**56**
balloon monkeys, combined	**112**

d. For the situation described in part (c), how many balloon animals of each type should Scott make, and how many of each type should Craig make? Why?

For all points on the upper-left segment of the combined PPF, Craig is producing nothing but balloon monkeys. Whenever fewer than 80 balloon dogs are produced, it must be the case that Scott is making at least some balloon monkeys, but if that would only happen while on the PPF is Craig is already making the maximum amount of balloon monkeys that he can.

balloon dogs, Scott	**56**	balloon dogs, Craig	**0**
balloon monkeys, Scott	**15**	balloon monkeys, Craig	**97**

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2. The residents of the town of Xtapolapocetl drink an above average amount of hot chocolate. Suppose that the quantity of hot chocolate drinks demanded (Q_D) and the quantity of hot chocolate drinks supplied (Q_S) each day in Xtapolapocetl are given by the equations:

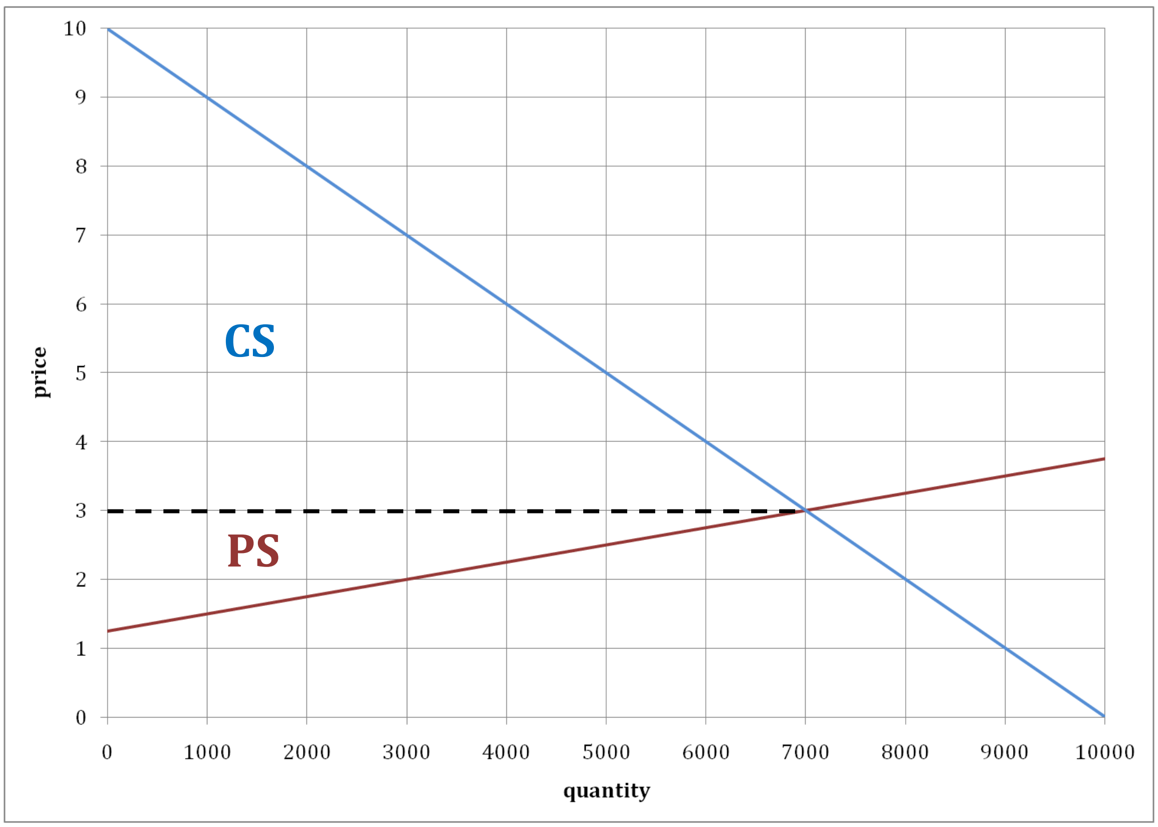
   $Q_D = 10{,}000 - 1000P \quad \Rightarrow \quad \mathbf{P = 10 - 0.001Q_D}$

   $Q_S = -5000 + 4000P \quad \Rightarrow \quad \mathbf{P = 1.25 + 0.00025Q_S}$

   where P is the price of a hot chocolate drink in dollars.

   a. Graph the supply and demand curves below, carefully labeling the curves and axes.

Market for hot chocolate in Xtapolapocetl



   b. What is the market equilibrium price?

The equilibrium price, P^*, is the price at which the quantity supplied equals the quantity demanded—where $Q_S = Q_D$. Thus:

$$-5000 + 4000P^* = 10{,}000 - 1000P^* \Rightarrow 5000P^* = 15{,}000 \Rightarrow P^* = 3$$

The equilibrium price of hot chocolate drinks in this market is $3.

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c. What is the market equilibrium quantity?

At the equilibrium price, the equilibrium quantity of hot chocolate drinks exchanged is given by either the quantity supplied or the quantity demanded: by definition the market equilibrium occurs where these two are the same. Given the equilibrium price found in part a, we have:

Q_S **= -5000 + 4000(3) = 7000**

Q_D **= 10,000 – 1000(3) = 7000**

The equilibrium quantity of hot chocolate drinks exchanged in this market is 7000.

d. What is the producer surplus?

The producer surplus (PS) is equal to the area of above the supply curve and below the equilibrium price. That is, in this case it is equal to the area of a triangle with height (3 – 1.25) and base 7000. The producer surplus is thus:

$$\frac{1.75 \cdot 7000}{2} = 6125$$

The producer surplus is equal to $6,125.

e. What is the consumer surplus?

The consumer surplus (CS) is equal to the area of below the demand curve and above the equilibrium price. That is, in this case it is equal to the area of a triangle with height (10 – 3) and base 7000. The consumer surplus is thus:

$$\frac{7 \cdot 7000}{2} = 24,500$$

The consumer surplus is equal to $24,500.

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Principles of Macroeconomics (200-level course)

3. Below is a schedule for the prices and quantities produced for hot chocolate, widgets, and knickknacks—the only three goods produced in the distant country of Xtapolapocetl—in 2012 and 2013.

	Quantities		Prices (in $)	
	2012	2013	2012	2013
hot chocolate	23	19	1	1.5
widgets	12	18	2.5	2
knickknacks	15	12	1	3

a. Fill in the table below, calculating the total GDP for Xtapolapocetl for 2012 and 2013, in both 2012 prices and 2013 prices.

	Using 2012 prices…		Using 2013 prices…	
	…and 2012 quantities	…and 2013 quantities	…and 2012 quantities	…and 2013 quantities
hot chocolate	**23**	**19**	**34.5**	**28.5**
widgets	**30**	**45**	**24**	**36**
knickknacks	**15**	**12**	**45**	**36**
total GDP	**68**	**76**	**103.5**	**100.5**

b. Calculate the growth rate of *nominal* GDP from 2012 to 2013. Express your answer as a percentage and round to one decimal place.

The growth rate in nominal GDP is the value of the quantities produced in 2013 in the prices of 2013 minus the value of the quantities produced in 2012 in the prices of 2012 divided by the value of the quantities produced in 2012 in the prices of 2012:

$$\frac{100.5-68}{68} \approx 47.8\%$$

nominal GDP growth rate from 2012 to 2013: **47.8%**

c. Calculate the growth rate of real GDP between the two years using 2012 prices as the fixed prices. Express your answer as a percentage and round to one decimal place.

The growth rate in real GDP using 2012 prices is 2013 production in 2012 prices minus 2012 production in 2012 prices divided by 2012 production in 2012 prices:

$$\frac{76-68}{68} \approx 11.8\%$$

real GDP growth rate using 2012 prices: **11.8%**

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d. Calculate the growth rate of real GDP between the two years using 2013 prices as the fixed prices. Express your answer as a percentage and round to one decimal place.

The growth rate in real GDP using 2013 prices is 2013 production in 2013 prices minus 2012 production in 2013 prices divided by 2012 production in 2013 prices:

$$\frac{100.5-103.5}{103.5} \approx -2.9\%$$

real GDP growth rate using 2013 prices **-2.9%**

4. The following equations describe an economy (where quantities are in billions of dollars):

$C = 400 + 0.8Y_D$	$TA = 800$	$EX = 150$
$I = 100$	$TR = 500 + 0.05Y$	$IM = 250$
$G = 480$		

Remember that $Y_D = Y - TA + TR$ and that in equilibrium $Y = AE = C + I + G + EX - IM$.

a. What is the equilibrium level of output (Y) for this economy? Show your work.

equilibrium level of Y **$4,000 billion**

In equilibrium:

$$\mathbf{Y = AE = C + I + G + EX - IM}$$

$$\mathbf{Y = 400 + 0.8(Y - 800 + 500 + 0.05Y) + 100 + 480 + 150 - 250}$$

$$\mathbf{Y = 880 + 0.8(1.05Y - 300)}$$

$$\mathbf{Y = 880 + \frac{4}{5}\left(\frac{21}{20}Y - 300\right) = 880 - 240 + \frac{21}{25}Y}$$

$$\mathbf{\Rightarrow \frac{4}{25}Y = 640}$$

$$\mathbf{\Rightarrow Y = 640 \cdot \frac{25}{4} = 4000}$$

b. What is the value of consumption spending (C) at the equilibrium level of output (Y) for this economy? Show your work.

In equilibrium:

$$\mathbf{C = 400 + 0.8(1.05Y - 300) = 400 + \frac{4}{5}\left(\frac{21}{20}Y - 300\right)}$$

$$\mathbf{C = 400 + \frac{4}{5}\left(\frac{21}{20} \cdot 4000 - 300\right) = 400 + \frac{4}{5}(4200 - 300) = 400 + \frac{4}{5}(3900) = 400 + 4(780)}$$

$$\mathbf{C = 400 + 3120 = 3520}$$

equilibrium level of C **$3,520 billion**

5. Assume that in the country of Zaniah the level of employment (e) in a given month is 5,237,920. If the unemployment rate (u_r) is 5%, what is the level of unemployment (u) for that month? Be as exact as possible and show your work.

[Hint #1: remember the relationship between u_r, e, and u. Hint #2: the answer will be a whole number—no fraction will be involved.]

Let e be the level of employment, u be the level of unemployment, and u_r be the rate of unemployment. Then we have:

$$u_r = \frac{u}{e+u} \quad \Rightarrow \quad (e+u)\cdot u_r = u \quad \Rightarrow \quad (1-u_r)\cdot u = e\cdot u_r \quad \Rightarrow \quad u = \frac{e\cdot u_r}{1-u_r}$$

Given the parameter values in the statement of the problem:

$$u = \frac{e\cdot u_r}{1-u_r} = \frac{5,237,920\cdot 0.05}{1-0.05} = \frac{5,237,920\cdot 0.05}{0.95} = \frac{5,237,920}{19} = 275,680$$

unemployment level (u) **275,680**

6. Which of the following has a higher present value?

- getting $100 one year from now when the prevailing interest rate is 20%
- getting $100 two years from now when the prevailing interest rate is 10%

$$PV = \frac{F}{(1+r)^t}$$

A. $100 in one year at an interest rate of 20%
B. $100 in two years at an interest rate of 10%
C. They have the same present value.

7. Solve for $\bar{r}$ by guessing, checking, and adjusting your guesses using a spreadsheet.

$$1200 = \frac{100}{(1+\bar{r})^1} + \frac{100}{(1+\bar{r})^2} + \frac{400}{(1+\bar{r})^3} + \frac{500}{(1+\bar{r})^4} + \frac{500}{(1+\bar{r})^5}$$

[Guessing and checking yields an answer of around 8.0904%.]

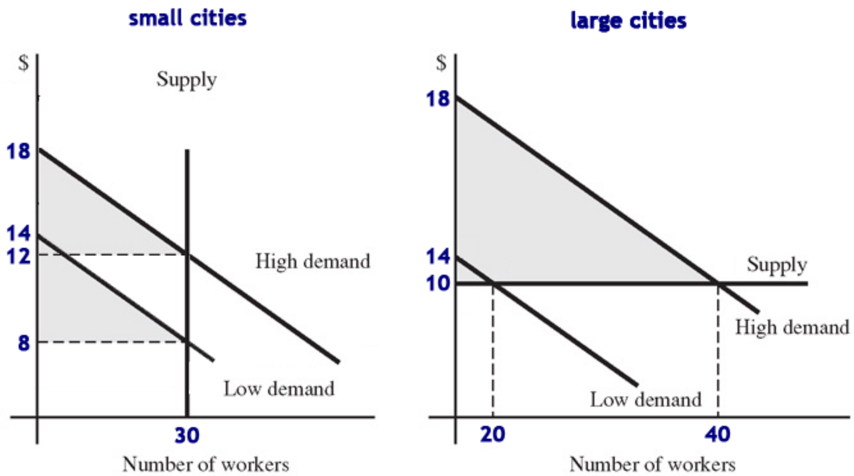
Introduction to Urban Economics (300-level course)

8. Mr. Mullett runs a traveling carnival that hires local workers in each city it visits. The demand for carnival activities is uncertain. At the end of the year Mr. Mullett reviews his financial records and discovers some puzzling differences between his experiences in small and large cities:

   i. He always paid the same wage in large cities ($10), but paid different wages in small cities (either $8 or $12).

   ii. He always hired the same quantity of labor in small cities (30 workers) but different quantities in big cities (either 20 or 40 workers).

   a. Using Figure 3-3 (seen in the book or in lecture 5) as a model, illustrate the carnival's employment of workers with two graphs, one for the typical small city and one for the typical big city. Assume that the demand curves for labor are linear and parallel, with vertical intercepts of $18 (high demand) and $14 (low demand).



[*ridiculously* not to scale]

   b. In the typical big city with high demand, profit is **$160**. (Show your work.)

   (1/2)·($18 - $10)·40 workers = $160

   c. In the typical big city with low demand, profit is **$40**. (Show your work.)

   (1/2)·($14 - $10)·20 workers = $40

   d. In the typical small city with high demand, profit is **$90**. (Show your work.)

   (1/2)·($18 - $12)·30 workers = $90

   e. In the typical small city with low demand, profit is **$90**. (Show your work.)

   (1/2)·($14 - $8)·30 workers = $90

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f. Assume that in either size of city the demand for Mr. Mullett's carnival is high with probability 40% and low with probability 60%. Given these probabilities, the expected profit is **<u>$88</u>** in a big city and **<u>$90</u>** in a small city. (Show your work.)

In the big city: (0.4)·($160) + (0.6)·($40) = $64 + $24 = $88

In the small city the expected profit is the same either way: $90

g. What would the probability of high demand have to be for the expected profit in the big city to be exactly the same as the expected profit in the small city? Why?

In the big city: (p)·($160) + (1 - p)·($40) = 160p$ + $40 - 40p$ = 120p$ + $40

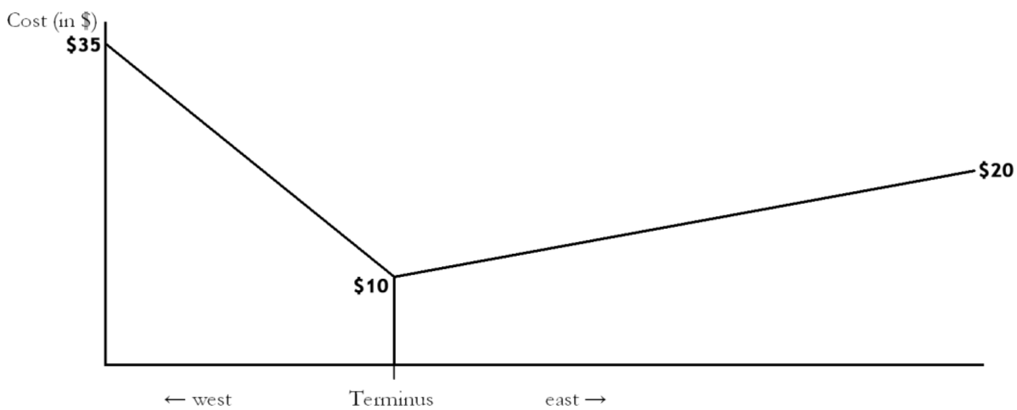
To be equal to the profit of the small city: 120p$ + $40 = $90 ⇒ 120p$ = $50 ⇒ p = 5/12

probability of high demand needed: **5/12 ≈ 41.67%**

9. The city of Terminus lies at the western end of a rail line. To the east are a hundred miles of wide plains along which there are several towns—all connected to Terminus by the rail line. To the west of Terminus are fifty miles of mountains, whose small villages are connected by a few winding dirt roads.

The only factory in the region is in Terminus. It produces widgets at a cost of $10 per unit at the factory door. Thanks to the rail line, the transport cost to anywhere east of Terminus is $0.10 per mile. Given the poor state of the roads through the mountains, the transport costs to anywhere west of Terminus is $0.50 per mile.

a. Graph the costs of widgets produced throughout the entire 150-mile region. Carefully label the costs at the factory, at the far western end of the region, and at the far eastern end of the region.



b. Assume that the cost of making a widget at home is $18. What is the market area for the factory? (That is, how many miles west of Terminus will it stretch, and how many miles east of Terminus will it stretch?)

Residents of the region will buy a factory-produced widget if that would be cheaper (after accounting for transportation costs) than what they could produce it for at home.

West of Terminus this will be when: $10 + 0.50d_w$ ≤ $18 ⇒ 0.50d_w$ ≤ $8 ⇒ $d_w \leq 16$

East of Terminus this will be when: $10 + 0.10d_e$ ≤ $18 ⇒ 0.10d_e$ ≤ $8 ⇒ $d_e \leq 80$

number of miles to the west of Terminus: **16**

number of miles to the east of Terminus: **80**

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10. Suppose that a household resides in an urban area at a distance of 5 miles from downtown. The household occupies a residential lot measuring 5000 square feet, and at this distance from downtown land rent is $2.00 per square foot per year.

One of the members of the household must commute to downtown for work five days a week (50 weeks per year). The total cost of this commuting (counting time costs as well as monetary costs) is $5.00 for each work day.

a. How much is the household currently paying in land rent per year? Show your work.

(5000 sq ft)·($2.00/sq ft/year) = $10,000/year

land rent per year: **$10,000**

b. How much is the household currently paying in commuting costs per year? Show your work.

($5.00/day)·(5 days/week)·(50 weeks/year) = $1,250/year

current commuting costs per year: **$1,250**

c. Assume that the per-mile cost of commuting is everywhere the same (i.e., it's the same cost to travel a mile either near downtown or on the outskirts of town). How much would the household's annual commuting costs be if they lived 4 miles from downtown or 6 miles from downtown? Show your work.

Since living 5 miles out results in commuting costs of $5.00/day and the per-mile cost is everywhere the same, each mile implies $1.00/day.

4 miles: ($4.00/day)·(5 days/week)·(50 weeks/year) = $1,000/year

6 miles: ($6.00/day)·(5 days/week)·(50 weeks/year) = $1,500/year

commuting costs per year living 4 miles from downtown: **$1,000**

commuting costs per year living 6 miles from downtown: **$1,500**

d. Assume that land rent is $2.50 per square foot four miles from downtown and $1.67 six miles from downtown. If the household rented a lot of exactly the same size as they currently do, how much would their land rent be per year if they lived 4 miles from downtown or 6 miles from downtown? Show your work.

4 miles: (5000 sq ft)·($2.50/sq ft/year) = $12,500/year

6 miles: (5000 sq ft)·($1.67/sq ft/year) = $8,350/year

land rent per year living 4 miles from downtown: **$12,500**

land rent per year living 6 miles from downtown: **$8,350**

e. Assuming that land rent and commuting costs are the only factors being considered by this household, is living five miles from downtown a locational equilibrium for this household? Why or why not? If not, should they move closer to or farther from downtown?

This and the other households are not currently at locational equilibrium because the sum of rent and commuting costs are not the same across locations. At the current distance of 5 miles, the sum is $11,250/year. But at 4 miles the sum would be $13,500/year, and at 6 miles the sum would be $9,850/year.

Facing these prices for rent and commuting, this household (and others) should move farther from the city center: the decline in annual rent more than makes up for the increased commuting costs.

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Introduction to Behavioral Economics (300-level course)

11. Arriving in Reno, Nevada, for a brief vacation, Anthony decides to find a room for the night in one of the local motels (while they all still have vacancies). He has reference-dependent preferences over the quality of lodging (L) and money (Y) according to the following utility function:

$$U(L, Y; R_L, R_Y) = v(4L - 4R_L) + v(Y - R_Y)$$

where $v(x) = \begin{cases} \sqrt{x+1} - 1 & \text{if } x \geq 0 \\ x & \text{if } x < 0 \end{cases}$

The day before, Anthony saw an online quote for one local motel for $63 per night. With that in mind, and given that he's seeking a relatively low quality motel, his reference points are $R_L = 6$, $R_Y = -63$. After a brief search he finds two motels. The first, M_1, offers a quality of 12 for a price of $83 per night (i.e., $L_1 = 12$ and $Y_1 = -83$). The second, M_2, offers a quality of 3 for a price of $55 per night (i.e., $L_1 = 3$ and $Y_1 = -55$)

a. What would Anthony's utility be for staying at M_1? Show your work.

The first motel offers Anthony a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(4L - 4R_L) + v(Y - R_Y) \\ &= v(4 \cdot 12 - 4 \cdot 6) + v(-83 - (-63)) \\ &= v(24) + v(-20) \\ &= (\sqrt{24+1} - 1) + (-20) \\ &= -16 \end{aligned}$$

b. What would Anthony's utility be for staying at M_2? Show your work.

The second motel offers Anthony a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(4L - 4R_L) + v(Y - R_Y) \\ &= v(4 \cdot 3 - 4 \cdot 6) + v(-55 - (-63)) \\ &= v(-12) + v(8) \\ &= (-12) + (\sqrt{8+1} - 1) \\ &= -10 \end{aligned}$$

c. At which of these two motels would he prefer to stay for the night? Why?

Of the two the second motel offers Anthony a higher level of utility (or, perhaps more intuitively put: a lower level of disutility), so he would prefer to stay at the second motel (M_2).

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d. Anthony's alternative to staying in a motel is sleeping in his car (which he has been known to do from time to time). This would yield $L_0 = 0$ and $Y_0 = 0$. Given his current reference points for quality of lodging and money would he prefer sleeping in his car to staying at M_1? Show your work.

Staying in his car would yield a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(4L - 4R_L) + v(Y - R_Y) \\ &= v(4 \cdot 0 - 4 \cdot 6) + v(0 - (-63)) \\ &= v(-24) + v(63) \\ &= (-24) + (\sqrt{63 + 1} - 1) \\ &= -17 \end{aligned}$$

Since -16 > -17 Anthony would <u>not</u> prefer sleeping in his car to M_1.

e. Would he prefer his car to M_2? Show your work.

Since -10 > -17 Anthony would <u>not</u> prefer sleeping in his car to M_2.

f. As Anthony is contemplating his options he finds that he has received a parking ticket for \$39. Assuming that his reference points in quality of lodging and money remain the same (namely, $R_L = 6$ and $R_Y = -63$), how does this negative shock affect the rank ordering of his lodging preferences between M_1, M_2, and his car? Show your work.

Now the first motel offers Anthony a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(24) + v(-20 - 39) \\ &= (\sqrt{24 + 1} - 1) + (-59) \\ &= -55 \end{aligned}$$

Now the second motel offers Anthony a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(-12) + v(8 - 39) \\ &= (-12) + (-31) \\ &= -43 \end{aligned}$$

Now sleeping in his car offers Anthony a utility level of:

$$\begin{aligned} U(L, Y; R_L, R_Y) &= v(-24) + v(63 - 39) \\ &= (-24) + (\sqrt{24 + 1} - 1) \\ &= -20 \end{aligned}$$

Since -20 > -43 > -55, the rank ordering of Anthony's preferences is now car with the highest utility, then the second motel, and lastly the first motel.