CHAPTER 21

PRACTICE SET

Questions

Q21-1. Each router using DVMRP creates the shortest-path three in three steps:

- **a.** In the first step, the router uses the RPF algorithm to keep only packets that have arrived from the source using the shortest-path three. In other words, the first part of the tree is made using the RPF algorithm.
- **b.** In the second step, the router uses the RPB algorithm to create a broadcast tree.
- **c.** In the third step, the router use the RPM algorithm to change the broadcast tree created in the second step to a multicast tree.

Q21-2.

- **a.** In the source-based tree approach, we need $20 \times 4 = 80$ shortest-path trees.
- **b.** In the group-shared tree, we need only 4 shortest-path trees, one for each group.

Q21-3. In multicasting, the sender host sends only one copy of the message, but it is multiplied at the routers if needed; all multiplied copies have the same destination address. In multiple-unicasting, the sender host sends one copy for each destination; each copy has its own destination address.

Q21-4. RPF does not create a shortest path tree; it uses the unicast forwarding table to find the previous node in the unicast shortest-path tree from the source to each itself. It accepts multicast messages only from that previous node.

Q21-5. Every multicast routing algorithm needs to somehow use a unicast protocol in its operation. For example, DVMRP needs to use RIP and MOSPF needs to use OSPF. Although PIM also needs to use a unicast protocol, the protocol can be either RIP or OSPF.

Q21-6. The group list is the union of the individual lists; it is {G1, G2, G3, G4}.

Q21-7.

a. In unicast communication, the destination is only one of the leaves of the tree in each transmission.

b. In multicast communication, the destination may be one or more leaves of the tree in each transmission.

Q21-8. Sending a multiple-recipient e-mail is a case of multiple unicasting. An email message needs recipient addresses at the application layer, which cannot be translated to a multicast address at the network layer. The recipients of an email address do not necessarily belong to the same group. In other words, we a one-to-many communication at the application layer, which should not be confused to one-to-many communication at the network layer.

Q21-9. DVMRP allows a router to create the shortest path-tree whenever it receives a multicast packet (on demand).

a. The number of shortest-path trees in DVMRP that use the source-based approach is huge.

b. If each router created all of the required multicast shortest-path trees, it would be a huge overhead.

Q21-10. PIM-DM is very similar to DVMRP, but it does not care about controlling the broadcast step of DVMRP because it assumes that most networks have a loyal member in each group. It only uses the first step (RPF) and the third step (RPM).

Q21-11. RPB creates a broadcast shortest path tree with the source as the root and networks as the leaves. In other words, it tries a shortest path from the source to every network assuming that all networks are interested to receive that particular group message.

Q21-12. In each case, we find the corresponding block to be able to find the group

a. 224.0.1.7 belongs to the block 224.0.1.0/24; it belongs to the internetwork control block.

b. 232.7.14.8 belongs the block 232.0.0.0/8; it belongs to the SSM block.

c. 239.14.10.12 belongs the block 239.0.0.0/8; it belongs to the administratively scoped block.

Q21-13. If a host is a member of *N* multicast group, it will have *N* multicast addresses.

Q21-14. MOSPF uses Dijkstra's algorithm to create the whole broadcast path tree in one shot, but DVMRP needs to use three steps because it does not have the LSDB to use Dijkstra's algorithm.

Q21-15. The multicast address block is 224.0.0.0/4. In other words, a multicast address is between 224.0.0.0 and 239.255.255.255. Based on this criteria we have

a. A multicast **b.** A multicast **c.** Not a multicast

Q21-16. RPF creates a multicast shortest path tree. It takes the broadcast shortest path tree created by the RPB and prunes the connection to those network that have no active member in that particular group.

Q21-17. In PIM-DM, it is assumed that most networks have a loyal member in each group, so it does not matter if the first packet reaches all networks. In PIM-SM, it is assumed that a few networks has a loyal member in each group, so broadcasting is wasting the bandwidth.

Problems

P21-1. Please correct the errors in this problem using the errata. Since router B tells that the source is 4 hops away, router B needs to be selected as the designated router.

P21-2. The AS number 24101 is (94.37) in base 256. We insert this two bytes in the block 233.*x*.*y*.0 to get the block **233.94.37.0/24**.

P21-3. We use binary notation to do transformation:

		11011111	00011000	00111100	00001001
			↓	↓	↓
00000001	00000000	01011110	00011000	00111100	00001001

The resulting address in hexadecimal is: **01:00:5E:18:3C:09**. Using the same method, we get the same result.

P21-4. Router R can prune $n - m$ networks that have no interest in the group.

P21-5. We define two properties for a block in classless addressing. The first address needs to divide the number of addresses in the block. The number of addresses in the block should also be a power of 2. Let us check these properties for these two blocks (two applets for chapter 4 can easily find the values).

a. In the first block, the value of the first address is 3,758,096,895 and the number of addresses in the block is 65,024. None of the conditions meet. The block is intended to be split in the future.

b. In the second block, the value of the first address is 3,758,292,992 and the number of addresses in the block is 134,021,120. None of the conditions meet. The block is intended to be split in the future.

c. In the third block, the value of the first address is 3,925,868,544 and the number of addresses in the block is 83,886,080. None of the conditions meet. The block is intended to be split in the future.

P21-6. To answer this question, we need to know the number of hops between the router and the source and the network address of the network where the source is located. Assuming the network address is 10.0.0.0, the entries look like

Destination	***Hops***	***Interface***
...	...	...
10.0.0.0	X	2
...	...	...

P21-7. There is no need for a *report message* to travel outside of its own network because its only purpose is to inform the next router in the spanning tree of group membership. There is no need for a *query message* to travel outside of the local network because its only purpose is to poll the local network for membership in any groups.

P21-8. In each case, we find the rightmost three bytes, subtract 8 from the leftmost digit if it is greater than 8, and add the result to the starting Ethernet address. Note that *a* and *b* represent the same Ethernet address.

a.

Original IP Address:					**E0**	**:**	**12**	**:**	**48**	**:**	**08**
After subtraction:							**12**	**:**	**48**	**:**	**08**
Result:	**01**	**:**	**00**	**:**	**5E**	**:**	**12**	**:**	**48**	**:**	**08**

b.

Original IP Address:					**EB**	**:**	**12**	**:**	**48**	**:**	**08**
After subtraction:							**12**	**:**	**48**	**:**	**08**
Result:	**01**	**:**	**00**	**:**	**5E**	**:**	**12**	**:**	**48**	**:**	**08**

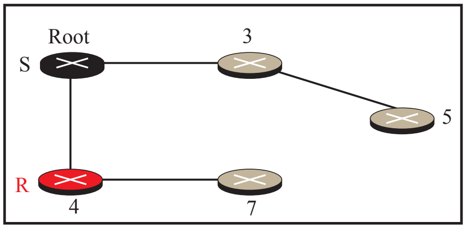
c.

Original IP Address:					**ED**	**:**	**12**	**:**	**06**	**:**	**58**
After subtraction:							**12**	**:**	**06**	**:**	**58**
Result:	**01**	**:**	**00**	**:**	**5E**	**:**	**12**	**:**	**06**	**:**	**08**

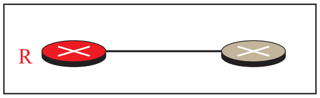
d.

Original IP Address:					**94**	**:**	**58**	**:**	**0C**	**:**	**08**
After subtraction:							**58**	**:**	**0C**	**:**	**08**
Result:	**01**	**:**	**00**	**:**	**5E**	**:**	**58**	**:**	**0C**	**:**	**08**

P21-9. The following show the shortest path from the source and the shortest path tree seen from router R.



a. Shortest path tree seen by router S



b. Shortest path tree seen by router R