IP AND SUBNETTING EXERCISES

Marta Muñoz San Román

1. Write the subnet, broadcast address and valid host range for the following:
    a. 192.168.100.17, with 4 bits of subnetting.

This belongs to Class C

Subnet is 192.168.100.16, broadcast is 192.168.100.31 and the valid host range is 192.168.100.17 to 30

    b. 192.168.100.66, with 3 bits of subnetting

Subnet is 192.168.100.64, broadcast is 192.168.100.95 and the valid host range is 192.168.100.65 to 94

    c. 172.16.10.5/20

Subnet is 172.16.0.0/20, broadcast is 172.16.15.255 and the valid host range is 172.16.0.1 to 172.16.15.254

    d. 172.16.10.33/255.255.252.0

Subnet is 172.16.8.0/22 (22 is equivalent to 255.255.252.0). The broadcast is 171.16.11.255 and the valid host range is 172.16.8.1 to 171.16.11.254

2. You have been asked to create a subnet that supports 126 hosts. What subnet mask is the most efficient one?

The 0s in the basic mask are dedicated to represent hosts. Having n bits we have 2n possible combinations. So, we need $2^n - 2 = 126$. As a result, $2^7 - 2 = 126$. This is the closest number to the desired quantity of hosts. This means that 7 bits for the hosts in the mask is represented as:

11111111.11111111.11111111.1[0000000]

Therefore, the most efficient subnet mask is 255.255 255.128 (because this is equals to 2^7) or /25

3. Given the following
    a. Network address: 192.168.10.0
    b. Subnet mask: 255.255.255.192

How many subnets are there? How many hosts? What are the valid subnets?

This is a Class C IP address. The general mask for this class is 255.255.255.0. the last decimal digit in the network part is 192, which into binary becomes 1100 0000. This means that 2 extra bits are dedicated to generate subnetworks: /26. This way:

- 2 bits = 2^2 = 4 subnets
- 8 – 2 bits = 2^6 = 62 hosts for the subnetwork

To calculate the **subnets**, it's needed to use all of the possible combinations. The first three octets, the 192, will be fixed, because the Class C and the 24 first bits in the default masks are all 1s.

The possible combinations in the last octet, considering the bits for the host as 0s, are:

1. $[00]000000_2 = 0$
2. $[01]000000_2 = 64$

3. [10]000000$_2$ = 128
4. [11]000000$_2$ = 192

The valid subnets are:

Network address	Host address	Broadcast
192.168.10.[00]000000	192.168.10.1 - 192.168.10.62	192.168.10.63
192.168.10.[01]000000	192.168.10.65 - 192.168.10.126	192.168.10.127
192.168.10.[10]000000	192.168.10.129 - 192.168.10.190	192.168.10.191
192.168.10.[11]000000	192.168.10.193 to 192.168.10.254	192.168.10.255

4. XYZ Company would like to subnet its network so that there are five separate subnets. They will need 25 computers in each subnet. Complete the following table: NOTE: If you create more than five subnets, list the extra ones too.

Subnet	Network address	Host addresses	Broadcast address
Subnet mask: 255.255.255.___			
First subnet	192.168.162.___	192.168.162.___ - 192.168.162.___	192.168.162.___
Second subnet	192.168.162.___	192.168.162.___ - 192.168.162.___	192.168.162.___
Third subnet	192.168.162.___	192.168.162.___ - 192.168.162.___	192.168.162.___
Fourth subnet	192.168.162.___	192.168.162.___ - 192.168.162.___	192.168.162.___
Fifth subnet	192.168.162.___	192.168.162.___ - 192.168.162.___	192.168.162.___
Sixth subnet ?			
?			

192.168.162.x → class C, because they are starting from 110 or between 192 and 223
[110]00000
192.168.162.00000000
11111111
192.168.162.0
DEFAULT IP ADDRESS: 192.168.162.255
2^8 - =254
We have 25 computers and we want to separate the network, in order to not waste 254 spaces. So, I can dedicate 3 extra bits and create 8 networks.
~~2^4 = 16 – 2 = 14~~
2^5 =32 – 2 = **30 computers are enough now**
8 – 3 = 5 bits
If the default mask is 255.255.285.0, I can dedicate 3 extra bits for the network, and 5 for the host, because the last ones are always for the host:
255.255.285.11100000 → 255.255.255.224/27
The first subnetwork will be 192.168.162.0, and the broadcast is 192.168.162.31
So, the subnets are:

Subnet	Network address	Host addresses	Broadcast
Subnet mask: 255.255.255.**254**			
First subnet	192.168.162.0	192.168.162.1 - 192.168.162.30	192.168.162.31
Second subnet	192.168.162.32	192.168.162.33 - 192.168.162.62	192.168.162.63
Third subnet	192.168.162.64	192.168.162.65 - 192.168.162.94	192.168.162.95
Fourth subnet	192.168.162.96	192.168.162.97 - 192.168.162.126	192.168.162.127
Fifth subnet	192.168.162.128	192.168.162.129 - 192.168.162.158	192.168.162.159
Sixth subnet	192.168.162.160	192.168.162.161 - 192.168.162.190	192.168.162.191
Seventh subnet	192.168.162.192	192.168.162.193 - 192.168.162.222	192.168.162.223
Eight subnet	192.168.162.224	192.168.162.225 - 192.168.162.254	192.168.162.255