Discussion Questions/Exercises

1. In the city of Trekburg, manufacturers have two options for intracity freight. They can use a conventional transportation system (the truck) or a matter transmitter, which instantly transports the output from the factory to the central export node. A transmitter can be rented for $C per year, and running the machine is costless. The transmitter can transport output up to a distance of two miles. All manufacturing output goes through the export node.
a. Draw the bid-rent function for a firm that uses the matter transmitter, and label it M.
b. On the same graph, draw a bid-rent function for a firm that uses the truck, annd label it T.
c. Will every manufacturer use the matter transmitter? If not, where will the firms using the truck be located?

2. Consider a traditional nineteenth-century monocentric city with a CBD radius of one mile. In 1869, buildings at the edge of the CBD are four stories tall. In 1870, all the buildings in the CBD are destroyed by an earthquake, and the mayor of the city announces that the maximum building height in the rebuilt city will be four stories. In addition, business development will be confined to a circle with a one-mile radius; that is, the size of the CBD is fixed. Suppose that the city is small enough so that events in the city do not affect the equilibrium prices of its export goods (office or manufacturing goods).
a. Draw the business bid-rent function before the earthquake and label it R69.
b. Draw the business bid-rent function after the earthquake (with the height restrictions) and label it R70.
c. Explain any differences between the two bid-rent functions.

3. Depict graphically the effects of the following changes on the division of CBD land between office firms and manufacturers.
a. The unit freight cost decreases.
b. The price of office output increases.
c. The opportunity cost of executive travel decreases.

4. Consider an industry that makes table tennis balls and competes with door makers for land near the central export node. Each table tenis ball firm produces the same quantity of output as a door firm (five tons), sells for the same price ($160 per ton), and has the same production isoquants. Which activity will locate closer to the export node?

5. Depict graphically the effects of the following changes on the equilibrium housing-price function:
a. The workweek is shortened from five days per week to four days per week.
b. The workers in two-earner households start riding to work together.

6. Suppose that a city restricts the heights of residential structures. The maximum height is four stories, the height that would normally occur at a distance of five miles from the city center. Draw two residential bid-rent functions, one for the city in the absence of height restrictions and one with height restrictions.

7. Consider a manufacturing firm that exports some of its output by train (through a central export node) and the rest by truck (the truck exits the metropolitan area using a suburban beltway). Suppose that production costs (including labor costs) are the same at all locations. The unit cost of transporting output inward (toward the central export node) is t_i, and the unit cost of transporting output outward (toward the beltway) is t_o. The volume of output going to the central export node is w_i, and the volume going to the beltway is w_o. Under what conditions will the firm's bid-rent function be positively sloped? How would your answer change if wages were lower in the suburbs?

8. Consider a metropolitan area with a 10-mile radius. Two members of the Dink household work: Mr. Dink commutes to the city center and Ms. Dink commutes to a suburban subcenter four miles due east of the city center.
a. Depict the household's housing-price function if travel time per mile is the same in both directions (toward the city center and away from the city center) and Mr. and Ms. Dink have the same opportunity cost of travel time.
b. Depict the household's housing-price function if the travel time per mile of inward commuting (toward the city center in the morning rush hour and away from the center in the evening rush hour) exceeds the travel time of outward commuting (away from the city center during the morning rush hour and toward the center during the evening rush hour), and Mr. and Ms. Dink have the same opportunity cost of travel time.

9. Comment on the following statement: "Instead of investing money in traditional radial mass-transit systems (hub-and-spoke systems), we should be investing in circumferential transit systems. We should build a circular transit system along the urban beltways."

10. The traditional core-dominated city was a segregated city in the sense that all employment was in one area (the core) and all residents lived in another area (the satellite). The modern city is less segregated in the sense that employment is dispersed throughout the city, in subcenters and along suburban beltways. Mr. Wizard recently made the following statement: "If my assumptions are correct, land use in the typical American city will soon be completely integrated. I predict that each manufacturer and each office firm will be surrounded by its workforce: the metropolitan area will have dozens of 'company villages.' A firm will be at the center of each village, and the firm's workers will occupy the land surrounding the factory or office. Every worker will be employed in the firm at the center of the village, and the firm's workers will occupy the land surrounding the factory or office. Every worker will be employed in the firm at the center of the village. That's integration."
a. Assume that Mr. Wizard's reasoning is correct. What are his assumptions? In other words, under what set of assumptions will a system of company villages develop?
b. Are Mr. Wizard's assumptions realistic?

11. The development of the internal-combustion engine caused fundamental changes in urban land-use patterns. The transformation from the core-dominated city to the modern suburbanized city took only about 50 years. Given the rapid pace of technological change, it seems likely that some future innovation will cause another transformation of cities. Given your knowledge of science fiction and fact, describe an innovation that would cause fundamental changes in the spatial structure of cities.