**CIS 350 – INFRASTRUCTURE TECHNOLOGIES**

**HOMEWORK # 6**

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(You may do this homework in groups of 2 students maximum.)

**Topics**: Networks and Data Communications (Chapter 12), Ethernet and TCP/IP Networking (Chapter 13), Communication Channel Technology (Chapter 14)

**Show your calculations**!

**Problem 1**

A mask representing some IP address is 255.255.248.0. Write the mask in

the binary form: 11111111.11111111.11111000.00000000

the prefix notation: /21

**Problem 2**

What is the class of the following IP addresses?

11000110.10000111.11001100.00000011 Class C

10000011.10000111.11001100.00000011 Class B

01111110.10000111.11001100.00000011 Class A

**Problem 3**

Your start-up company has been assigned the following IP address by IANA: 198.226.10.0. You are to design 11 subnetworks within this network, with each subnetwork supporting up to 20 hosts. Can these subnetworks and hosts be designed? If not, which address class A, B, or C would allow for this particular design?

IP: 198.226.10.0; IP(Binary form) **110**00110.11100010.00001010.00000000; /24 Class C

11 subnetworks within network, each subnetwork supporting up to 20 hosts

Mask=255.255.255.0; Mask(Binary)=11111111.11111111.11111111.00000000

32-24=8bits

2ⁿ-2>=11; 2ⁿ>=13 ; n=4

8-4=4bits left for hosts in each subnetwork.

2n-2>=20; 2ⁿ >= 22; 25>=22; 5 bits needed for 20 hosts. Not enough in class c for this to be designed. Need a class B address.

**Problem 4**

Your company has been assigned the following IP address by IANA: 141.200.0.0. Design a network that consists of 1000 subnetworks with each subnetwork having up to 30 hosts.

1. What address class is it? \_class b\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Express this IP address in the binary form: 10011101.11001000.00000000.00000000

1. What is the mask associated with this IP address? Write the mask in the decimal, binary and prefix form.

Mask in decimal 255.255.0.0\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mask in binary 11111111.11111111.00000000.00000000\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mask in prefix form \16\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Perform calculations below to check if this network can be designed.

2n-2>=1000; 2n>=1002; 210>=1002; n = 10 bits are needed to design 1000 subnetworks.

16-10=6 bits are left for hosts in each subnetwork

2n>=30; 2n>=32; 26>=32; n = 6 bits are needed for 30 hosts. 10 bits for subnetworks + 6 bits for hosts <= the 16 bits available in the mask. This design can be done.

1. What is the subnetwork mask? Write the subnetwork mask in the decimal, binary and prefix form.

Mask in decimal 255.255.255.192\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mask in binary 11111111.11111111.11111111.11000000

Mask in prefix form \26\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For questions (e) through (h) do **not** follow the Cisco approach with AllZero and AllOnes addresses for subnetworks briefly discussed in class and described at this link <http://www.cisco.com/en/US/tech/tk648/tk361/technologies_tech_note09186a0080093f18.shtml>,

but rather use the approach covered in the class examples.

1. Write the address for the 1st subnetwork as well as the 1 host, 2nd host, the last host, and the broadcast address for the 1st subnetwork. Present the addresses in the binary and decimal forms.

1st subnet: 141.200.0.192 10011101.11001000.00000000.11 000000

1st host: 141.200.0.193 10011101.11001000.00000000.11 000001

2nd host: 141.200.0.194 10011101.11001000.00000000.11 000010

Last host: 141.200.0.254 10011101.11001000.00000000.11 011110

broadcast address for the 1st subnet:

141.200.0.255 10011101.11001000.00000000.11 111111

1. Write the address for the 2nd subnetwork as well as the 1 host, 2nd host, the last host, and the broadcast address for the 2nd subnetwork. Present the addresses in the binary and decimal forms.

2nd subnet: 141.200.1.0 10011101.11001000.00000001.00 000000

1st host: 141.200.1.1 10011101.11001000.00000001.00 000001

2nd host: 141.200.1.2 10011101.11001000.00000001.00 000010

Last host: 141.200.1.62 10011101.11001000.00000001.00 111110

broadcast address for the 2nd subnet:

141.200.1.63 10011101.11001000.00000001.00 111111

1. Write the address for the last subnetwork as well as the 1 host, 2nd host, the last host, and the broadcast address for the last subnetwork. Present the addresses in the binary and decimal forms.

Last subnet: 141.200.255.0 10011101.11001000.11111111.00 000000

1st host: 141.200.255.1 10011101.11001000.11111111.00 000001

2nd host: 141.200.255.2 10011101.11001000.11111111.00 000010

Last host: 141.200.255.62 10011101.11001000.11111111.00 111110

broadcast address for the last subnet:

141.200.255.63 10011101.11001000.11111111.00 111111

1. Use the masking operation to show explicitly that the last host residing on the 2nd subnetwork indeed belongs to this subnetwork.

Subnet mask: 11111111.11111111.11111111.11000000

Last host on 2nd subnet: 10011101.11001000.00000001.00111110

Bit by bit/AND result: 10011101.11001000.00000001.00000000

**Problem 5**

A signal travels from point A to B in a communication channel. The signal power at points A and B are 1000 and 100 watts, respectively. Calculate the signal gain/loss in [decibels – dB] at point B. Was the signal attenuated or amplified?

Loss[dB] = 10log10(100/1000) = 10(-1) = -10 dB; Signal was attenuated

**Problem 6**

A signal travels from point A to B in a communication channel. The signal power at points A and B are 100 and 1000 watts, respectively. Calculate the signal gain/loss in [decibels – dB] at point B. Was the signal attenuated or amplified?

Gain[dB] = 10log10(1000/100) = 10( 1) = 10 dB; Signal was amplified

**Problem 7**

You should know from the slides on chapter 14 covered in the classroom that the speed of data transmission over a communication channel depends on the bandwidth of the channel [expressed in Hz] as well as the power of the signal and noise of the channel [both expressed in Watts]. Shannon proposed a formula that allows one to calculate the maximum data rate [expressed in bps (bits/second)] for an analog signal with noise send over a channel.

S = f × log2 (1+W/N)

where:

* S – data transfer rate in bps
* f – signal bandwidth [expressed in Hz]
* W – signal power [in Watts], and
* N – noise power [in Watts]

Calculate the data rate (speed of transmission) of the telephone signal of 3.1 KHz bandwidth, 0.2 watts of power, and 0.0002 watts of noise? (Note that the log function uses base 2.)

You may use Excel function =LOG(x, 2) to calculate log2(x), where x is an argument and 2 is the base; or you may use your calculator with the LOG10(x) function knowing that log10(x)/log10(2) = log2(x).

S = f × log2 (1+W/N) =

3100 \* log2 (1+0.2/0.0002) =

3100 \* log2 (1+0.2/0.0002) =

3100 \* log2 (1+1000) =

3100 \* log2 (1001) =

3100 \* 9.967226 ≈

30898.4 bps