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 255.192.0.0. Write the mask in

the binary form: **11111111.11000000.000000.000000**
the prefix notation: **/10**

Problem 2

What is the class of the following IP addresses?

10000011.10000111.11001100.00000011	**Class B**
01111110.10000111.11001100.00000011	**Class A**
200.10.56.0 (decimal form)	**Class C**

Problem 3

Your start-up company has been assigned the following IP address by IANA: 138.226.0.0. You are to design 200 subnetworks within this network, with each subnetwork supporting up to 500 hosts. Can these subnetworks and hosts be designed? If not, which address class A, B, or C would allow for this particular design?

10001010.11100010.00000000.00000000, **Class B**

Class B addresses have the following mask: 255.255.0.0
11111111.11111111.00000000.00000000 0r /16
32-16 = 16

Problem 4

Your company has been assigned the following IP address by IANA: 135.100.0.0. Design a network that consists of 500 subnetworks with each subnetwork having up to 60 hosts.

(a) What address class is it? **Class B**

Express this IP address in the binary form: **10000111. 01100100.00000000.00000000**

(b) 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**

(c) Perform calculations below to check if this network can be designed.

(d) What is the subnetwork mask? Write the subnetwork mask in the decimal, binary and prefix form.

Mask in decimal _____
Mask in binary _____
Mask in prefix form _____

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.

(e) 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.

(f) 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.

(g) 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.

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

Problem 5

A signal travels from point A to B in a communication channel. The signal power at points A and B are 100000 and 100 watts, respectively. Calculate the signal gain/loss in [decibels – dB] at point B. Was the signal attenuated or amplified? (Slide 24 Chapter 14)

10 log 10(100/100000)= -1000 dB (signal 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 100000 watts, respectively. Calculate the signal gain/loss in [decibels – dB] at point B. Was the signal attenuated or amplified?

10 log10(100000/100) = 1000 dB (signal 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.

$S = f \times \log_2 (1+W/N)$

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 8 KHz bandwidth, 2 watts of power, and 0.002 watts of noise? (Note that the log function uses base 2.)

You may use Excel function =LOG(x, 2) to calculate $\log_2(x)$, where x is an argument and 2 is the base; or you may use your calculator with the $LOG_{10}(x)$ function knowing that $\log_{10}(x)/\log_{10}(2) = \log_2(x)$.