EEL4598/5718: Computer Communications

Homework 5

7.2

Is it possible for a network to offer best-effort virtual-circuit service? What features would such a service have, and how does it compare to best-effort datagram service?

7.4

Where is complexity concentrated in a connection-oriented network? Where is it concentrated in a connectionless network?

7.7

Apply the end-to-end argument to the question of how to control the delay jitter that is incurred in traversing a multihop network.

7.20

A message of size m bits is to be transmitted over an L-hop path in a store-and-forward packet network as a series of N consecutive packets, each containing k data bits and h header bits. Assume that $m \gg k + h$. The bit rate of each link is R bits/second. Propagation and queueing delays are negligible.

a. What is the total number of bits that must be transmitted?
b. What is the total delay experienced by the message (i.e., the time between the first transmitted bit at the sender and the last received bit at the receiver)?
c. What value of k minimizes the total delay?

7.21

Suppose that a datagram network has a routing algorithm that generates routing tables so that there are two disjoint paths between every source and destination that is attached to the network. Identify the benefits of this arrangement. What problems are introduced with this approach?

7.26

Suppose a routing algorithm identifies paths that are "best" in the following sense: (1) minimum number of hops, (2) minimum delay, or (3) maximum available bandwidth. Identify the conditions under which the paths produced by the different criteria are the same? are different?

7.29

Consider the datagram packet network in Figure 7.25 Reconstruct the routing tables (using minimum-hop routing) that result after node 4 fails. Repeat if node 3 fails instead.

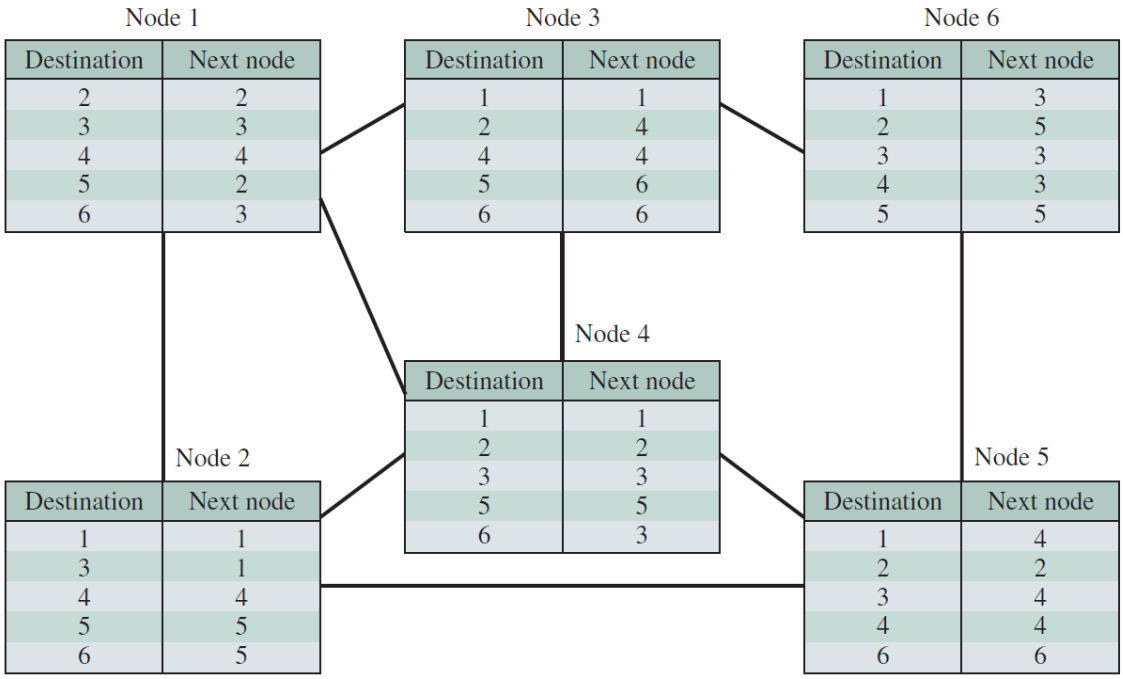
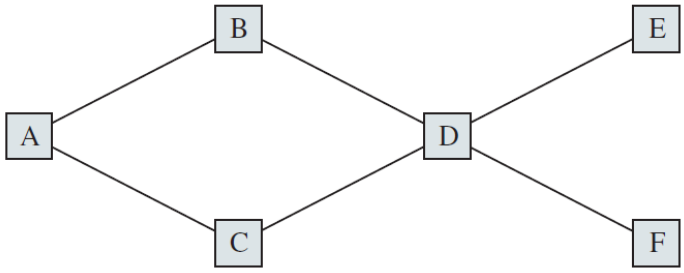


FIGURE 7.25 Routing tables for datagram network

7.30

Consider the following six-node network. Assume all links have the same bit rate R.



a. Suppose the network uses datagram routing. Find the routing table for each node, using minimum-hop routing.

b. Explain why the routing tables in part (a) lead to inefficient use of network bandwidth.

c. Can VC routing improve efficiency in the use of network bandwidth? Explain why or why not.

d. Suggest an approach in which the routing tables in datagram routing are modified to improve efficiency. Give the modified routing tables.

7.32

Consider the network in Figure 7.30

a. Use the Bellman-Ford algorithm to find the set of shortest paths from all nodes to destination node 2.

b. Now continue the algorithm after the link between node 2 and 4 goes down.

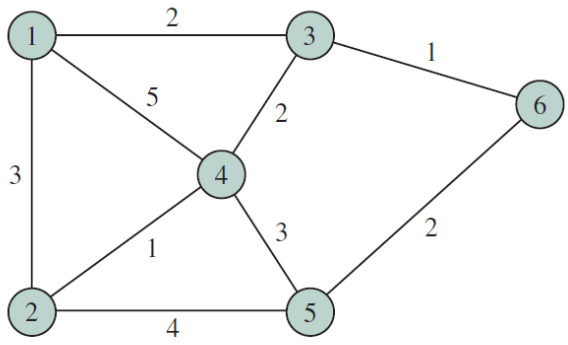


FIGURE 7.30 A sample network with associated link costs

7.33

Consider the network in Figure 7.30

a. Use the Dijkstra algorithm to find the set of shortest paths from node 4 to other nodes.

b. Find the set of associated routing table entries.

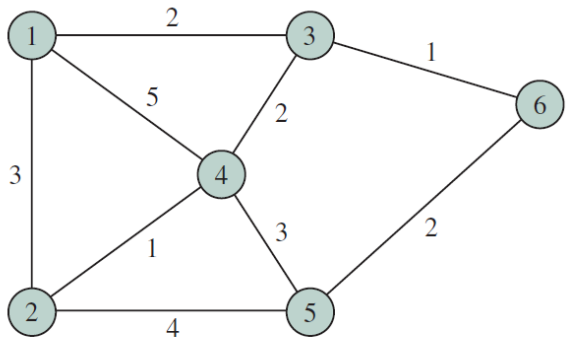


FIGURE 7.30 A sample network with associated link costs

Additional problems:

A1.

Using Bellman-Ford algorithm and Dijkstra algorithm, respectively, find the shortest path tree to node 5 in Figure 7.30.

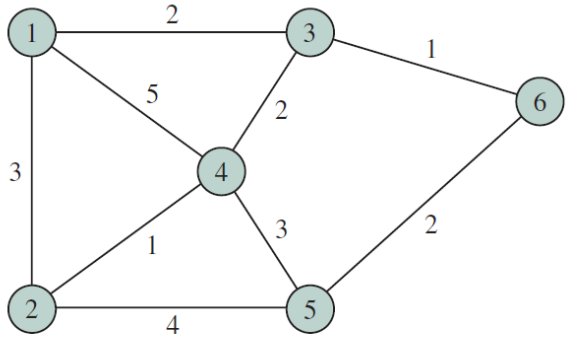


FIGURE 7.30 A sample network with associated link costs