

Assignment #8

No late assignments accepted!

ECE 487 (Data Communications Networks) **Section B1**

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Your Last Name: _____ Your First Name: _____

Your Student ID: _____

Due: Thursday, March 19, 2020, 4:00 PM, in the assignment box at 2nd Floor - Pedway between ICE and ETLC

1. Change the following IP addresses from binary notation to dotted-decimal notation. (4 points)

- a) 01110110 11101110 01100111 01111011
- b) 10101110 11000010 11111000 00011101
- c) 11011111 11110000 00001110 01011101
- d) 11110111 11101111 11000111 00011100

Solution:

- a) 118.238.103.123
- b) 174.194.248.29
- c) 223.240.14.93
- d) 247.239.199.28

2. In a block of addresses with mask "/15", we know the IP address of one host is 24.32.12.56. What are the first address and the last address in this block? **Please show the addresses using dotted-decimal notation.** (4 points)

Solution:

The mask is $n=15$.

We write the given IP address in binary: 00011000.00100000.00001100.00111000

We change the $32-n=17$ rightmost bits to all 0s, and get the first address in the block: 00011000.00100000.**00000000.00000000** (24.32.0.0).

We change the $32-n=17$ rightmost bits to all 1s, and get the last address in the block: 00011000.00100000.**1.1111111.1111111** (24.33.255.255).

3. (12 points) An organization is granted the address block 16.0.0.0/8. The administrator wants to create 1024 equal-size subnets. Assume no address is left unused after the 1024 subnets are created.

a) Find the subnet mask. (2 points)

b) Find the number of addresses in each subnet. (2 points)

c) Find the first and last addresses (using dotted-decimal notation) in the first subnet. (4 points)

d) Find the first and last addresses (using dotted-decimal notation) in the last subnet. (4 points)

Solution:

a)&b): the total number of addresses of the organization is: $2^{32-8} = 2^{24}$.

The number of addresses in each subnet is $2^{24}/1024 = 2^{14}$. Therefore, the subnet mask is 32-14=18.

c)&d): Since the mask for the organization is 8, the first 8 bits of all addresses should be 0b00010000 (here "0b" means the following number is in binary format). Since the subnet mask is 18, the 10 bits following the first 8 bits will distinguish the 1024 subnets: the 10 bits are (0,0,0,0,0,0,0,0,0,0) for the first subnet, the 10 bits are (0,0,0,0,0,0,0,0,0,1) for the second subnet, ..., and the 10 bits are (1,1,1,1,1,1,1,1,1,1) for the last subnet. In the following, underscore means subnet prefix

Therefore, for the first subnet, the first address is 0b 00010000 00000000 00000000 00000000 (16.0.0.0), and the last address is 0b 00010000 00000000 00111111 11111111 (16.0.63.255).

For the last subnet, the first address is 0b 00010000 11111111 11000000 00000000 (16.255.192.0), and the last address is 0b 00010000 11111111 11111111 11111111 (16.255.255.255).