

CS 485/ECE 440/CS 585 Fall 2017 Homework #2

Answer key

There is no due date and this won't be turned in for a grade, but you should have it done by Friday, September 1st. If you email me your answers (email them in the text body of an email to crandall@cs.unm.edu) or stop by office hours I can help you make sure you have the correct answers.

Do your own work, but you may talk with your classmates about this assignment at a high level and compare answers.

For #1 and #2 you should do the conversion from/to binary/decimal by hand and show your work. Questions #1 and #2 are sanity checks, if you struggle with them please come talk to me before the drop deadline about if this is the right class for you to be in at this time. For #3 through #10 you can do the conversion using Google, a calculator, or whatever you like.

1. What is 196 in binary?

0b11000100

$$196 = 2^7 + 2^6 + 2^2 = 128 + 64 + 4$$

2. What is 0b01101011 in decimal?

107

$$2^6 + 2^5 + 2^3 + 2^1 + 2^0 = 64 + 32 + 8 + 2 + 1 = 107$$

3. Approximately how many IP addresses are there on a /18 network?

About $2^{14} = 16,384$

/18 means that the subnet mask is 255.255.192.0, or 18 1's and 14 0's in binary ($32 - 18 = 14$). The 14 0's leave 14 bits that are not part of the network number, so 2^{14} possible IPs per /18 network (ignoring IP addresses we can't use).

4. My IP address is 202.10.46.57, and my netmask is 255.255.255.224. Is 202.10.46.20 on my subnet?

No

Convert 202.10.46.57, 255.255.255.224, and 202.10.46.20 to binary. Then do a bitwise and of each IP with the subnet mask

202.10.46.57 & 255.255.255.224 gives you a different network number than 202.10.46.20 & 255.255.255.224, so they are not on the same network.

5. My IP address is 202.10.46.57, and my netmask is 255.255.255.224. Is 202.10.46.39 on my subnet?

Yes

Same as for #4, except that in this case you get the same network number, so they are on the same network.

6. My IP address is 202.10.46.57, and my netmask is 255.255.255.224. What is my network number in a.b.c.d/m notation?

202.10.46.32/27

To get the network number, convert both 202.10.46.57 and 255.255.255.224 to binary and apply a logical AND, getting 202.10.46.32. Then you add /27 on the end to specify the size of the network, where 255.255.255.224 converted to binary is 27 1's and 5 0's, so a /27.

7. My network number is 45.218.76.128/25. Is 45.218.76.165 on my subnet?

Yes

Same as for number 5.

8. My network number is 45.218.76.128/25. What is my netmask?

255.255.255.128

You can ignore the network number, the netmask is determined by the /25, which means 25 1's and $32 - 25 = 7$ 0's. So 11111111.11111111.11111111.10000000, or, in decimal, 255.255.255.128.

9. If I own the network 10.9.0.0/16 and I want to split it into four equal parts, what are the network numbers of each of the four parts?

10.9.0.0/18

10.9.64.0/18

10.9.128.0/18

10.9.192.0/18

A /18 is one fourth the size of a /16, so we need four /18's. If we convert 10.9.0.0 to binary and then apply the subnet mask 255.255.192.0, we'll have two more bits in our network number and should use all four possibilities of those two bits. So, our netmask in binary is 11111111.11111111.11000000.00000000. The two bits in binary are the added two bits for going from /16 to /18, so we should use network numbers with bits in those positions that make these two bits be all four possibilities: 00, 01, 10, and 11. Converting back to decimal we get 10.9.0.0, 10.9.64.0, 10.9.128.0, and 10.9.192.0, then we add /18 on to the end of each of those to specify their sizes.

10. Approximately how many IP addresses are there on a network with a netmask of 255.255.128.0?

About $2^{15} = 32,768$

255.255.128.0 in binary is

11111111.11111111.10000000.00000000. That's a /17, which is 17 1's and 15 0's. The calculation is then the same as for number 3, but with $32 - 17 = 15$.