

Forget the bitwise operations. Here's how I do subnets. In my head! Any subnet, any mask in 30 seconds or less.

First - credit where it is due. My method has been shamelessly stolen from Wendell Odom's CCENT/CCNA ICND1 Official Exam Certification Guide.

The whole secret around subnets lies in:

- the subnet mask
- knowing your 2x, 4x, 8x, 16x, 32x, 64x and 128x times tables as far as 256

Most people can handle 2x, 4x and (at a pinch) 8x. 32x, 64x and 128x only have 8, 4 or 2 items before you hit 256, so that leaves you your 16x tables to learn.

Here's the deal:

Look at the "interesting" number in the subnet mask. That is, the number that is NOT 0 or 255. In your case: 138.43.39.15/255.255.255.240 Your "interesting" octet is octet 4 ie 240. Subtract this number from 256 - you'll get 16 (256-240=16) in this case. If the mask was 255.255.255.224 you'd get 256-224=32. There are only 7 possibilities (excluding 0 and 255). Learn them. I'll list them later for you.

Back to 138.43.39.15 255.255.255.240  
256-240=16.

Odom calls this the "magic number". I'll stick with his definition.

The key to understanding subnet is this "magic number". Read the following carefully:

If the "magic number" is 16, then

- ALL of your subnet numbers will be multiples of 16, starting at 0
- All of your broadcast addresses will be 1 less than a multiple of 16.
- The first IP address on any subnet is simply the subnet address plus 1 in the last octet
- The last IP address on any subnet is simply the broadcast address minus 1 in the last octet.

Now read that last section again until it sticks.

In your case, where the magic number is 16, the subnet MUST be one of the following: 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240 (256)

There you go - that's your 16x tables up to 256. Told you to learn this didn't I? By the way, your 32x tables is just every 2nd number from the above.

Note that the last entry before 256 is the same as the subnet mask's "interesting octet". This is ALWAYS the case.

Back to 138.43.39.15 255.255.255.240 again.

Now your "interesting octet" is the 4th octet, which for your IP address is 15.

- Your subnet number MUST be less than 15, but one of the multiples of 16 listed above. Clearly 0 is the only multiple of 16 less than 15.
- So your subnet is 138.43.39.0
- The next subnet would be 138.43.39.16 - the NEXT multiple of 16.
- The first address on your subnet will be 138.43.39.0+1 = 138.43.39.1
- The broadcast address will be the NEXT subnet minus 1 ie 138.43.39.16-1 = 138.43.39.15
- The last address will be one less than the broadcast address: 138.43.39.15-1 = 138.43.39.14

So the address you started with is the broadcast address for its subnet = 138.43.39.15

Here's another example:

134.27.183.219 255.255.255.248  
Magic number=256-248=8  
The "interesting octet" is the last

octet, so I focus on 219  
Recalling my 8x tables around 219  
0  
8  
..  
208  
216  
224  
etc

- I can see that my subnet number must be 216 - **the closest multiple of 8** to 219 **that is not greater than** 219.
- The first address then would be 217
- The broadcast address would be 223 (1 less than the next multiple of 8)
- The last address would be 222.

Or expressed fully:

- Subnet: 134.27.183.216
- 1st Address: 134.27.183.217
- Last Address: 134.27.183.222
- Broadcast: 134.27.183.223
- Next Subnet: 134.27.183.224 (I list this because I actually figure this out then work backwards for the broadcast and last address)

This one is a bit harder - the interesting octet is the 3rd octet  
22.19.178.234 255.255.224.0  
Magic number=256-224=32  
The interesting octet is the 3rd octet, so I focus on 178.  
Recalling my 32x tables around 178  
0  
32  
..  
160  
192  
224

- I see 160 is **the closest multiple** of 32 **that is not greater than** 178
- This makes my subnet 22.19.160.0
- The first address 22.19.160.0+1=22.19.160.1
- The NEXT subnet ('cause I'm going to work backwards) is 22.19.192.0
- So the broadcast address is 22.19.192.0-1=22.19.191.255
- And the last address 1 less than the broadcast address: 22.19.191.255-1=22.19.191.254

Remember there are only 7 possible magic numbers (8 if you count 256-255=1), so they are not hard to learn. ♦ Here they are  
**Mask** **Magic number**  
255 ♦ ♦ 1 (just for completeness)  
254 ♦ ♦ 2  
252 ♦ ♦ 4 (this is a common one)  
248 ♦ ♦ 8  
240 ♦ ♦ 16  
224 ♦ ♦ 32  
192 ♦ ♦ 64  
128 ♦ ♦ 128

One more tricky one to finish:  
12.34.56.78 255.255.252.0  
Magic number=256-248=8  
The interesting octet is the 3rd octet, so I focus on 56.  
Recalling my 4x tables around 56  
0  
4  
..  
48  
52  
56  
60

- I can see that my subnet number must be 56 - **the closest multiple of 4** to 56 **that is not greater than** 56. ♦ See why it is tricky?
- The "interesting octet" value is a multiple of the magic number, so you stop there.
- This makes my subnet 12.34.56.0
- The first address 12.34.56.0+1=12.34.56.1
- The NEXT subnet ('cause I'm going to work backwards) is 12.34.60.0
- So the broadcast address is 12.34.60.0-1=12.34.59.255
- And the last address 1 less than the broadcast address: 12.34.59.255-1=12.34.59.254

Finally, if you want to learn this stuff (like for CCNA exam) spend half an hour a night on [http://www.subnettingquestions.com](http://www.subnettingquestions.com/)