CSC / ECE 573 Internet Protocols, Fall 2005

# Homework #5



**Due Date**

- Due Tuesday, November 8, at 11:45pm

**Instructions**

- Homeworks should be submitted individually. We use the standard submit utility for our class to submit all work, which means your work must be prepared electronically.
- Put your name, the assignment number, and date at the top of the first page. Put solutions in order (don't make the TA hunt for your solution).
- Do not plagiarize; that means, do not copy content from any source without permission from the instructor, and if permitted, acknowledge the source.
- This homework is worth a total of 100 points

**Problems**

1. A subnetted network hosts a machine M with an IP address of 154.213.129.112. If the subnet mask of this network is 255.255.224.0, assuming this is a classful address, provide the following information about M's IP address:
    1. Network ID
    2. Subnet ID
    3. Host ID
    4. Network directed broadcast address
    5. Subnet broadcast address
    6. first IP address and last IP address in the subnet
    7. Maximum number of hosts in the subnetwork
    8. Maximum number of such subnetworks in the network.

2. A class C address is subnetted. What should be the value of the subnet mask in order to support as many subnetworks as possible, while having at least 20 hosts in each subnetwork? Using your suggested subnet mask, how many subnetworks can be supported, and how many hosts can be accomodated in each subnetwork?

3. Consider a site that chooses to subnet a class B network address, but decides that some physical nets will use 6 bits of the local portion to identify the physical networks, while others will use 8. Find an assignment of host addresses that makes destination addresses ambiguous.

4. A contiguous subnet mask in class A can have how many 1's, with the remaining bits 0's?

5. What is the most efficient (fewest, largest) CIDR advertisement(s) for the set of addresses in the range from 195.5.96.0 to 195.5.159.255 inclusive? The advertisement(s) should only include the networks in this range.

6. If addresses 194.0.0.0 through 194.36.20.255 are already allocated, and a business asks for 4096 addresses to be allocated to it, what is the lowest starting address that can be allocated to it, and what mask is assigned to it? (dotted decimal form preferred)

7. A router has routes as follows:

```
Network Address                       / Mask                                  / Next Hop
11000010 00011000 00000000 00000000 / 11111111 11111111 11111000 00000000 / R1
11000010 00011000 00000010 00000000 / 11111111 11111111 11111110 00000000 / R2
11000010 00011000 00001000 00000000 / 11111111 11111111 11111100 00000000 / R2
11000010 00011000 00010000 00000000 / 11111111 11111111 11110000 00000000 / R3
00000000 00000000 00000000 00000000 / 00000000 00000000 00000000 00000000 / R4
```

   To which network will each of the following packets be routed? Justify your answer.
   1. 192.24.3.35
   2. 194.24.23.93
   3. 194.24.12.45
   4. 194.24.2.100
   5. 194.24.30.29

8. If a network starts with the (classless) address 153.98.14.0 and ends with the address 153.98.15.255 how many 1's are there in the CIDR mask for this network?

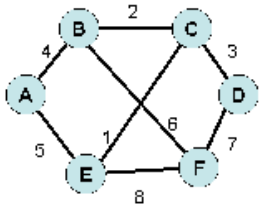
9. An organization is given 16 class C addresses beginning with X.Y.80.0. What is the supernet mask?

10. The set of IP addresses from 29.18.0.0 to 29.18.128.255 has been aggregated to 29.18.0.0/17. However, there is a gap of 1024 unassigned addresses from 29.18.60.0 to 29.18.63.255 that are now suddenly assigned to a network using a different outgoing interface. Is it now necessary to split up the aggregated address into it constituent blocks and reaggregate? Explain and show the result.

11. Under what circumstances will a hop count metric produce better routes than a metric based on delay?

12. Can you imagine a situation in which an autonomous system chooses *not* to advertise all its networks? Hint: think of a university.

13. Consider the subnet of the figure below. Distance vector routing is used and the following vectors have just come in to router C:
    from B: (5,0.8.12.6,2);
    from D: (16,12,6,0,9,10);
    and from E: (7,6,3,9,0,4).
    The measured delays to B, D, and E are 6, 3, and 5, respectively. What is C's new routing table? Give both the outgoing interface to use and the expected delay to the destination.




14. For the following network, what is the distance and next hop from each router to the target network?

```
      2
   A-----B
  / \   2/ \
 /  2\ /   |
 |    C   /     Link costs are shown
10\ 11| /3
   \  |/
    --D
      |<=== target network
```

    If the link from B to D goes down, show what the sequence of distances/next hops is for each router to the target network, assuming routers send updates at the same time, using...
    1. normal distance vector updates
    2. distance vector with split horizon

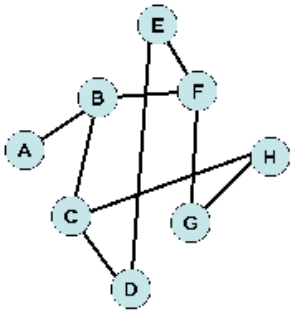
15. Consider the distance vector update shown in Figure 14.7 (reproduced below) of the text carefully. For each item updated in the table, give the reason why the router will perform the update. The first table is an existing router K's table, and the second is an incoming routing update message from router J. The marked entries are used to update existing entries or add new entries for router K.

| Destination | Distance | Route |
|---|---|---|
| **Network 1** | 0 | direct |
| **Network 2** | 0 | direct |
| **Network 4** | 8 | Router L |
| **Network 17** | 5 | Router M |
| **Network 24** | 6 | Router J |
| **Network 30** | 2 | router Q |
| **Network 42** | 2 | router J |

| Destination | Distance |
|---|---|
| Network 1 | 2 |
| ***Network 4 | 3 |
| Network 17 | 6 |
| ***Network 21 | 4 |
| Network 24 | 5 |
| Network 30 | 10 |
| ***Network 42 | 3 |

16. Read the RIP specification carefully. Can routes reported in a response to a query differ from the routes reported by a routing update message? If so, how?

17. Assume for the following network that LSA flooding is done synchronously (each node floods LSAs as needed at each iteration). If all nodes flood their LSAs at the same time, how many iterations will it take until flooding of router B's LSA's is complete, and on what links will information be flooded in each iteration?




18. How does OSPF minimize the number of messages transmitted when LSAs are flooded?

19. Read the OSPF specification carefully. What is the virtual link facility for, and how is it used?

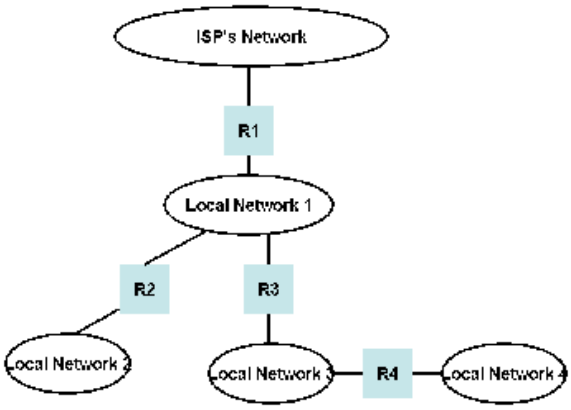
20. An OSPF router on the boundary of an area containing networks which can be aggregated as 10.2.0.0/16 creates a summary LSA to send to neighboring area boundary routers. The cost advertised is 7. Show the resulting summary LSA.

21. A broadcast subnet connects routers with interfaces 10.4.7.2, 10.4.7.1, 10.4.7.3, 10.4.7.4, and 10.4.7.5. If 10.4.7.3 has been elected the Designated Router, show the Network LSA it advertises for this subnet.

22. Three routes are aggregated by AS20 before advertising to other AS'es. The PATH attributes of these 3 routes are [AS2,AS4,AS7], [AS4, AS9, AS12], and [AS2,AS4,AS10,AS12]. What is the PATH attribute for the aggregated

route that is advertised by AS20?

23. For the networks in figure 15.2 of our textbook (Comer, vol. I, 4th ed), which router(s) should run BGP, and why? This figure is reproduced below. Assume that the ISP shown is one AS, and the local networks are all part of another AS. [Someone informs me (I haven't verified this) that the text says network 4 is also attached to another ISP as well, which would be a 3rd AS].




24. Examine the BGP-4 specification carefully. Is it legal for a router to advertise reachability to a destination if it has not installed a route to that network in its local routing table? Explain.

*Created on November 1 , 2005*
*Last Modified November 8, 2005*
*Maintained by Douglas S. Reeves*