

A plane with a capacity of 13 weight units is to be used to transport the products. How should the plane be loaded to maximize the value of goods shipped? (Formulate the problem as an integer program and solve by dynamic programming.)

5. Any linear-programming problem with n decision variables and m constraints can be converted into an n -stage dynamic-programming problem with m state parameters.

Set up a dynamic-programming formulation for the following linear program:

$$\text{Minimize } \sum_{j=1}^n c_j x_j,$$

subject to:

$$\sum_{j=1}^n a_{ij} x_j \leq b_i \quad (i = 1, 2, \dots, m),$$

$$x_j \geq 0 \quad (j = 1, 2, \dots, n).$$

Why is it generally true that the simplex method rather than dynamic programming is recommended for solving linear programs?

6. Rambling Roger, a veteran of the hitchhiking corps, has decided to leave the cold of a Boston winter and head for the sunshine of Miami. His vast experience has given him an indication of the expected time in hours it takes to hitchhike over certain segments of the highways. Knowing he will be breaking the law in several states and wishing to reach the warm weather quickly, Roger wants to know the least-time route to take. He summarized his expected travel times on the map in Fig. E11.1. Find his shortest time route.
7. J. J. Jefferson has decided to move from the West Coast, where he lives, to a mid-western town, where he intends to buy a small farm and lead a quiet life. Since J. J. is single and has accumulated little furniture, he decides to rent a small truck for \$200 a week or fraction of a week (one-way, no mileage charge) and move his belongings by himself. Studying the map, he figures that his trip will require four stages, regardless of the particular routing. Each node shown in Fig. E11.2 corresponds to a town where J. J. has either friends or relatives and where he plans to spend one day resting and visiting if he travels through the town. The numbers in brackets in Fig. E11.2 specify the travel time in days between nodes. (The position of each node in the network is not necessarily related to its geographical position on the map.) As he will travel through different states, motel rates, tolls, and gas prices vary significantly; Fig. E11.2 also shows the cost in dollars for traveling (excluding truck rental charges) between every two nodes. Find J. J.'s cheapest route between towns 1 and 10, including the truck rental charges.
8. At THE CASINO in Las Vegas, a customer can bet only in dollar increments. Betting a certain amount is called "playing a round." Associated with each dollar bet on a round, the customer has a 40% chance to win another dollar and a 60% chance to lose his, or her, dollar. If the customer starts with \$4 and wants to maximize the chances of finishing with at least \$7 after two rounds, how much should be bet on each round? [*Hint.* Consider the number of dollars available at the beginning of each round as the state variable.]
- *9. In a youth contest, Joe will shoot a total of ten shots at four different targets. The contest has been designed so that Joe will not know whether or not he hits any target until after he has made all ten shots. He obtains 6 points if any shot hits target 1, 4 points for hitting target 2, 10 points for hitting target 3, and 7 points for hitting target 4. At each shot there is an 80% chance that he will miss target 1, a 60% chance of missing target 2, a 90% chance of missing target 3, and a 50% chance of missing target 4, given that he aims at the appropriate target.
- If Joe wants to maximize his expected number of points, how many shots should he aim at each target?
10. A monitoring device is assembled from five different components. Proper functioning of the device depends upon its total weight q so that, among other tests, the device is weighted; it is accepted only if $r_1 \leq q \leq r_2$, where the two limits r_1 and r_2 have been prespecified.

The weight q_j ($j = 1, 2, \dots, 5$) of each component varies somewhat from unit to unit in accordance with a normal distribution with mean μ_j and variance σ_j^2 . As q_1, q_2, \dots, q_5 are independent, the total weight q will also be a normal variable with mean $\mu = \sum_{j=1}^5 \mu_j$ and variance $\sigma^2 = \sum_{j=1}^5 \sigma_j^2$.

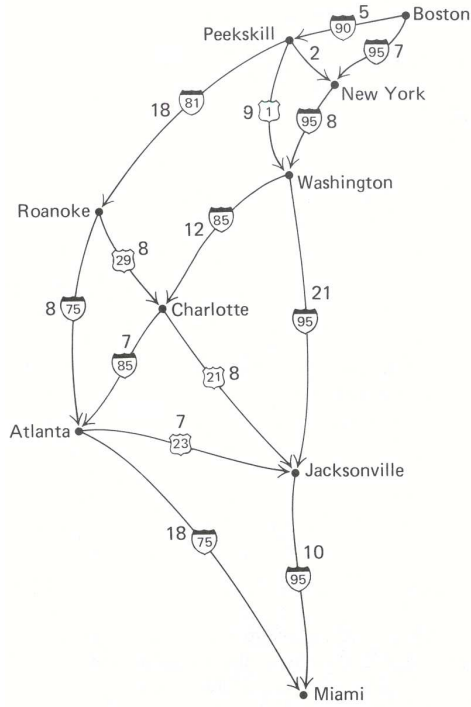


Figure E11.1 Travel times to highways.

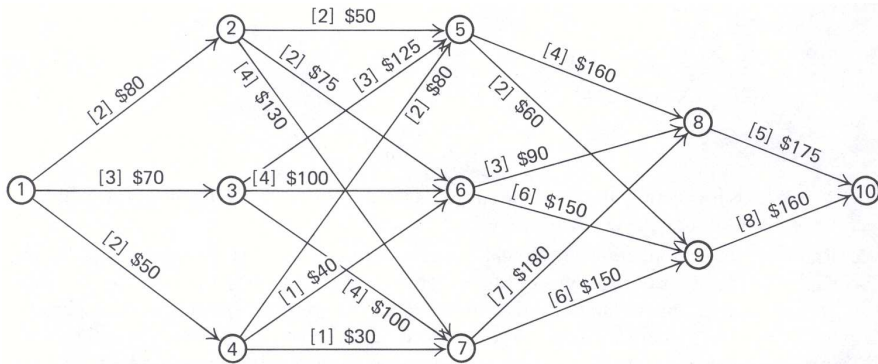


Figure E11.2 Routing times and costs.