4.15 For the network given in Figure 4.50, give global distance-vector tables like those of table 4.5 and 4.8 when

(a)Each node knows only the distances to its immediate neighbor.

(b)Each node has reported the information it had in the preceding step to its immediate neighbors.

(c)Step (b) happens a second time

Solution:

(a)

| Information Stored at Node | Distance to Reach Node | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| A | 0 | ∞ | 3 | 8 | ∞ | ∞ |
| B | ∞ | 0 | ∞ | ∞ | 2 | ∞ |
| C | 3 | ∞ | 0 | ∞ | 1 | 6 |
| D | 8 | ∞ | ∞ | 0 | 2 | ∞ |
| E | ∞ | 2 | 1 | 2 | 0 | ∞ |
| F | ∞ | ∞ | 6 | ∞ | ∞ | 0 |

(b)

| Information Stored at Node | Distance to Reach Node | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| A | 0 | ∞ | 3 | 8 | 4 | 9 |
| B | ∞ | 0 | 3 | 4 | 2 | ∞ |
| C | 3 | 3 | 0 | 3 | 1 | 6 |
| D | 8 | 4 | 3 | 0 | 2 | ∞ |
| E | 4 | 2 | 1 | 2 | 0 | 7 |
| F | 9 | ∞ | 6 | ∞ | 7 | 0 |

(c)

| Information Stored at Node | Distance to Reach Node | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| A | 0 | 6 | 3 | 6 | 4 | 9 |
| B | 6 | 0 | 3 | 4 | 2 | 9 |
| C | 3 | 3 | 0 | 3 | 1 | 6 |
| D | 6 | 4 | 3 | 0 | 2 | 9 |
| E | 4 | 2 | 1 | 2 | 0 | 7 |
| F | 9 | 9 | 6 | 9 | 7 | 0 |

4.17 For the network given in Figure 4.50, show how the link-state algorithm builds the routing table for node D.

Solution:

| Step | Confirmed | Tentative |
|---|---|---|
| 1 | D (0,-) | |
| 2 | D(0, -) | A(8,A) E(2,E) |
| 3 | D(0, -), E(2, E) | A(8, A), C(3, E), B(4, E) |
| 4 | D(0, -), E(2, E), C(3, E) | A(6, E), B(4, E), F(9, E) |
| 5 | D(0, -), E(2, E), C(3, E), B(4, E) | A(6, E), F(9, E) |
| 6 | D(0, -), E(2, E), C(3, E), B(4, E), A(6, E) | F(9, E) |
| 7 | D(0, -), E(2, E), C(3, E), B(4, E), A(6, E), F(9, E) | |
| | Done | |

4.20 For the network in Figure 4.50, suppose the forwarding tables are all established as in Exercise 15 and then C-E link fails. Give

(a) The tables of A, B, D, and F after C and E have reported the news.

(b) The tables of A and D after their next mutual exchange.

(c) The table of C after A exchanges with it.

(a) A:

| Dest | Cost | nexthop |
|---|---|---|
| B | ∞ | |
| C | 3 | C |
| D | ∞ | |
| E | ∞ | |
| F | 9 | C |

B:

| Dest | Cost | nexthop |
|---|---|---|
| A | ∞ | |
| C | ∞ | |
| D | 4 | E |
| E | 2 | E |
| F | ∞ | |

D:

| Dest | Cost | nexthop |
|---|---|---|
| A | ∞ | |
| B | 4 | E |
| C | ∞ | |
| E | 2 | E |
| F | ∞ | |

F:

| Dest | Cost | nexthop |
|---|---|---|

| | | |
|---|---|---|
| A | 9 | C |
| B | ∞ | |
| C | 6 | C |
| D | ∞ | |
| E | ∞ | |

(b) A:

| Dest | Cost | nexthop |
|---|---|---|
| B | 12 | D |
| C | 3 | C |
| D | 8 | D |
| E | 10 | D |
| F | 9 | C |

D:

| Dest | Cost | nexthop |
|---|---|---|
| A | 8 | A |
| B | 4 | E |
| C | 11 | A |
| E | 2 | E |
| F | 17 | A |

(c) C:

| Dest | Cost | nexthop |
|---|---|---|
| A | 3 | A |
| B | 15 | A |
| D | 11 | A |
| E | 13 | A |
| F | 6 | F |

4.25 Suppose a set of routers all use the split-horizon technique; we consider here under what circumstances it makes a difference if they use poison reverse in addition.
(a) Show that poison reverse makes no difference in the evolution of the routing loop in the two examples described in Section 4.2.2, given that the hosts involved use split horizon.
(b) Suppose split-horizon routers A and B somehow reach a state in which they forward traffic for a given destination X toward each other. Describe how this situation will evolve with and without the use of poison reverse.
(c) Give a sequence of events that leads A and B to a looped states as in (b), even if poison reverse is used. (Hint: Suppose B and A connect through a very slow link. They each reach X through a third nod, C, and simultaneously advertise their routes to each other.)

Solution:
(a). The textbook already explains how poison reverse is not needed when F-G fails. When the A-E

link fails, the following sequence (or something similarly bad) may happen depending on the timing, whether or not poison reverse is used.

i. A sends (E, inf) to B.

ii. C sends (E, 2) to B. This route is via A.

iii. A sends (E, inf) to C.

iv. B sends (E, 3) to A. This route is via C.

v. C sends (E, inf) to B.

vi. A sends (E, 4) to C. This route is via B.

vii. B sends (E, inf) to A.

viii. C sends (E, 5) to B. This route is via A.

ix. A sends (E, inf) to C.

x. B sends (E, 6) to A. The oscillation goes on and on like this.

(b)Without poison reverse, A and B would send each other updates that simply didn't mention X; presumably (this does depend somewhat on implementation) this would mean that the false routes to X would sit there until they eventually aged out. With poison reverse, such a loop would go away on the first table update exchange.

(c)

1. B and A each send out announcements of their route to X via C to each other.
2. C announces to A and B that it can no longer reach X; the announcements of step 1 have not yet arrived.
3. B and A receive each others announcements from step 1, and adopt them.

4.40 An organization has a class C network 200.1.1 and wants to form subnets for four departments, with hosts as follows:

A 72 hosts

B 35 hosts

C 20 hosts

D 18 hosts

There are 145 hosts in all.

(a) Give a possible arrangement of subnet masks to make this possible.

(b) Suggest what the organization might do if department D grows to 34 hosts.

Solution:

(a) Giving each department a single subnet, the nominal subnet sizes are 27, 26, 25, 25 respectively; we obtain these by rounding up to the nearest power of 2. A possible arrangement of subnet numbers is as follows. Subnet numbers are in binary and represent an initial segment of the bits of the last byte of the IP address; anything to the right of the / represents host bits. The / thus represents the subnet mask. Any individual bit can, by symmetry, be flipped throughout; there are thus several possible bit assignments.

A 0/ one subnet bit, with value 0; seven host bits

B 10/
C 110/
D 111/
The essential requirement is that any two distinct subnet numbers remain distinct when the longer one is truncated to the length of the shorter.
(b) We have two choices: either assign multiple subnets to single departments, or abandon subnets and buy a bridge. Here is a solution giving A two subnets, of sizes 64 and 32; every other department gets a single subnet of size the next highest power of 2:
A 01/
001/
B 10/
C 000/
D 11/