**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 \_\_**198.135.204.3 Class C**\_\_\_

10000011.10000111.11001100.00000011 \_\_**131.135.204.3 Class B**\_\_\_

01111110.10000111.11001100.00000011 \_\_**126.135.204.3 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?

**NNNNNNNN.NNNNNNNN.NNNNNNNN.HHHHHHHH**

**Mask is /24**

**2^N – 2 >= 11**

**2^N >= 13**

**N = 4**

**198.226.10.xxxx ||xxxx**

**We have to borrow 4 from the host**

**2^2 – 2 >= 20**

**2>=20 no, the subnetworks and the host cannot be designed because 2 is not greater than or equal to 20. It’s Class C because the first octet between 192-223.**

**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: \_\_\_\_\_\_**10001101.11001000.00000000.00000000**\_\_\_\_

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.

**NNNNNNNN.NNNNNNNN.HHHHHHHH.HHHHHHHH**

**Mask is /16**

**2^N – 2 >= 1000**

**2^N >= 1002**

**N = 10**

**141.200.xxxxxxxx.xx || xxxxxx**

**We have to borrow 10 from the host**

**2^8 – 2 >= 30**

**254 >= 30 yes, the subnetworks and the host can be designed**

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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.

**10001101.11001000.00000000.1 || 0000000 141.200.0.128 -address of the 1st subnet**

**10001101.11001000.00000000.1 || 0000001 141.200.0.129 -address of the 1st host on the 1st subnet**

**10001101.11001000.00000000.1 || 0000010 141.200.0.130 -address of the 2nd host on the 1st subnet**

**10001101.11001000.00000000.1 || 1111110 141.200.0.254 -address of the last host on the 1st subnet**

**10001101.11001000.00000000.1 || 1111111 141.200.0.255 - broadcast address for the 1st subnet**

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.

**10001101.11001000.00000001.0 || 0000000 141.200.1.0 -address of the 2nd subnet**

**10001101.11001000.00000001.0 || 0000001 141.200.1.1 -address of the 1st host on the 2nd subnet**

**10001101.11001000.00000001.0 || 0000010 141.200.1.2 -address of the 2nd host on the 2nd subnet**

**10001101.11001000.00000001.0 || 1111110 141.200.1.126 -address of the last host on the 2nd subnet**

**10001101.11001000.00000001.0 || 1111111 141.200.1.127 - broadcast address for the 2nd subnet**

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.

**10001101.11001000.11111111.0 || 0000000 141.200.255.0 -address of the last subnet**

**10001101.11001000.11111111.0 || 0000001 141.200.255.1 -address of the 1st host on the last subnet**

**10001101.11001000.11111111.0 || 0000010 141.200.255.2 -address of the 2nd host on the last subnet**

**10001101.11001000.11111111.0 || 1111110 141.200.255.126 -address of the last host on the last subnet**

**10001101.11001000.11111111.0 || 1111111 141.200.255.127 - broadcast address for the last subnet**

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

**Subnet mask 255.255.255.192 11111111.11111111.11111111.11000000**

**AND**

**Last host on the 2nd subnetwork 141.200.1.126 10001101.11001000.00000001.01111110**

**Subnet address 141.200.1.0 10001101.11001000.00000001.00000000**

**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?

**Signal gain/loss in dB = 10 log10 (P2/P1)**

**= 10 log10 (100/1000)**

**= -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?

**Signal gain/loss in dB = 10 log10 (P2/P1)**

**= 10 log10 (1000/100)**

**= 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).

**3.1 KHz = 3100 Hz**

**S = f x log2 (1+ W/N)**

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

**= 3100 x log2 (1001)**

**= 3100 x 9.97**

**= 30907 bps**