**­CS 6043: Computer Networking**

**SPRING 2016**

**HOMEWORK #3**

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1. (20 pts) Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets? And what are the ranges of IP addresses for the four subnets?

**Answer:**

IP address range: 128.119.40.128 – 128.119.40.191

128.119.40.128 (last 8 bits: 10000000, reserved address), 128.119.40.191(last 8 bits: 10111111, reserved address, broadcast)

Four Subnets:

1. 128.119.40.64/28
2. 128.119.40.80/28
3. 128.119.40.96/28
4. 128.119.40.112/28

2. (20 pts) A router has the following (CIDR) entries in its routing table:

Address/Mask Next hop

135.46.56.0/22 Interface 0

135.46.60.0/22 Interface 1

192.53.40.0/23 Router 1

default Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?

**Answer:**

1. 135.46.63.10

Taking the first 22 bits of 135.46.63.10 as network address,

135.46.63.10 = 10000111 00101110 00111111 00001010

255.255.252.0 = 11111111 11111111 11111100 00000000

135.46.60.0 = 10000111 00101110 00111100 00000000

Match with network address in the routing table. The 2nd row matches. The router will forward the packet to Interface 1

2. 135.46.57.14

135.46.57.14 = 10000111 00101110 00111001 00001110

255.255.252.0 = 11111111 11111111 11111100 00000000

135.46.56.0 = 10000111 00101110 00111100 00000000

It matches entry with 135.46.56.0/22 and no other matches found, so it’s forwarded to Interface 0.

3. 135.46.52.2

135.46.52.1 = 10000111 00101110 00110100 00000010

255.255.252.0 = 11111111 11111111 11111100 00000000

135.46.52.0 = 10000111 00101110 00110100 00000000

It doesn’t match any entry, so it’s forwarded to the one defined in default entry namely Router 2

4. 192.53.40.7

192.53.40.7 = 11000000 00110101 00101000 00000111

255.255.254.0 = 11111111 11111111 11111110 00000000

192.53.40.0 = 11000000 00110101 00101000 00000000

It matches entry with 192.53.40.0/23, and no other matches found, so it’s forwarded to Router 1

5. 192.53.56.7

192.53.56.7 = 11000000 00110101 00111000 00000111

255.255.254.0 = 11111111 11111111 11111110 00000000

192.53.56.0 = 11000000 00110101 00111000 00000000

It doesn’t match any entry, so it’s forwarded to the one defined in defaults entry, namely, Router 2.

3. (20 pts)

a) Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. How many datagrams would be required to send an MP3 file consisting of 2 million bytes? Assume that IP header is 20-byte and that the data is carried in TCP segments. Explain how you computed your answer.

**Answer:**

MP3 file size = 2 million bytes. Assume the data is carried in TCP segments, with each TCP segment also having 20 bytes of header. Then each datagram can carry 1500-40=1460 bytes of the MP3 file

Number of datagrams required => (2 \* (10^6))/1460 =1369.8630

All but the last datagram will be 1,500 bytes; the last datagram will be 1260+40 = 1300 bytes. Note that here there is no fragmentation – the source host does not create datagrams larger than 1500 bytes, and these datagrams are smaller than the MTUs of the links

b) 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?

**Answer:**

Max sixe of data field in fragment = 700 -20 =680

(2400-20)/680 = 4

All fragments’ identification number is 422. All fragments except the last one should be 700 bytes, the last datagram should be 360 bytes. The offset of 4 fragments should be 0, 85, 170, 255. The fragment bit flag of first 3 fragments will be 1, the last fragment bit flag will be 0.

4. (20 pts) 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 in your textbook.



Answer:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Step | N’ | D(t),p(t) | D(u),p(u) | D(v),p(v) | D(w),p(w) | D(y),p(y) | D(z),p(z) |
| 0 | x | ∞ | ∞ | 3,x | 6,x | 6,x | 8,x |
| 1 | xv | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |
| 2 | xvu | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |
| 3 | xvuw | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |
| 4 | xvuwy | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |
| 5 | xvuwyt | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |
| 6 | xvuwytz | 7,v | 6,v | 3,x | 6,x | 6,x | 8,x |

5. (20 pts) 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.



**Answer:**

Step1:

Source / Destination

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | U | V | X | Y | Z |
| V | ∞ | ∞ | ∞ | ∞ | ∞ |
| X | ∞ | ∞ | ∞ | ∞ | ∞ |
| Z | ∞ | 6 | 2 | ∞ | 0 |

Step2:

Source / Destination

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | U | V | X | Y | Z |
| V | 1 | 0 | 3 | ∞ | 6 |
| X | ∞ | 3 | 0 | 3 | 2 |
| Z | 7 | 5 | 2 | 5 | 0 |

Step3:

Source / Destination

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | U | V | X | Y | Z |
| V | 1 | 0 | 3 | 3 | 5 |
| X | 4 | 3 | 0 | 3 | 2 |
| Z | 6 | 5 | 2 | 5 | 0 |

Step4:

Source / Destination

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | U | V | X | Y | Z |
| V | 1 | 0 | 3 | 3 | 5 |
| X | 4 | 3 | 0 | 3 | 2 |
| Z | 6 | 5 | 2 | 5 | 0 |