# ITMO 440/540 - Data Networks

# Midterm – Part II

# November 3, 2015

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CWID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**I. CLASSFUL NETWORK: Given the classful IP address 95.37.9.136, answer the following questions about the address and the network on which it is found.**

1. What Class is this address? **A \_\_\_\_\_\_\_\_\_**

2. What is the binary representation of the network mask of the network on which this particular address is located?

**11111111 00000000 00000000 00000000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the dotted decimal representation of the network mask of the network on which this particular address is located?

**255.0.0.0** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the binary representation of the address **95.37.9.136**?

**01011111 00100101 00001001 10001000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Copy the bits that represent the NetID portion of this address: **01011111** \_\_\_\_\_\_\_\_\_\_

6. Copy the bits that represent the HostID portion of this address:

**00100101 00001001 10001000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. What is the address of the network on which this IP address is found? (Give your answer in dotted-decimal.) **95.0.0.0 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

8. Write the first address of this network in binary notation:

**01011111 00000000 000000000 00000000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Write the first address of this network in dotted decimal notation:

95.0.0.0 \_\_\_\_\_\_\_\_\_\_\_\_\_

10. Write the last address of this network in binary notation.

**01011111 11111111 11111111 11111111** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. Write the last address of this network in dotted-decimal notation.

**95.255.255.255** \_\_\_\_\_\_\_

**II. CREATING SUBNETWORKS on this CLASSFUL NETWORK: Create 4 sub-networks on the network above. You may use the subnetwork that is identified using all 0’s and the subnetwork that is identified using all 1’s. This is similar to the example in the textbook and in the slides. Answer the following questions about the subnetworks you will create.**

1. How many host bits will you use to identify each of the sub-networks? \_\_\_\_\_\_\_\_\_\_ **2** \_\_\_\_\_\_\_\_\_\_

2. Write the subnetwork mask that you will use.

*The mask will include the network mask plus the bits that you are using to create the subnetworks. The total number of bits in the mask will still be 32. Some of the 0’s in the network mask will turn into 1’s in the subnetwork mask. Give your answer in both binary and dotted decimal notations.*

2. Write the subnetwork mask in binary notation:

**11111111 11000000 00000000 00000000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Write the subnetwork mask in dotted-decimal notation.

**255. 192.0.0** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. How many IP addresses will be in **each** of your sub-networks? (Include the first address and last address of the subnet.) **232-10 = 222**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Write the sub-network addresses of all of the sub-networks that you can create. These are the first addresses of each subnetwork. Fill in the subnetwork addresses in the table below as follows.

*Identify the byte from which you will borrow host bits to identify your subnetworks. You should write that byte in binary but you can write the other bytes in decimal. Enter this mixed-format information in the middle column below. Then in the right hand column write the dotted decimal representation of each subnetwork address. Remember, these are the first addresses of each subnetwork so be sure to represent the host bits accordingly.*

**95.xx yyyyyy yyyyyyyy yyyyyyyy Here, I wrote the form of all the IP addresses on the network. I used x’es to represent the bits that will represent the subnetworks. I used y’s to represent the bits that will be used to create the host addresses on the subnetworks.**

**Then the only byte that I left in binary notation was the byte that had a combination of subnetwork mask bits and host bits. I showed that in red below.**

|  |  |  |
| --- | --- | --- |
| Subnet | mixed binary and decimal | dotted decimal |
| 1 | **95.00 000000 .0.0** | **95.0.0.0** |
| 2 | **95.01 100000 .0.0** | **95.64.0.0** |
| 3 | **95.10 000000 .0.0** | **95.128.0.0** |
| 4 | **95.11 000000 .0.0** | **95.192.0.0** |

**III. CLASSLESS ADDRESSES**

**Given the classless IP address 95.37.9.136/25, answer the following questions about the address and the network on which it is found.**

1. What is the binary representation of the network mask of this network?

**11111111 11111111 11111111 10000000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What is the dotted-decimal representation of the network mask of this network?

**255.255.255.128** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the binary representation of the address **95.37.9.136/25**?

**01011111 00100101 00001001 10001000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the Prefix portion of this IP Address in binary?

**01011111 00100101 00001001 1** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. What is the Suffix portion of this IP Address in binary? **0001000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. How many total IP addresses can there be on the network on which this IP address is found? (Include the first address and the last address.)

**2 (32-25) == 27 or 128** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Write is the **network address** (first address) of the network on which this IP address is found in binary notation.

**01011111 00100101 00001001 10000000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Write the **network address** (first address) of the network on which this IP address is found in dotted-decimal notation.

**95.37.9.128** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Write the **network broadcast address** (last address) of the network on which this IP address is found in binary notation.

**01011111 00100101 00001001 11111111** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. Write the **network broadcast address** (last address) of the network on which this IP address is found in dotted-decimal notation.

**95.37.9.255** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**II. CREATING SUBNETWORKS on this CLASSLESS NETWORK:**

**You want to create 4 sub-networks on your network. You are allowed to use the all-zeros and the all-1’s subnetwork addresses as in the examples in the textbook and in the notes. You want them all to be the same size. Answer the following questions about the sub-networks you will create.**

1. How many host bits will you use to identify each of the sub-networks?

**2** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What is the subnetwork mask of your sub-networks expressed in binary notation?

**11111111 11111111 11111111 11100000** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the network mask of your sub-networks expressed in dotted-decimal notation?

**255.255.255.128** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. How many IP addresses will be in each of your sub-networks? (Include the first address and the last address.) **2(32 – 27) == 25** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Write down the sub-network addresses of all of the sub-networks that you can create. Write each subnetwork address first in binary notation and then in dotted decimal notation. Fill in the mixed binary and decimal version of the Subnetwork addresses in the middle column of the table below. Then translate this mixed binary and decimal format into the dotted decimal representation of the subnetwork addresses and fill in that information in the right hand column.

|  |  |  |
| --- | --- | --- |
| Subnet | mixed binary and decimal | dotted decimal |
| 1 | **95.37.9.** 100 00000 | **95.37.9.128** |
| 2 | **95.37.9.** 101 00000 | **95.37.9.160** |
| 3 | **95.37.9.** 110 00000 | **95.37.9.192** |
| 4 | **95.37.9.** 111 00000 | **95.37.9.224** |

Help with the procedure:

*Because this material was only recently presented, I have outlined the steps for you to follow below:*

*i)Write the Network Address in binary notation:*

**01011111 00100101 00001001 10000000**  *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*ii) In this binary address, change all the subnet ID bits to x’es and change all the remaining host bits into y’s. So, if you are using 4 subnet ID bits, you will write xxxxyy... where there are as many y’s as there are host bits left over after you take away the subnet ID bits from the original host bits.*

**01011111 00100101 00001001 1xxyyyyy** *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

iii) *Now assign bit values to all the x’es in you wrote above and fill in the middle column in the table below with this mixed decimal and binary representation. Notice that there is only one byte that you have to keep in binary notation, and the rest you can show in decimal.*