

Homework

due date

1. Suppose a water bottling firm has customers located in Washington DC and Baltimore, Md as well as at sites along a line in between, as follows:

<u>Location</u>	<u>Number of Customers</u>
Washington DC	100
5 miles from DC	49
10 miles from DC	38
15 miles from DC	10
20 miles from DC	41
25 miles from DC	46
Baltimore (35 miles from DC)	100

- a. Suppose that a separate trip must be made to each customer and that transportation cost per mile is the same for all trips. Where does the business locate to minimize total transportation cost?

Suppose that it costs .05 per mile to transport a case of bottled water. Each customer demands one case of bottled water per week.

- b. Calculate the firm's weekly transportation cost of servicing all of its market areas from the median location.
- c. Suppose Washington DC offers a subsidy to the firm to locate its operations within the city. The size of the subsidy amounts to \$75 per week. Compare the increased transportation cost of locating in DC to the size of the subsidy (ignore all other costs). Would the firm increase its profits if it located in DC?
- d. Baltimore responds by offering a subsidy equal to \$122.5 per week. Which of the two cities would the firm choose to produce in? (Assume the only costs it looks at are transportation costs compared to the subsidy.) Would it make sense to choose either city over the median location?
- e. Suppose the quantity demanded at each site doubled and the subsidies remained. Within which site should the firm locate?
- f. Suppose the quantity demanded at each site fell to half its original values and the subsidies are unchanged. Within which site should the firm locate?
- g. Explain why, in terms of efficiency in resource allocation, it is not a good idea for the bottling plant to move away from the median location.

2. The table below summarizes the productivity of workers in wheat and cloth production in two parts of a region.

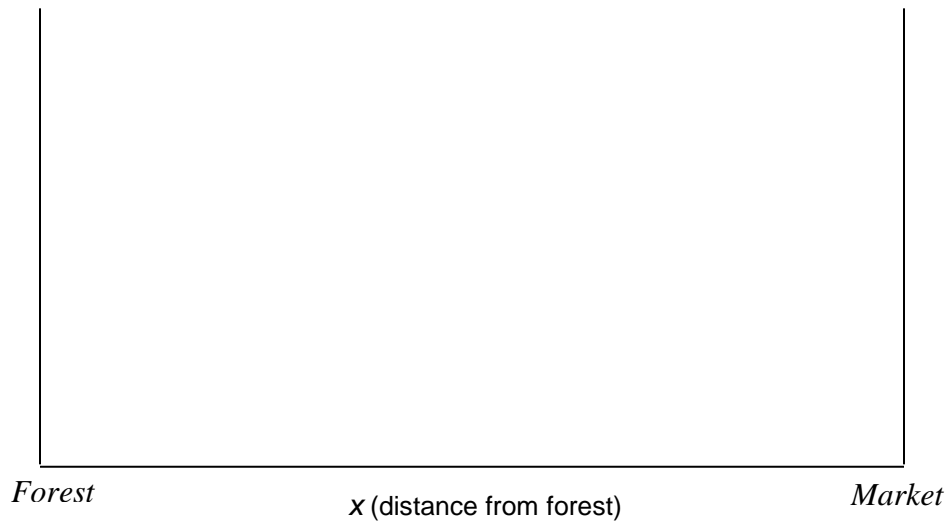
	<u>Output per Labor Hour</u>		<u>Opportunity Cost of Production</u>	
	<i>East</i>	<i>West</i>	<i>East</i>	<i>West</i>
Wheat	1	10		
Cloth	1	3		

- a. Complete the table by providing the opportunity costs of producing wheat and cloth in the East and the West.
 - b. Assuming the regions will trade with one another, explain why each should specialize in producing one of the goods, as opposed to each region producing both goods.
 - c. Give some possible reasons why a region would be able to produce a given good at a lower (opportunity) cost than another.
 - d. Discuss the role of transportation cost in inducing the East and West regions to specialize and trade output. Would decreasing transportation cost induce greater specialization and trade or less?
3. The discussion in class of the market area of the three stores assumed that each had the same production costs. As a result, each household patronized the nearest store. Suppose the retailer in the middle discovered a less costly way to market its good and cut its store price from \$9 to \$6. The two remaining retailers continue to sell the good for \$9.
- a. How does the decrease in cost affect the market area of the retailer with the new lower price?
 - b. What is the net price at the border between retailers?
 - c. Will each household still patronize the closest retailer?

4. Suppose the following relationship holds for a bat-producing firm.

	<u>Input</u> (wood)	<u>Output (bats)</u>
Physical Weight (tons)	4	3
Transport rate (cost per ton per mile)	\$1	\$1
Monetary weight		

- a. Fill in the monetary weights. Interpret the calculated monetary weights.



- b. If X_M equals 20, draw in the distribution and procurement cost lines and label their endpoints using a diagram such as the one above.
- c. At which location will the firm minimize transportation cost: the forest or the market site?
- d. If the firm produced three tons of bats per time period, what would be the total cost of transportation at the cost minimizing location?
- e. Suppose the cost of shipping bats increases from \$1 per ton to \$4 per ton, while the cost of shipping wood remains at \$1 per ton. Depict the effect on a separate graph and explain any changes in optimal location.
- f. Suppose the firm starts producing bats with wood and cork, using two tons of wood and two tons of cork to produce three tons of bats. Cork is ubiquitous (available at all locations at the same price). Assume the marginal costs of transporting inputs and

outputs are \$1 per ton/mile. Depict the effect on a separate graph and explain any changes in optimal location.

5. The production of pottery involves the use of clay as a primary input. Suppose the following relationship holds for a pottery making firm.

	Input (Clay)	Output (Pottery)
Physical Weight (tons)	5	3
Transport rate (cost per ton per mile)	\$1	\$2
Monetary weight		

- How is it possible that the physical weight of the output is less than the transferred input?
- Explain why the marginal transportation cost for the output should be greater than that for the input. Are there transportation inputs that would be used in shipping the output that would not be used for the input?
- Fill in the monetary weights and interpret. Is this weight losing production?



Resource

Market

x (distance from resource)

Assume the firm produces 3 tons of pottery per period.

- d. If X_M equals 15, draw in the distribution and procurement cost lines.
 - e. Which location minimizes total transportation cost?
 - f. Does the scenario suggest urban areas could develop around concentrations of pottery firms?
 - g. Suppose the marginal cost of transporting output falls to \$1. How would this be possible?
 - h. Recalculate the distribution and procurement costs. Depict the effect on a separate graph and explain any change in optimal location.
 - i. Does this new scenario suggest urban areas could develop around concentrations of pottery firms?
6. Consider the market area for carpet-cleaning firms in a metropolitan area with the following characteristics.
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|----|--|------------|
| a. | per capita demand is 3 carpet cleanings per year | $d=3$ |
| b. | population density (of consumers) is 600 per square mile | $e=600$ |
| c. | land area of metropolitan area is 150 square miles | $A=150$ |
| d. | output per firm is 11,250 cleanings per year | $q=11,250$ |
- A. Calculate the total number of carpet cleanings that will take place in the metropolitan area in a year.
 - B. Calculate the number of carpet cleanings per square mile.
 - C. Calculate the total number of firms that will service the market.
 - D. Calculate the size of each firm's geographic market.
- Suppose population density decreased to half its previous level.**
- E. Calculate the change in the number of carpet-cleaning firms in the metropolitan area.
 - F. Calculate the change in the geographic market area for each carpet-cleaning firm.