Homework – Chapter 4

P7. Suppose two packets arrive to two different input ports of a router at exactly the same time. Also suppose there are no other packets anywhere in the router.
a. Suppose the two packets are to be forwarded to two *different* output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a *shared bus*?
b. Suppose the two packets are to be forwarded to two *different* output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a *crossbar*?
c. Suppose the two packets are to be forwarded to the *same* output port. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a *crossbar*?

P10. Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	**Link Interface**
11100000 00000000 00000000 00000000 Through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 Through 11100001 01111111 11111111 11111111	2
otherwise	3

a. Provide a forwarding table that has five entries, uses longest prefix matching, and forwards packets to the correct link interfaces.
b. Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:
11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

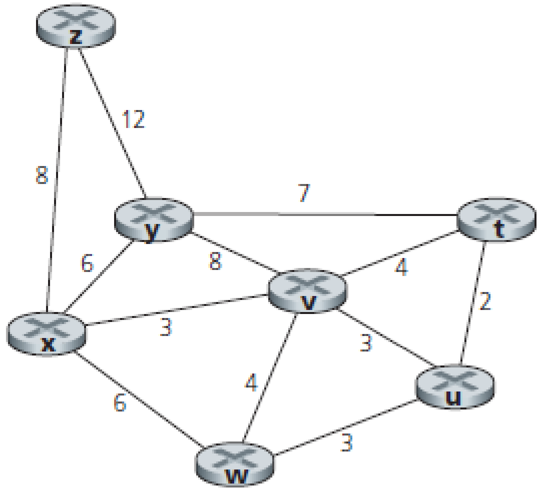
P11. Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

Prefix Match	Interface
00	0
010	1
011	2
10	2
11	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range

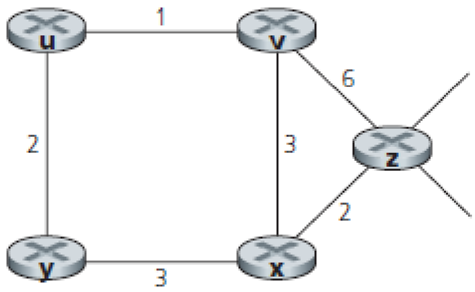
P19. Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

P26. Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from *x* to all network nodes. Show how the algorithm works by computing a table similar to Table 4.3.



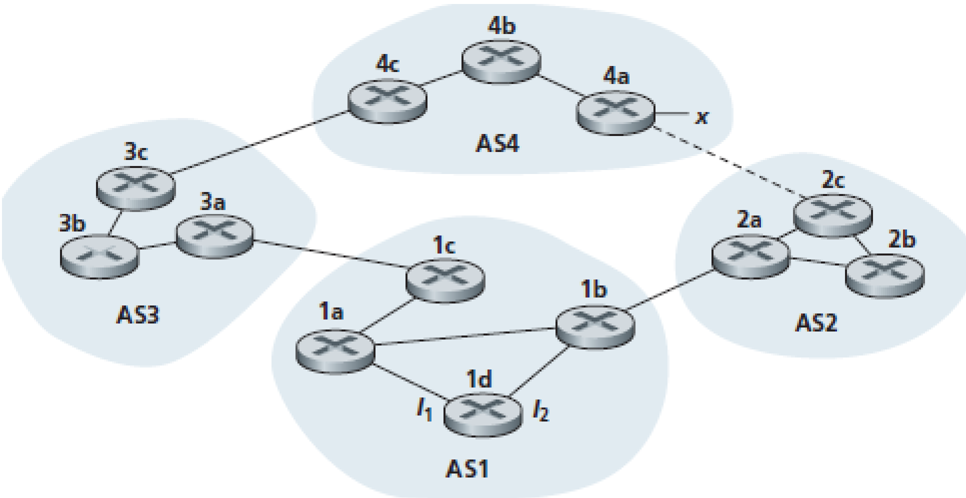
P27. Consider the network shown in Problem P26. Using Dijkstra's algorithm, and showing your work using a table similar to Table 4.3, do the following:
a. Compute the shortest path from *t* to all network nodes.
b. Compute the shortest path from *u* to all network nodes.
c. Compute the shortest path from *v* to all network nodes.
d. Compute the shortest path from *w* to all network nodes.
e. Compute the shortest path from *y* to all network nodes.
f. Compute the shortest path from *z* to all network nodes.

P28. Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node *z*.



P32. Consider the count-to-infinity problem in the distance vector routing. Will the count-to-infinity problem occur if we decrease the cost of a link? Why? How about if we connect two nodes which do not have a link?

P35. Describe how loops in paths can be detected in BGP.



P38. Referring to the previous problem, once router 1d learns about x it will put an entry (x, I) in its forwarding table.

a. Will I be equal to I_1 or I_2 for this entry? Explain why in one sentence.

b. Now suppose that there is a physical link between AS2 and AS4, shown by the dotted line. Suppose router 1d learns that x is accessible via AS2 as well as via AS3. Will I be set to I_1 or I_2? Explain why in one sentence.

c. Now suppose there is another AS, called AS5, which lies on the path between AS2 and AS4 (not shown in diagram). Suppose router 1d learns that x is accessible via AS2 AS5 AS4 as well as via AS3 AS4. Will I be set to I_1 or I_2? Explain why in one sentence.

P47. Consider the topology shown in Figure 4.44. Suppose that all links have unit cost and that node E is the broadcast source. Using arrows like those shown in Figure 4.44 indicate links over which packets will be forwarded using RPF, and links over which packets will not be forwarded, given that node E is the source.

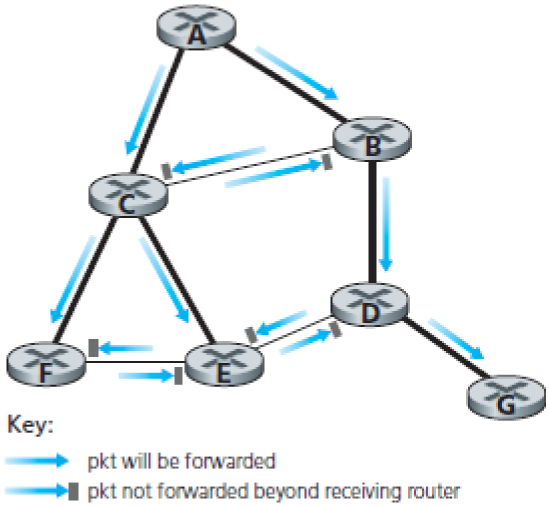


Figure 4.44 ♦ Reverse path forwarding

P49. Consider the topology shown in Figure 4.46, and suppose that each link has unit cost. Suppose node *C* is chosen as the center in a center-based multicast routing algorithm. Assuming that each attached router uses its least-cost path to node *C* to send join messages to *C*, draw the resulting center-based routing tree. Is the resulting tree a minimum-cost tree? Justify your answer.

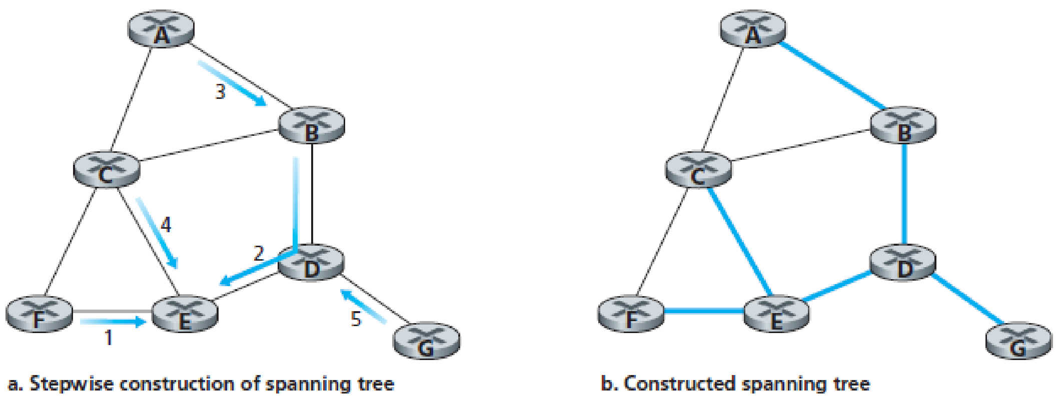


Figure 4.46 ♦ Center-based construction of a spanning tree