<div align="center">**Practical No:6**</div>

Problem Definition: Write a program to demonstrate Sub-netting and find subnet masks.

Objective:
- Learn concepts of subnetting.
- Create a small networks with four subnets.

Theory:

Subnet is the procedure of dividing big size networks into the smaller networks which is based on the layer 3 of IP address. Each CPU on network has its IP address that helps in representing the position on network. IPv4 and IPv6 are the two versions of IP addresses that are available. Here we are performing subnetting on IPv4.

IPv4

To denote an IP address we are using dotted decimal notation, which appears as the 4 numbers that are being spitted by dots. Every number of the IP address known as octet which is being designed from eight individual bits. Every octet could create the number in the range of 0 to 255. An IP address is 32 bits long in binary and is being divided into two components as the host component and network component. Host component is used for identifying the individual hosts on the network and defines the specific device on a particular network segment whereas Network component is used for identifying the network that the packet is being intended for. It is also used for defining network segment of device.

IP Classes in decimal notation
1. Class E addresses are in the range of 240 to254.
2. Class D addresses are in the range of 224 to 239.
3. Class C addresses are in the range of 192 to 223.
4. Class B addresses are in the range of 128 to 191.
5. Class A addresses are in the range of 1 to 126.
a) 0 is being reserved and it helps in representing all the IP address.
b) 127 is the reserved address and it is being utilised for the testing, like as a loop
   back on the interface.
c) 255 is a reserved address and it is utilised for the purpose of broadcasting.

Subnet mask

It is a 32 bits long address which is utilised in IP address in order to differentiate among the host address and network address. Subnet mask is always used with IP address. Subnet mask is used to identify the part of an IP addresses as host address and network address.

For example how we would figure out the network partition and the host partition from the IP address 192.168.1.10? Here we are requiring the subnet mask to get the information regarding the addresses of network and host.

In the decimal notation, subnet mask value is in the range of 1 to 255 and is used for the representation of network address and the value 0 [Zero] is used for the representation of host address.

In the binary notation, subnet mask on the bit [1] is used for the representation of network address while off bit [0] is used for the representation of host address.
In decimal notation

IP address : 192.168.1.10
Subnet mask: 255.255.255.0
Network address : 192.168.1 and host address : 10.
In binary notation
IP address : 11000000.10101000.00000001.00001010
Subnet mask: 11111111.11111111.11111111.00000000
Network address : 11000000.10101000.00000001 and host address: 00001010

IP Class	Default Subnet	Network bits	Host bits	Total hosts	Valid hosts
A	255.0.0.0	First 8 bits	Last 24 bits	16,777,216	16,777,214
B	255.255.0.0	First 16 bits	Last 16 bits	65,536	65,534
C	255.255.255.0	First 24 bits	Last 8 bits	256	254

Table 2.1: Subnet mask

Subnetting

It is the procedure of dividing big size network into the small networks called as subnets. It happens only when we extends the standard boundaries of the subnet mask. Fundamentally we borrow the host bits for the network creation.

Example: Being a network administrator, you were asked to create the two networks, each network will be able to host the 30 systems. Single class C IP range could achieve this need, still you have to buy the 2 IP range of class C, one for each. Single class C IP range assist in providing of 256 total addresses and we need only 30 addresses, thus 226 addresses will be unutilised. These unutilized addresses will make an extra route for the advertisement that will be slowing down the network.

With subnetting we only need to buy single range of class C. You can make the configuration of router to take the first 26 bits instead of its default 24 bits as a network bits. Here we would be extending the standard boundary of the subnet mask and then borrow the 2 host bits so as to create a network. We can take the two bits from the host range and then counting them as network bits will help in creating two new subnets, and assign hosts to them. Considering the two new networks bits matches in the addresses, then the address belongs to the same network. You could change either of these two bits, and then you will be in a new subnet. The default subnet masks are shown in table 2.2.

Class	Subnet Mask	Format
A	255.0.0.0	Network.Host.Host.Host
B	255.255.0.0	Network.Network.Host.Host
C	255.255.255.0	Network.Network.Network.Host

Table 2.2: Default subnet mask

All the hosts that are on the same subnet should be agreed on the subnet mask. Otherwise, the packets that are actually being intend for another subnet might never leaves the existing subnet: a host would not give it to the router a packet which it thinks being destined for a local segment.

Name	Network	Hosts From	Hosts To	Broadcast Address
A	192.168.4.0	192.168.4.1	192.168.4.62	192.168.4.63
B	192.168.4.64	192.168.4.65	192.168.4.126	192.168.4.127
C	192.168.4.64	192.168.4.129	192.168.4.190	192.168.4.191
D	192.168.4.64	192.168.4.193	192.168.4.254	192.168.4.255

Table 2.3: Four subnets from Network ID 192.168.4.0

Ping

It is nothing but a basic Internet program. It allows a user to check whether the particular IP address exists and can accept the request or not. Ping is utilized for diagnosis to make sure that the host computer or the user is trying to reach is being actually operated. Ping working is carried out by sending the Internet Control Message Protocol (ICMP) then the echo Request to the specified interface on a network and then waiting for the reply. Ping could be used for troubleshoot so as to test the connectivity and then determines the response time.

Python APIs

1. Creating and running threads for pinging on different IPs. worker = Thread(target=pinger, args=(i, queue)) worker.setDaemon(True) worker.start()
2. Subprocess call for sending a ping request. subprocess.call(\ping -c 1 %s" % ip, shell=True, stdout=open(_/dev/null', _w'), stderr=subprocess.STDOUT)

Algorithm: Pinging Machines on the Subnet.

1: Set an array and initialize it with the IPs to ping.
2: Define a ping function for sending ICMP echo request.
3: Spawn a thread pool and call the ping function defined in Step2 for sending ICMP echo requests to the IPs initialized in Step1.
4: Capture the reply and print if that IP node is alive or dead.

Conclusion: we have studied implement sub-netting and finding sub net mask.

Signature with Date