

5. A major traffic problem in the Greater Cincinnati area involves traffic attempting to cross the Ohio River from Cincinnati to Kentucky using Interstate 75. Let us assume that the probability of no traffic delay in one period, given no traffic delay in the preceding period, is 0.85 and that the probability of finding a traffic delay in one period, given a delay in the preceding period, is 0.75. Traffic is classified as having either a delay or a no-delay state, and the period considered is 30 minutes.

- a. Assume that you are a motorist entering the traffic system and receive a radio report of a traffic delay. What is the probability that for the next 60 minutes (two time periods) the system will be in the delay state? Note that this result is the probability of being in the delay state for two consecutive periods.
- b. What is the probability that in the long run the traffic will not be in the delay state?
- c. An important assumption of the Markov process models presented in this chapter has been the constant or stationary transition probabilities as the system operates in the future. Do you believe this assumption should be questioned for this traffic problem? Explain.

8. Assume that a third grocery store, Quick Stop Groceries, enters the market share and customer loyalty situation described in Section 16.1. Quick Stop Groceries is smaller than either Murphy's Foodliner or Ashley's Supermarket. However, Quick Stop's convenience with faster service and gasoline for automobiles can be expected to attract some customers who currently make weekly shopping visits to either Murphy's or Ashley's. Assume that the transition probabilities are as follows:

From		To	
	Murphy's	Ashley's	Quick Stop
Murphy's Foodliner	0.85	0.10	0.05
Ashley's Supermarket	0.20	0.75	0.05
Quick Stop Groceries	0.15	0.10	0.75

- a. Compute the steady-state probabilities for this three-state Markov process.
- b. What market share will Quick Stop obtain?
- c. With 1000 customers, the original two-state Markov process in Section 16.1 projected 667 weekly customer trips to Murphy's Foodliner and 333 weekly customer trips to Ashley's Supermarket. What impact will Quick Stop have on the customer visits at Murphy's and Ashley's? Explain.

12. Given the following transition matrix with states 1 and 2 as absorbing states, what is the probability that units in states 3 and 4 end up in each of the absorbing states?

$$P = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \end{matrix} & \begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 0.0 & 0.0 \\ 0.2 & 0.1 & 0.4 & 0.3 \\ 0.2 & 0.2 & 0.1 & 0.5 \end{bmatrix} \end{matrix}$$