# Tutorial 1: IPv4 Addressing and Subnetting

(a)  (b)
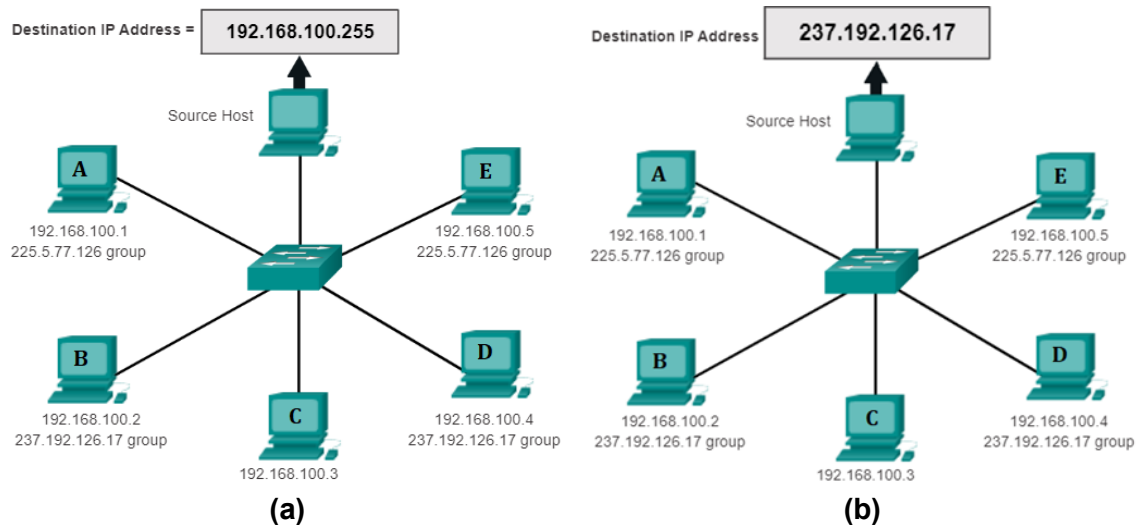
## Q2. a) Identify IPv4 Addresses:

**Step 1: Analyze the table below and list the range of host and broadcast addresses given a network/prefix mask pair.**
The first row shows an example of how the table should be completed.

| IP Address/Prefix | First Host Address | Last Host Address | Broadcast Address |
|---|---|---|---|
| 192.168.10.10/24 | 192.168.10.1 | 192.168.10.254 | 192.168.10.255 |
| 10.101.99.17/23 | | | |
| 209.165.200.227/27 | | | |
| 172.31.45.252/24 | | | |
| 10.1.8.200/26 | | | |
| 172.16.117.77/20 | | | |
| 10.1.1.101/25 | | | |
| 209.165.202.140/27 | | | |
| 192.168.28.45/28 | | | |

## b) Classify IPv4 Addresses

**Step 1: Analyze the table shown below and identify the type of address (network, host, multicast, or broadcast address).**

The first row shows an example of how the table should be completed.

| IP Address | Subnet Mask | Address Type |
|---|---|---|
| 10.1.1.1 | 255.255.255.252 | host |
| 192.168.33.63 | 255.255.255.192 | |
| 239.192.1.100 | 255.252.0.0 | |
| 172.25.12.52 | 255.255.255.0 | |
| 10.255.0.0 | 255.0.0.0 | |

| | | |
|---|---|---|
| 172.16.128.48 | 255.255.255.240 | |
| 209.165.202.159 | 255.255.255.224 | |
| 172.16.0.255 | 255.255.0.0 | |
| 224.10.1.11 | 255.255.255.0 | |

## Step 2: Analyze the table shown below and identify the address as public or private.

| IP Address/Prefix | Public or Private |
|---|---|
| 209.165.201.30/27 | |
| 192.168.255.253/24 | |
| 10.100.11.103/16 | |
| 172.30.1.100/28 | |
| 192.31.7.11/24 | |
| 172.20.18.150/22 | |
| 128.107.10.1/16 | |
| 192.135.250.10/24 | |
| 64.104.0.11/16 | |

## Step 3: Analyze the table shown below and identify whether the address/prefix pair is a valid host address.

| IP Address/Prefix | Valid Host Address? | Reason |
|---|---|---|
| 127.1.0.10/24 | | |
| 172.16.255.0/16 | | |
| 241.19.10.100/24 | | |
| 192.168.0.254/24 | | |
| 192.31.7.255/24 | | |
| 64.102.255.255/14 | | |
| 224.0.0.5/16 | | |
| 10.0.255.255/8 | | |
| 198.133.219.8/24 | | |

**Q3. How many possible networks are possible using Class B addresses? How many valid hosts are possible in each network?**

**Q4. Rewrite the IPv6 addresses with no leading zeros and compressed version.**

| | |
|---|---|
| Preferred | FE80:0000:0000:0000:0123:4567:89AB:DFEE |
| No leading zeros | FE80:0:0:0:123:4567:89AB:DFEE |
| Compressed | FE80::123:4567:89AB:DFEE |
| | |
| Preferred | FF02:0000:0000:0000:0000:0001:FF00:0200 |
| No leading zeros | |
| Compressed | |
| | |
| Preferred | 0000:0000:0000:0000:0000:0000:0000:0001 |
| No leading zeros | |
| Compressed | |

## Q5. Fill up the following table:

| Hosts Needed | Subnet Mask (Binary) | Subnet Mask (Decimal) | Prefix Notation (/x) |
|---|---|---|---|
| 250 | 11111111.11111111.11111111.00000000 | 255.255.255.0 | /24 |
| 25 | | | |
| 1000 | | | |
| 75 | | | |
| 10 | | | |
| 500 | | | |

## Q6. Fill up the following table:

| Network Address | 192 | 168 | 26 | 98 |
|---|---|---|---|---|
| Subnet Mask | 255 | 255 | 255 | 128 |
| Network Address in Binary | 11000000 | 10101000 | 00011010 | 01100010 |
| Subnet Mask in Binary | 11111111 | 11111111 | 11111111 | 10000000 |
| Number of valid Hosts | | | | |

## Q7. Fill up the following table:

| Network Address | 192 | 168 | 13 | 64 |
|---|---|---|---|---|
| Subnet Mask in decimal | 255 | 255 | 255 | 224 |
| Network Address in Binary | 11000000 | 10101000 | 00001101 | 01001111 |
| Subnet Mask in Binary | 11111111 | 11111111 | 11111111 | 11100000 |
| First usable Host IP address in decimal | | | | |
| Last usable Host IP address in decimal | | | | |
| Broadcast address in decimal | | | | |
| Next Network address in decimal | | | | |

## Q8. Design an IP Addressing Scheme for the following topology (using traditional Subnetting scheme).
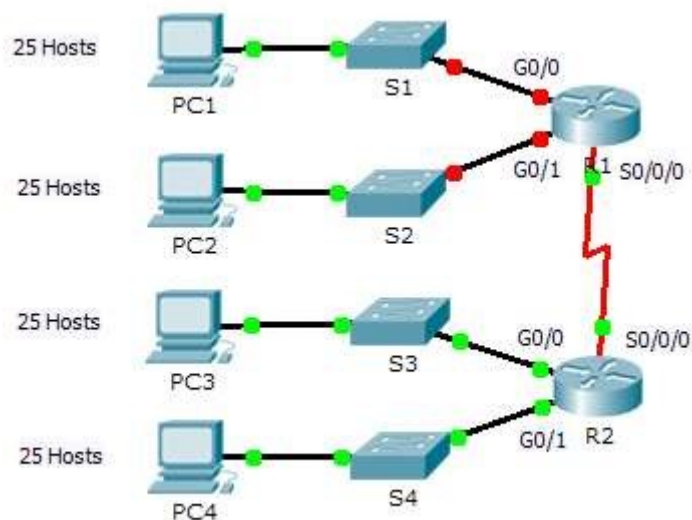
## Step 1: Subnet the 192.168.100.0/24 network into the appropriate number of subnets.

a. Based on the topology, how many subnets are needed?

b. How many bits must be borrowed to support the number of subnets in the topology table?

c. How many subnets does this create?

d. How many usable hosts does this create per subnet?

e. Calculate the binary value for the first five subnets. The first subnet is already shown.

```
Net 0: 192. 168. 100.  0   0   0   0   0   0   0   0
Net 1: 192. 168. 100. ___ ___ ___ ___ ___ ___ ___ ___
Net 2: 192. 168. 100. ___ ___ ___ ___ ___ ___ ___ ___
Net 3: 192. 168. 100. ___ ___ ___ ___ ___ ___ ___ ___
Net 4: 192. 168. 100. ___ ___ ___ ___ ___ ___ ___ ___
```

f. Calculate the binary and decimal value of the new subnet mask.

```
11111111.11111111.11111111.  ___ ___ ___ ___ ___ ___ ___ ___
255. 255. 255. _____
```

g. Fill in the **Subnet Table**, listing the decimal value of all available subnets, the first and last usable host address, and the broadcast address. Repeat until all addresses are listed.

Subnet Table

| Subnet Number | Subnet Address | First Usable Host Address | Last Usable Host Address | Broadcast Address |
|---|---|---|---|---|
| 0 | | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |

## Step 2: Assign the subnets to the network shown in the topology.
a. Assign Subnet 0 to the LAN connected to the GigabitEthernet 0/0 interface of R1:
b. Assign Subnet 1 to the LAN connected to the GigabitEthernet 0/1 interface of R1:
c. Assign Subnet 2 to the LAN connected to the GigabitEthernet 0/0 interface of R2:
d. Assign Subnet 3 to the LAN connected to the GigabitEthernet 0/1 interface of R2:
e. Assign Subnet 4 to the WAN link between R1 to R2:

## Step 3: Document the addressing scheme.
Fill in the **Addressing Table** using the following guidelines:
a. Assign the first usable IP addresses to R1 for the two LAN links and the WAN link.
b. Assign the first usable IP addresses to R2 for the LANs links. Assign the last usable IP address for the WAN link.
c. Assign the second usable IP addresses to the switches.
d. Assign the last usable IP addresses to the hosts.

## Addressing Table

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|--------|-----------|-----------|-------------|-----------------|
| R1 | G0/0 | | | |
| | G0/1 | | | |
| | S0/0/0 | | | |
| R2 | G0/0 | | | |
| | G0/1 | | | |
| | S0/0/0 | | | |
| S1 | VLAN 1 | | | |
| S2 | VLAN 1 | | | |
| S3 | VLAN 1 | | | |
| S4 | VLAN 1 | | | |
| PC1 | NIC | | | |
| PC2 | NIC | | | |
| PC3 | NIC | | | |
| PC4 | NIC | | | |

**Q9. You have been given the 192.168.10.0/24 network address to subnet, with the following topology.**
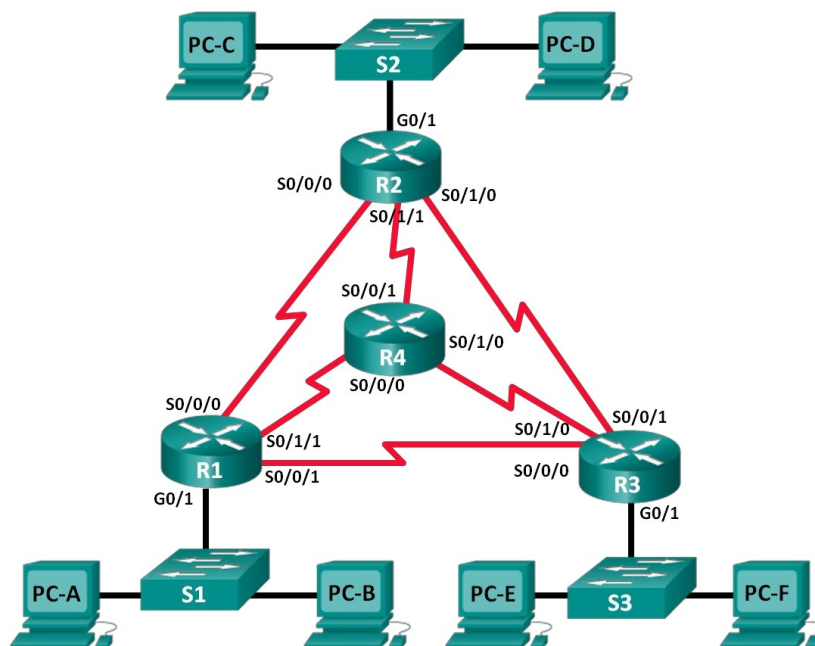


**Determine the number of subnets in the above Network Topology.**

a. How many subnets are there?

b. How many bits should you borrow to create the required number of subnets?

c. How many usable host addresses per subnet are in this addressing scheme?

d. What is the new subnet mask in dotted decimal format?

e. How many subnets are available for future use?

## Q10. Design a VLSM Addressing Scheme for the following topology.
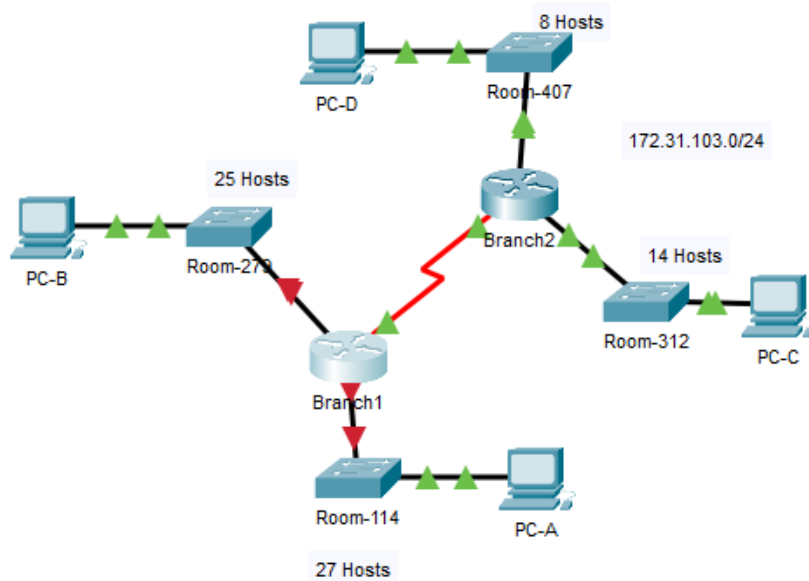


### Step 1: Determine the number of subnets needed.

You will subnet the network address 172.31.103.0/24. Fill in the blanks according to the requirements:
a. PC-A LAN will require _____host IP addresses:
b. PC-B LAN will require _____host IP addresses:
c. PC-C LAN will require _____host IP addresses:
d. PC-D LAN will require _____host IP addresses:

e. How many subnets are needed in the network topology?

### Step 2: Fill up the following Subnet Table:

| Subnet Description | Number of Hosts Needed | Network Address/CIDR | First Usable Host Address | Last Usable Host Address | Broadcast Address |
|---|---|---|---|---|---|
| PC-A LAN | | | | | |
| PC-B LAN | | | | | |
| PC-C LAN | | | | | |
| PC-D LAN | | | | | |
| WAN Link | | | | | |

### Step 3: Fill up the following Address Table:

| Device | Interface | Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| Branch1 | G0/0 | | | |
| | G0/1 | | | |
| | S0/0/0 | | | |
| Branch2 | G0/0 | | | |
| | G0/1 | | | |
| | S0/0/0 | | | |
| Room-114 | VLAN 1 | | | |
| Room-279 | VLAN 1 | | | |
| Room-312 | VLAN 1 | | | |
| Room-407 | VLAN 1 | | | |
| PC-A | NIC | | | |
| PC-B | NIC | | | |
| PC-C | NIC | | | |
| PC-D | NIC | | | |