CSC/ECE 573 Section 001

Spring 2017

Homework #1

Keywords: Classless Addressing, CIDR, Sub-netting, Super-netting

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Instructions

- You can do this homework in groups of two (at most).
- The total number of points is 30.
- You must answer all questions for full credit.
- Use only this paper for your answers, in the space provided.
- The due date is as posted on the web page (please submit your answers through Wolfware).

Question 1: [9 pts]

[1] **[2 points]** Given the following two address/mask combinations assigned to devices A and B. Determine if these devices are on the same subnet or different subnets.
Device A: 172.16.17.30/20
Device B: 172.16.28.15/20

Device A: 10101100.00010000.00010001.00011110
11111111.11111111.11110000.00000000
subnet: 10101100.0001000.00010000.00000000 = 172.16.16.0

Device B: 10101100.00010000.00011100.00001111
11111111.11111111.11110000.00000000
subnet: 10101100.0001000.00010000.00000000 = 172.16.16.0

Obviously, these devices are on the same subnet.

[2] Given the Class C network of 204.15.5.0/24. An administrator needs to subnet his network and has the following requirements:

Subnet A: must support 14 hosts
Subnet B: must support 28 hosts
Subnet C: must support 2 hosts
Subnet D: must support 7 hosts
Subnet E: must support 28 host

A) **[3 points]** Provide the address/mask of the 5 subnets when all 5 subnets have the same size.
Subnet A: 204.15.5.0/27
Subnet B: 204.15.5.32/27
Subnet C: 204.15.5.64/27
Subnet D: 204.15.5.96/27
Subnet E: 204.15.5.128/27

B) **[4 points]** Provide the address/mask of the 5 subnets when all 5 subnets have the minimal possible *power of two* size. For example, a subnet with 7 hosts should accommodate at most 2^3=8 hosts.

Subnet A: 204.15.5.0/28
Subnet B: 204.15.5.32/27
Subnet C: 204.15.5.64/31
Subnet D: 204.15.5.96/29
Subnet E: 204.15.5.128/27

Question 2: [8 points]

A large number of consecutive IP addresses are available starting at 204.16.0.0. Suppose that four organizations A, B, C, and D, request 4000, 4000, 2000, and 8000 addresses, respectively and in that order.

A) **[5 points]** For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the *w.x.y.z/s* notation.

A: 204.16.0.0 – 204.16.15.255	204.16.0.0/20
B: 204.16.16.0 – 204.16.31.255	204.16.16.0/20
C: 204.16.32.0 – 204.16.39.255	204.16.32.0/21
D: 204.16.64.0 – 204.16.95.255	204.16.64.0/19

B) **[3 points]** Later it is found that all of them need to be forwarded to the same router, anyway. Can any of them be aggregated? Explain.

Obviously, A and B can be aggregated into 204.16.0.0/19, then they could be aggregated with C into 204.16.0.0/18. Finally, they could be aggregated into 204.16.0.0/17.

Question 3: [7 points]

An organization purchases a Class B address space and plans to use subnetting to assign addresses to its end nodes, which are spread across multiple physical networks. There are 30 networks, and the network with the largest number of hosts has 100 hosts. The administrator desires to use the same subnet mask in all routes of all internal routers if this is possible.

A) **[4 points]** What are the possible subnet masks it could use?

To distinguish 30 networks, we need 5 bits at least. To distinguish 100 hosts, we need 7 bits at least. As for Class B address, we have 16 bits for hosts. Thus, the subnet ID part could be 5, 6, 7, 8 or 9 bits long. These correspond respectively to /21, /22, /23, /24 and /25 masks.

B) **[3 points]** Suppose it is known that one of the networks will later grow to 150 hosts. Which of the masks identified in part (A) will continue to work and which will not?

To distinguish 150 hosts, we need 8 bits at least. Thus, the subnet Id part could be 5, 6, 7 or 8 bits long. These correspond respectively to /21, /22, /23 and /24 masks.

Question 4: [6 points]

A router has just received the following new IP addresses: 88.62.104.0/21, 88.62.112.0/21, 88.62.120.0/21 and 88.62.128.0/21. If all of them use the same outgoing interface, can they be aggregated? If so, to what? If not, why not?

88.62.104.0/21: 01011000, 00111110, 01101000, 00000000
88.62.112.0/21: 01011000, 00111110, 01110000, 00000000
88.62.120.0/21: 01011000, 00111110, 01111000, 00000000
88.62.128.0/21: 01011000, 00111110, 10000000, 00000000

Since we have four /21 address, it would be aggregated for /19 if they are aggregated. Because other bits are same, the IP addresses' 17^{th} bit to 24^{th} bit are as followed.
1) 01101 [000]
2) 01110 [000]
3) 01111 [000]
4) 10000 [000]

The first three addresses' 17^{th} bit to 19^{th} bit are same. However, the fourth address is totally different. So the above IP address can be aggregated as 88.62.0.0/16