1) Introduction

If you have a network that ranges from 192.168.1.0 to 192.168.1.255 explain why individual devices in the network can only be assigned IP addresses in the range of 192.168.1.1 to 192.168.1.254. **(write down the answers in your written report).**

Answer:

If I have network address from 192.168.1.1 to 192.168.1.255, then we can say that:

The network identifier would be 192.168.1.0
- An address like 192.168.0.0 becomes unusable for any other purpose after it's established as a network number. If an administrator assigns 192.168.0.0 to any device on the network as a static IP address, the network stops functioning until that device is taken offline.As a network number, this address is used in routing tables and by routers to share network information with each other.

The broadcast address would be 192.168.1.255
- A broadcast is a multipoint connection in a computer network. A data packet is transmitted from one point to all users of a messaging network in this way. This occurs with the use of the broadcast address.

So, valid ip addresses would be 192.168.1.1 to 192.168.1.254.

2) Find IP & MAC

Find out about network and hardware information for the computer you are currently using. **(Write down the IP and MAC address of your computer in your written report).**

Answer:
My IP address is 192.168.0.102 and my MAC address is 60:f6:77:4f:4d:f9

```
tanvir@tanvir-IT-18043:~$ ip -c address
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eno1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc fq_codel state DOWN group default qlen 1000
    link/ether ac:e2:d3:68:7f:15 brd ff:ff:ff:ff:ff:ff
3: wlo1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 60:f6:77:4f:4d:f9 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.102/24 brd 192.168.0.255 scope global dynamic noprefixroute wlo1
       valid_lft 4042sec preferred_lft 4042sec
    inet6 fe80::c3d3:fd16:1c0a:19da/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
tanvir@tanvir-IT-18043:~$
```

3) Routing Table basics

Now, enter the command: **"$ netstat -r"** to print your computers routing table. Explain (very briefly) the different columns: **Destination, Gateway, Genmask, Flags, MSS, Window, irtt and Iface, (write the answer in your written report in table form).**

Answer:

When a router receives a packet, it examines the destination IP address, and looks up into its Routing Table to figure out which interface packet will be sent out.

```
tanvir@tanvir-IT-18043:~$ netstat -r
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
default         _gateway        0.0.0.0         UG        0 0          0 wlo1
link-local      0.0.0.0         255.255.0.0     U         0 0          0 wlo1
192.168.0.0     0.0.0.0         255.255.255.0   U         0 0          0 wlo1
tanvir@tanvir-IT-18043:~$
```

Destination: The network ID or destination corresponding to the route.

Gateway: This column indicates the defined gateway for the network. If you see an * in this column, it means that no forwarding gateway is needed for the specified network.

Genmask: The mask that is used to match a destination IP address to the network ID.

Flags: The U output in this columns means that the route is up. The G output indicates that specified gateway should be used for this route. D stands for dynamically installed, M stands for modified, and R means reinstated.

MSS: The MSS column indicates the default Maximum Segment Size for TCP connections over this route.

Windows: The Window column indicates the default window size for TCP connections over this route.

Irtt: The Irtt column indicates the Initial Round Trip Time for this route.

Iface: The Iface column shows the network interface. If you had more than one interface, you would see lo (for loopback), eth0 (first Ethernet device), and eth1 (for the second Ethernet device), and so on for the number of interfaces you have installed.

4) Virtual Interfaces

Linux offers the possibility to set up interfaces according to your networking needs. For instance, if needed, you can configure an interface for multiple IP addresses by creating new virtual interfaces with another IP address.

a) Create a new virtual interface with following IP address, 192.168.2.32 and netmask 255.255.255.0 then check to see if the interface was created successfully? **(save a print screen of your interface table to display in your written report document).**

b) Now, you need to set up a route for this interface so that your computer can see it. Otherwise, everyone else on the network will be able to reach the new interface except you. Issue the needed command, then issue the "$ netstat -r" command and check if the route to your added interface is visible **(save a print screen of your routing table to display in your written report document together with the command(s) you used to set up the interface).**

c) Next remove the route for this interface, **(write down the command(s) in your written report).**

d) Then remove the interface completely, **(write down the command(s) in your written report).**

Answer:

a) Creating Virtual Interface :

   sudo ip addr add 192.168.2.32/24 brd + dev enp0s3 label enp0s3:vir

b) Inserting Interface in the Routing Table:

   sudo route add default gw 192.168.2.32

```
File   Edit   View   Search   Terminal   Help
tanvir@farhana-IT-18038:~/Desktop$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask          Flags   MSS Window  irtt Iface
default          _gateway         0.0.0.0          UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
link-local       0.0.0.0          255.255.0.0      U         0 0          0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
tanvir@farhana-IT-18038:~/Desktop$ sudo route add default gw 192.168.2.32
tanvir@farhana-IT-18038:~/Desktop$ netstat -r
Kernel IP routing table
Destination      Gateway          Genmask          Flags   MSS Window  irtt Iface
default          farhana-IT-1803  0.0.0.0          UG        0 0          0 enp0s3
default          _gateway         0.0.0.0          UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
link-local       0.0.0.0          255.255.0.0      U         0 0          0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
tanvir@farhana-IT-18038:~/Desktop$ netstat -rn
Kernel IP routing table
Destination      Gateway          Genmask          Flags   MSS Window  irtt Iface
0.0.0.0          192.168.2.32     0.0.0.0          UG        0 0          0 enp0s3
0.0.0.0          10.0.2.2         0.0.0.0          UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
169.254.0.0      0.0.0.0          255.255.0.0      U         0 0          0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
tanvir@farhana-IT-18038:~/Desktop$
```

c)   Deleting Interface from Routing table:

sudo route delete default gw 192.168.2.32

```
File   Edit   View   Search   Terminal   Help
farhana@farhana-IT-18038:~$ sudo route add default gw 192.168.2.32
farhana@farhana-IT-18038:~$ netstat -rn
Kernel IP routing table
Destination      Gateway          Genmask          Flags   MSS Window  irtt Iface
0.0.0.0          192.168.2.32     0.0.0.0          UG        0 0          0 enp0s3
0.0.0.0          10.0.2.2         0.0.0.0          UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
169.254.0.0      0.0.0.0          255.255.0.0      U         0 0          0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
farhana@farhana-IT-18038:~$ sudo route delete default gw 192.168.2.32
farhana@farhana-IT-18038:~$ netstat -rn
Kernel IP routing table
Destination      Gateway          Genmask          Flags   MSS Window  irtt Iface
0.0.0.0          10.0.2.2         0.0.0.0          UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
169.254.0.0      0.0.0.0          255.255.0.0      U         0 0          0 enp0s3
192.168.2.0      0.0.0.0          255.255.255.0    U         0 0          0 enp0s3
farhana@farhana-IT-18038:~$
```

d) Deleting Virtual Interface:

sudo ip addr delete 192.168.2.32/24 dev enp0s3:vir

```
tanvir@farhana-IT-18038:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fe80::5a80:6675:43e8:fcaa  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:7c:e3:36  txqueuelen 1000  (Ethernet)
        RX packets 119  bytes 11226 (11.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 273  bytes 28337 (28.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s3:vir: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.2.32  netmask 255.255.255.0  broadcast 192.168.2.255
        ether 08:00:27:7c:e3:36  txqueuelen 1000  (Ethernet)

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 65  bytes 6243 (6.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 65  bytes 6243 (6.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

tanvir@farhana-IT-18038:~$ sudo ip addr delete 192.168.2.32/24 dev enp0s3:vir
tanvir@farhana-IT-18038:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fe80::5a80:6675:43e8:fcaa  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:7c:e3:36  txqueuelen 1000  (Ethernet)
        RX packets 129  bytes 12120 (12.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 284  bytes 29283 (29.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 67  bytes 6415 (6.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 67  bytes 6415 (6.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

tanvir@farhana-IT-18038:~$
```

5) Add a New Network

Add a new network. Obviously, first you need to be aware of your network address, netmask, gateway and what ethernet device you wish to set up for it. However, to keep things simple but still get a feel for the principle, in our case we will use the values for the primary network you belong to.

a) Enter the command needed to add another network with the same values as your primary network meaning: **(yourPrimaryNetorkAddress) and (netmaskForYourNetwork), (write down the command(s) in your written report).**

b) Assign the default gateway for your newly added network (tip the same default gateway as you primary network), **(yourDefaultGatewayAddress)**

c) Look for your newly added network in your routing table by issuing the **"$ netstat -r"** command. You should now have a double setup of your primary network in the table **(save a print screen of your routing table to display in your written report document).**

d) Now, remove your changes meaning the double routing table setup for your primary network. First issue the command needed to delete your newly added route then issue the command to delete your newly added default gateway. **(write down the command(s) in your written report)**

Answer:

6) Multinetwork Scenario Configuration

You should now set up a working routing table for a multi-network scenario. Assume that you have two network cards available connected to two different LANs. The destination of the first network is, 10.0.2.0 with netmask 255.0.0.0 and the second, 192.168.1.0 with netmask 255.255.255.0. Furthermore, a firewall is assumed to exist between the two networks, where network card eth0 is attached to the 10.0.2.0 network and eth1 is attached to the 192.168.1.0 network. To forward packets on the Internet the firewall needs to route packets from the 10.0.2.0 network through the 192.168.1.0 network. The firewall system must be set up with two IP addresses, 10.0.2.1 on eth0 and 192.168.1.25 on eth1. The gateway to the Internet on the 192.168.1.0 network should be 192.168.1.1.

Provide the necessary commands to route on the firewall/router system:
    a) Assign the firewall IP addresses to eth1 and eth2.
    b) Add the routes for the networks, i.e., 192.168.1.0 on eth1 and 10.0.2.0 on eth0
    c) Assign the Internet gateway (meaning: 192.168.1.1) as the default gateway.
    (write down the command(s) in your written report)

d) Enter the necessary command(s) in order for packets belonging to computers in the 10.0.2.0 network to be routed to the 192.168.1.0 network and the Internet. In other words this should tell each computer on the 10.0.2.0, which the default gateway is, i.e., your firewall/router. You do not need to worry about the route back configuration it is enough to assign the proper default gateway for the 10.0.2.0 network.
(write down the command(s) in your written report)