CHAPTER 14

Unicast Routing Protocols (RIP, OSPF, and BGP)

Exercises

1. RIP is an intradomain routing protocol that enables routers to update their routing tables within an autonomous system.

2. A RIP message is used by a router to request and receive routing information about an autonomous system or to periodically share its knowledge with its neighbors.

3. The expiration timer is 6 times that of the periodic timer to allow for some missed communication between routers.

4. The hop count limit helps RIP instability by limiting the number of times a message can be sent through the same router, thereby limiting the back and forth updating that may occur if part of a network goes down.

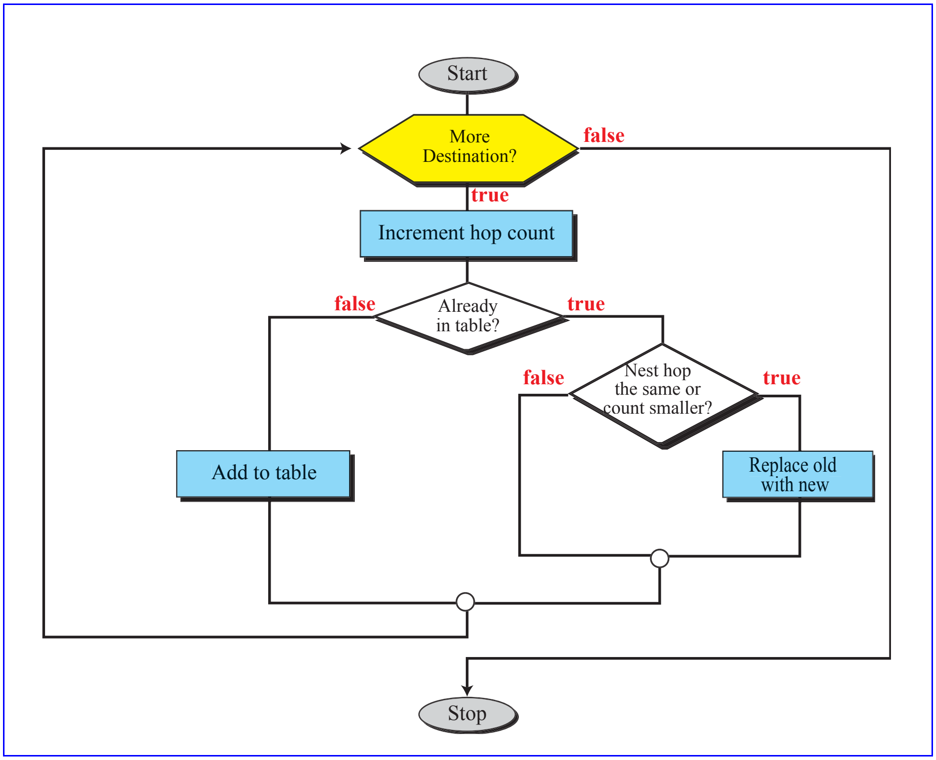
5. The two major shortcomings are two-node instability and three-node instability. For the former, infinity can be re-defined as a number such as 20. Another solution is the split horizon strategy or split horizon combined with poison reverse. These methods do not work for three-node instability.

6. The basis for classification of networks in OSPF is the number of routers connected to the network.

7. In distance vector routing each router sends all of its knowledge about an autonomous system to all of the routers on its neighboring networks at regular intervals. It uses a fairly simple algorithm to update the routing tables but results in a lot of unneeded network traffic. In link state routing a router floods an autonomous system with information about changes in a network only when changes occur. It uses less network resources than distance vector routing in that it sends less traffic over the network but it uses the much more complex Dijkstra Algorithm to calculate routing tables from the link state database.

8. See Figure 14.1.

Figure 14.1 *Exercise 8*



9. OSPF messages are propagated immediately because a router using OSPF will immediately flood the network with news of any changes to its neighborhood. RIP messages are distributed slowly because a network using RIP relies on the periodic updates that occur every 30 seconds to carry any news from one router to the next and to the next. This process may take a lot of time.

10. The general formula can be given as follows:

$$\textbf{Number of bytes in the message} = 4 + (20 \times N)$$

N is the number of advertised networks. A RIP message that advertises a single network (N = 1) would be 24 bytes.

11. One periodic timer is needed.

12. 20 expiration timers are needed, one for each entry.

13. 5 garbage collection timers are needed, one for each invalid route.

14. We assume that router C is 1 hop away. Then the modified table from C is:

Table 14.1

Network	*Hops*
Net1	3
Net2	2
Net3	4
Net4	8

Comparing this to the old table, we get the following:

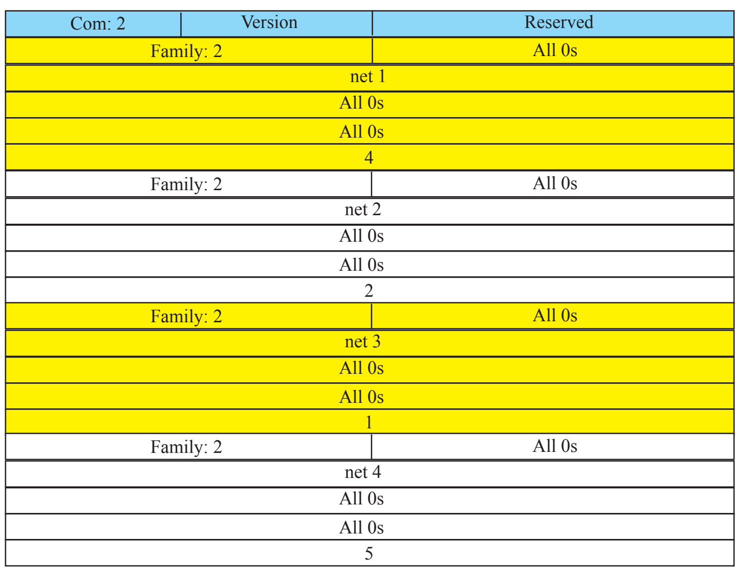
Table 14.2

Network	*Hops*	
Net1	3	C
Net2	2	C
Net3	1	F
Net4	5	G

15. 2 + (10 × N) = Empty bytes in a message advertising N networks

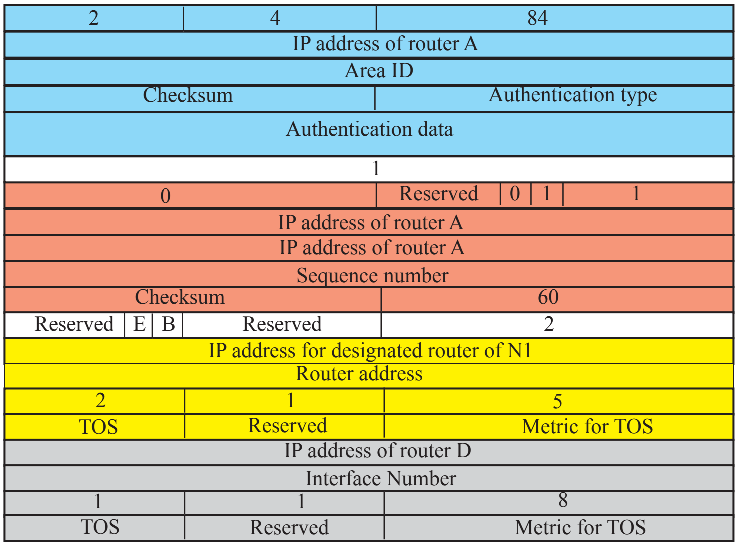
16. See Figure 14.2.

Figure 14.2 *Exercise 16*



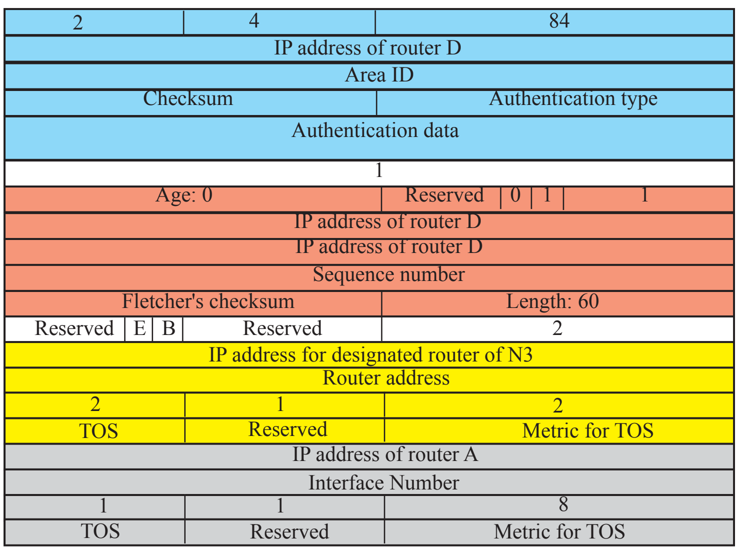
17. See Figure 14.3.

Figure 14.3 *Exercise 17*



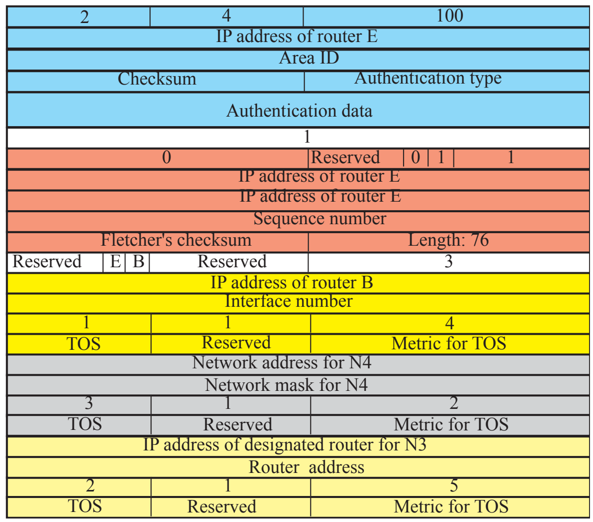
18. See Figure 14.4.

Figure 14.4 *Exercise 18*



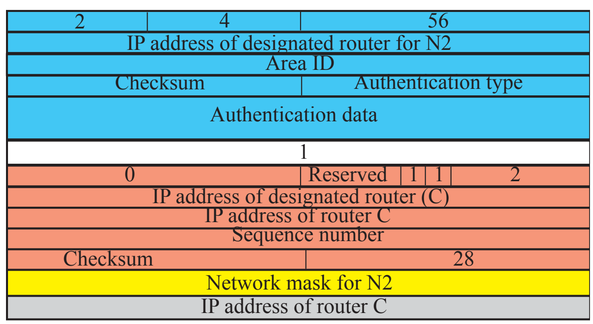
19. See Figure 14.5.

Figure 14.5 *Exercise 19*



20. See Figure 14.6 .

Figure 14.6 *Exercise 20*



21. See Figure 14.7.

22. See Figure 14.8.

23. See Figure 14.9.

Figure 14.7 *Exercise 22*

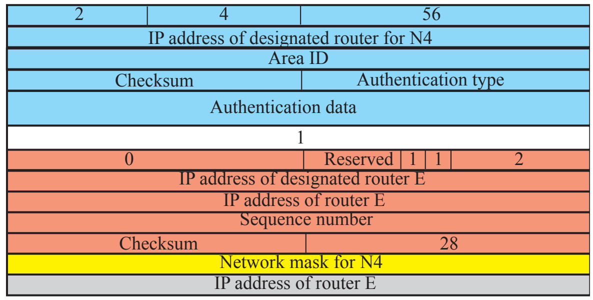


Figure 14.8 *Exercise 22*

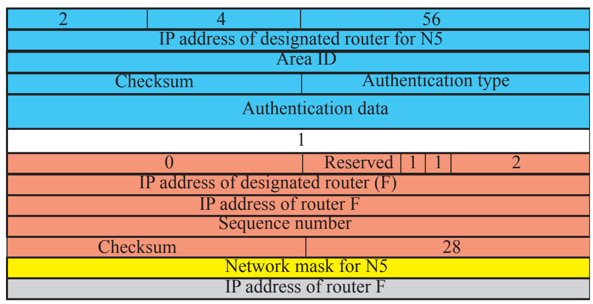
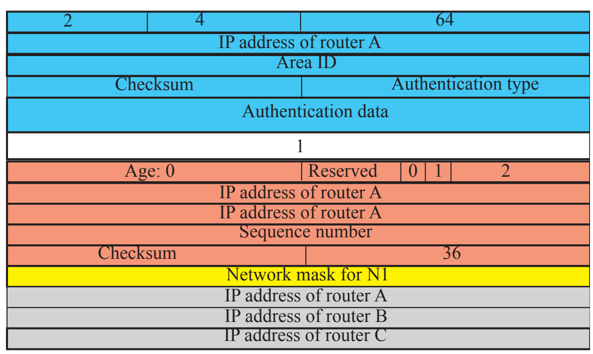


Figure 14.9 *Exercise 23*



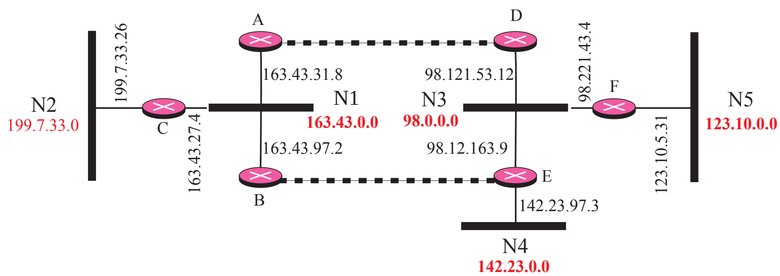
24. See Figure 14.10.

Figure 14.10 *Exercise 24*

2	4	64			
IP address of router D					
Area ID					
Checksum		Authentication type			
Authentication data					
1					
0		Reserved	0	1	2
IP address of router D					
IP address of router D					
Sequence number					
Checksum		36			
Network mask for N3					
IP address of router D					
IP address of router E					
IP address of router F					

25. See Figure 14.11.

Figure 14.11 *Exercise 25*



26. See Figure 14.12. We assume that the router C has does not know any neighbor yet. Therefore, we did not include any neighbor IP addresses..

Figure 14.12 *Exercise 26*

From router C through 163.43.0.0

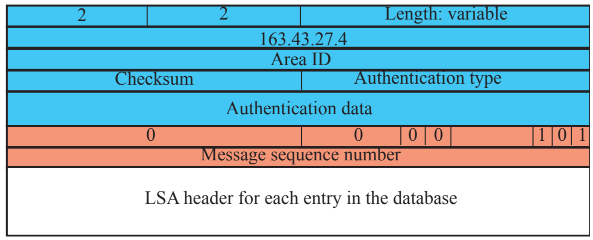
2	1	44			
163.43.27.4					
Area ID					
Checksum		Authentication type			
Authentication data					
255.255.0.0					
Hello interval		0	0	1	Priority
Dead interval					
Designated router for 163.43.0.0					
Backup designated router for 163.43.0.0					

From router C through 199.7.33.0

2	1	44			
199.7.33.26					
Area ID					
Checksum		Authentication type			
Authentication data					
255.255.255.0					
Hello interval		0	1	1	Priority
Dead interval					
199.7.33.26					
199.7.33.26					

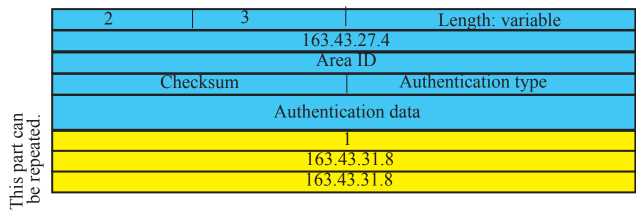
27. See Figure 14.13.

Figure 14.13 *Exercise 27*



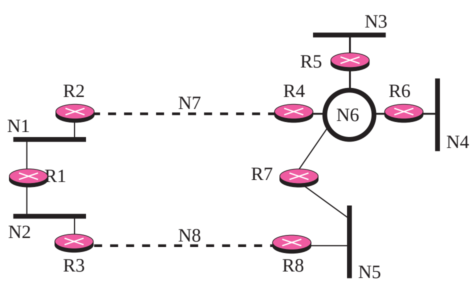
28. See Figure 14.14. We have shown the case that the router is looking for one LSA. It needs to repeated if the router needs more LSAs. .

Figure 14.14 *Exercise 28*



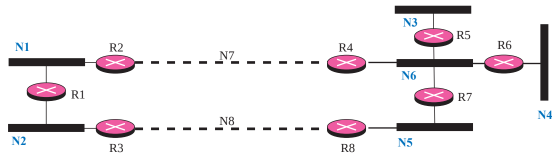
29. See Figure 14.15.

Figure 14.15 *Exercise 29*



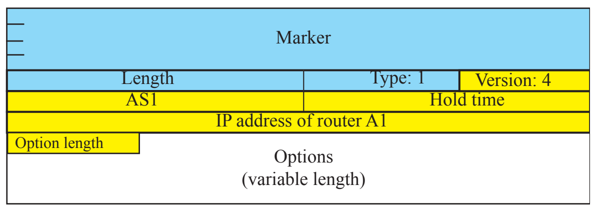
30. See Figure 14.16.

Figure 14.16 *Exercise 30*



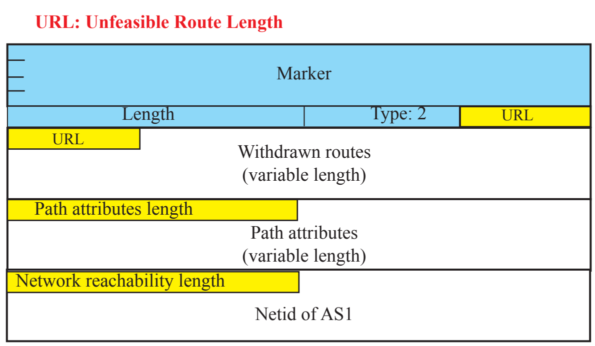
31. Transient networks: N1, N2, N5, and N6. Stub networks: N3 and N4
32. See Figure 14.17.

Figure 14.17 *Exercise 32*



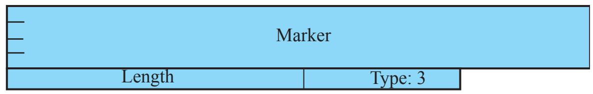
33. See Figure 14.18.

Figure 14.18 *Exercise 33*



34. See Figure 14.19.

Figure 14.19 *Exercise 34*



35. See Figure 14.20.

Figure 14.20 *Exercise 35*