Lab 04: Subnetting

A subnetwork or subnet is a **logical subdivision** of an IP network. The practice of **dividing a network into two or more networks** is called subnetting.

Network and Hosts in Classes:

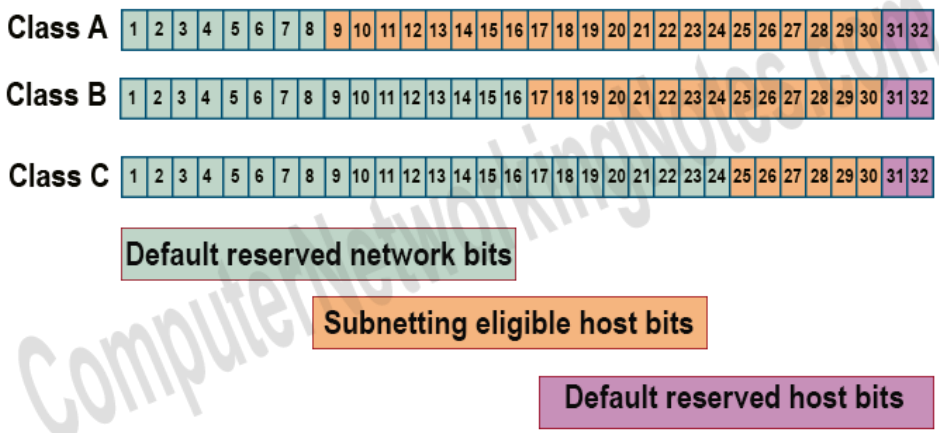
	8 Bits (Octet)	8 Bits (Octet)	8 Bits (Octet)	8 Bits (Octet)
Class A	Network	Hosts	Hosts	Hosts
Class B	Network	Network	Hosts	Hosts
Class C	Network	Network	Network	Hosts

Number of Hosts Combination in Classes:

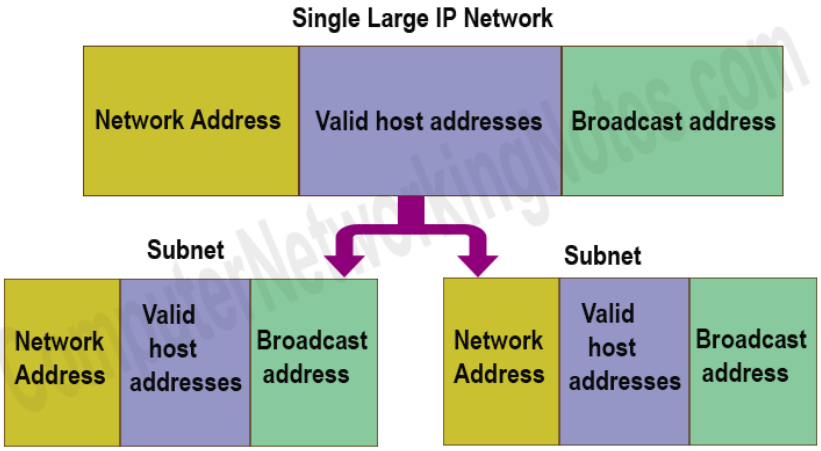
Lets see the number of possible host combinations in each class.
In class C, 2^8 hosts in each network are possible ie., equals to 256 hosts in each network .

	Possible Hosts
Class A	256 x 256 x 256 = 16,777,216
Class B	256 x 256 = 65,536
Class C	256

Eligible Bits for Subnetting:



Network and Broadcast Addresses:



Example 1:

Let's suppose, we have
IP address: 100.10.20.0
Number of required hosts: 100 hosts per subnet
Number of required subnets: 30 subnets

Perform subnetting and tell which subnet contains the given IP address.

Step 1:

Identify the class of given IP. This is class **A**.
Calculate the upper bound (power of 2) of given required hosts and subnets.
Number of required hosts: 100 hosts per subnet >> 128 hosts per subnet (2^**7**)
Npte: Check of 128-2 is greater than required hosts as (one ip required for network address and one for broadcast address)
Number of required subnets: 30 subnets >> 32 subnets (2^**5**)

Step 2:

Write a subnet of the class of the ip address.

255.0.0.0

11111111.00000000.00000000.00000000

Step 3:

Check if subnetting is possible.
Multiply upper bounds of hosts and subnets.

2^7 x 2^5 = 4096 .. Eq (1)

Now check representable or possible hosts in IP address.

2^8 x 2^8 x 2^8 = 16,777,216 .. Eq (2)

Condition:
If Eq (1) < Eq(2) then subnetting is possible else no need to work further.

Step 4:

Borrow bits from the left of the subnet mask from host octets.

11111111.00000000.00000000.00000000

Now we have an upper bound 2^5 of subnets so we will borrow 5 bits from hosts for subnets.

11111111.**00000**000.00000000.00000000
11111111.**11111**000.00000000.00000000

New Subnet Mask: **255.248.0.0**

Step 5:

Count 0's left in the subnet mask.

11111111.11111**000.00000000.00000000**

Number of zeros = 19
2^19 = 524288

Take a mod of 2 power number of zeros to bring the number in range of 0 to 255 i.e., maximum value of an octet.

In our case, it will be,

524288 / 256 = 2048

Again divide from 256 until number is smaller than 256

(if number is already in range 0-255, ignore this step)

So, the **range of the subnet** is **08**.

Step 6:

Creating the subnets.
Tip: Start creating subnets from the octet you borrowed zeros. In our case it's the second octet and class A.

First subnet:
100.**0**.0.0 - 100.**7**.255.255
The range is 8 so including 0 till 7 (0,1,2,3,4,5,6,7) makes 8 numbers.
Network Address: 100.0.0.0
Broadcast Address: 100.7.255.255

Second subnet:
100.**8**.0.0 - 100.**15**.255.255
Network Address: 100.8.0.0
Broadcast Address: 100.15.255.255

Third subnet:
100.**16**.0.0 - 100.**23**.255.255
Network Address: 100.16.0.0
Broadcast Address: 100.23.255.255

Fourth subnet:
100.**24**.0.0 - 100.**31**.255.255
Network Address: 100.24.0.0
Broadcast Address: 100.31.255.255

Fifth subnet:
100.**32**.0.0 - 100.**39**.255.255
Network Address: 100.32.0.0
Broadcast Address: 100.39.255.255

So on…..
Assign the subnets to topology along with a new subnet mask **255.248.0.0**.

Practice Examples: solve on papers

1. IP address: 172.168.1.0
   Number of required hosts: 160 hosts per subnet
   Number of required subnets: 60 subnets
   Perform subnetting and tell which subnet contains the given IP address.

2. IP address: 10.10.20.0
   Number of required hosts: 100 hosts per subnet
   Number of required subnets: 100 subnets
   Perform subnetting and tell which subnet contains the given IP address.

3. IP address: 192.168.29.1
   Number of required hosts: 100 hosts per subnet
   Number of required subnets: 60 subnets
   Perform subnetting and tell which subnet contains the given IP address.

4. IP address: 220.162.49.1
   Number of required hosts: 30 hosts per subnet
   Number of required subnets: 60 subnets

Perform subnetting and tell which subnet contains the given IP address.

Lab Task

Configure the following topology using the second question of practice example and apply dynamic routing RIP (Routing Information Protocol).