Assignment No.	(A-2)
Title	Subnetting
Roll No.	
Class	T.E.
Date	
Subject	Programming Lab IV
Signature	

Assignment no: (A-2)

Title: Subnetting.

Problem Statement: Consider the network id 192.168.10.0 or such relevant IP and create four subnets namely A, B, C, D. Assign the subnet mask. Write a Python \ C++ program to perform the following operations (use overloading if applicable).
a) Ping the machine of same subnet.
b) Ping the machine in subnet A from machine of subnet B.
c) Analyze the output of the above sub assignments.

Prerequisites:
Basics of Networking, good knowledge about binary number system and the conversions between decimal to binary and binary to decimal, IPv4 addressing and classes, subnet mask etc.

Objectives:
1] To learn concept of sub-netting a network.
2] To study how to subnet a Class C network.

Tools:
Operating System:.
Programming Language: Python/C++.
Additional Tool:

Theory:

Subnetting (RFC 950) is the process of dividing any classful IP network (Class A, Class B, or Class C network) into smaller networks.

What is Subnet Mask?

An IPv4 address has two components, the network part and the host part. IPv4 address is a combination of IPv4 address and Subnet mask. The purpose of subnet mask is to identify which part of an IPv4 address is the network part and which part is the host part. Subnet mask is also a 32 bit number where all the bits of the network part are represented as "1" and all the bits of the host part are represented as "0".

If we take an example for a Class C network, 192.168.10.0, the address part and the subnet mask can be represented as below.

Component	Binary	Decimal
Address Part	11000000.10101000.00001010.00000000	192.168.10.0
SN Mask	11111111.11111111.11111111.00000000	255.255.255.0

For a Class C IPv4 address, the first three octets are used to represent the Network part and the lact octet is used to represent the host part. From the above table, we can see all "1" in the

network part and all "0" in nthe host part. When this subnet mask is converted to a decimals, it will become 255.2555.255.0. The default subnet mask for aClass C network is 255.255.255.0, Class B network is 255.255.0.0 and Class A network is 255.0.0.0

What is a Network Address?

A network address is used to identify the subnet that a host may be placed on and is used to represent that network. We can find the network address by assigning all bits in the host part as 0.

Class C Subnetting

Subnetting is done by taking the bit/s from host part and adding it to the network part. Consider the same Class Cexample given above. Remember, the first three octets of a Class C network is used to represent the network and the last octet is used to represent the host. The default format for a Class C IPv4 address is Network.Network.Network.Host.

To make things easy, you may remember this.

If all the bits in the host part are "0", that represents the network id.

If all the bits in the host part are "0" except the last bit, it is the first usable IPv4 address.

If all the bits in the host part are "1" except the last bit, it is the last usable IPv4 address.

If all the bits in the host part are "1", that represents the directed broadcast address.

All the IPv4 addresses between the first and last IPv4 addresses (including the first and last) can be used to configure the devices.

Class C - One Bit Subnetting

Consider the network shown above. If we include one bit from the host part to the network part, the subnet mask is changed into 255.255.255.128. The single bit can have two values in last octet, either 0 or 1.

11000000.10101000.00001010.0|0000000
11111111.11111111.11111111.1 | 0000000

That means, we can get two subnets if we do a single bit subnetting.

SubNet No	Description	Binaries	Decimal
1	Network Address	11000000.10101000.00001010.00000000	192.168.10.0
	First IPv4 address	11000000.10101000.00001010.00000001	192.168.10.1
	Last IPv4 address	11000000.10101000.00001010.01111110	192.168.10.126
	Broadcast Address	11000000.10101000.00001010.01111111	192.168.10.127
2	Network Address	11000000.10101000.00001010.10000000	192.168.10.128
	First IPv4 address	11000000.10101000.00001010.10000001	192.168.10.129
	Last IPv4 address	11000000.10101000.00001010.11111110	192.168.10.254
	Broadcast Address	11000000.10101000.00001010.11111111	192.168.10.255

The network 192.168.10.0 is divided into two networks, each network has 128 total IPv4 addresses and 126 usableIPv4 addresses (two IPv4 addresses are used in each subnet to represent the network address and the directed broadcast address). The subnet mask for one bit subnetting is 255.255.255.128.

Class C - Two Bit Subnetting (expected solution of problem statement)

If we include two bits from the host part to the network part, the subnet mask is changed into 255.255.255.192. The two bits added to network part can have four possible values in last octet and that are 00, 01, 10 and 11. That means, we can get four networks if we do a two bit subnetting (as expected in the problem statement).

11000000.10101000.00001010.00 | 000000
11111111.11111111.11111111.11 | 000000

SubNet No	Description	Binaries	Decimal
1	Network Address	11000000.10101000.00001010.00000000	192.168.10.0
	First IPv4 address	11000000.10101000.00001010.00000001	192.168.10.1
	Last IPv4 address	11000000.10101000.00001010.00111110	192.168.10.62
	Broadcast Address	11000000.10101000.00001010.00111111	192.168.10.63
2	Network Address	11000000.10101000.00001010.01000000	192.168.10.64
	First IPv4 address	11000000.10101000.00001010.01000001	192.168.10.65
	Last IPv4 address	11000000.10101000.00001010.01111110	192.168.10.126
	Broadcast Address	11000000.10101000.00001010.01111111	192.168.10.127
3	Network Address	11000000.10101000.00001010.10000000	192.168.10.128
	First IPv4 address	11000000.10101000.00001010.10000001	192.168.10.129
	Last IPv4 address	11000000.10101000.00001010.10111110	192.168.10.190
	Broadcast Address	11000000.10101000.00001010.10111111	192.168.10.191
4	Network Address	11000000.10101000.00001010.11000000	192.168.10.192
	First IPv4 address	11000000.10101000.00001010.11000001	192.168.10.193
	Last IPv4 address	11000000.10101000.00001010.11111110	192.168.10.254
	Broadcast Address	11000000.10101000.00001010.11111111	192.168.10.255

The network 192.168.10.0 is divided into four networks, each network has 64 total IPv4 addresses and 62 usableIPv4 addresses (two IPv4 addresses are used in each subnet to represent the network address and the directed broadcast address). The subnet mask for two bit subnetting is 255.255.255.192.

Class C Subnetting can be summerized as below:

Subnet Bits	Subnet Mask	CIDR	Total Subnets	Usable IPs/Subnet
0	255.255.255.0	/24	1	254
1	255.255.255.128	/25	2	126
2	255.255.255.192	/26	4	62

3	255.255.255.224	/27	8	30
4	255.255.255.240	/28	16	14
5	255.255.255.248	/29	32	6
6	255.255.255.252	/30	64	2

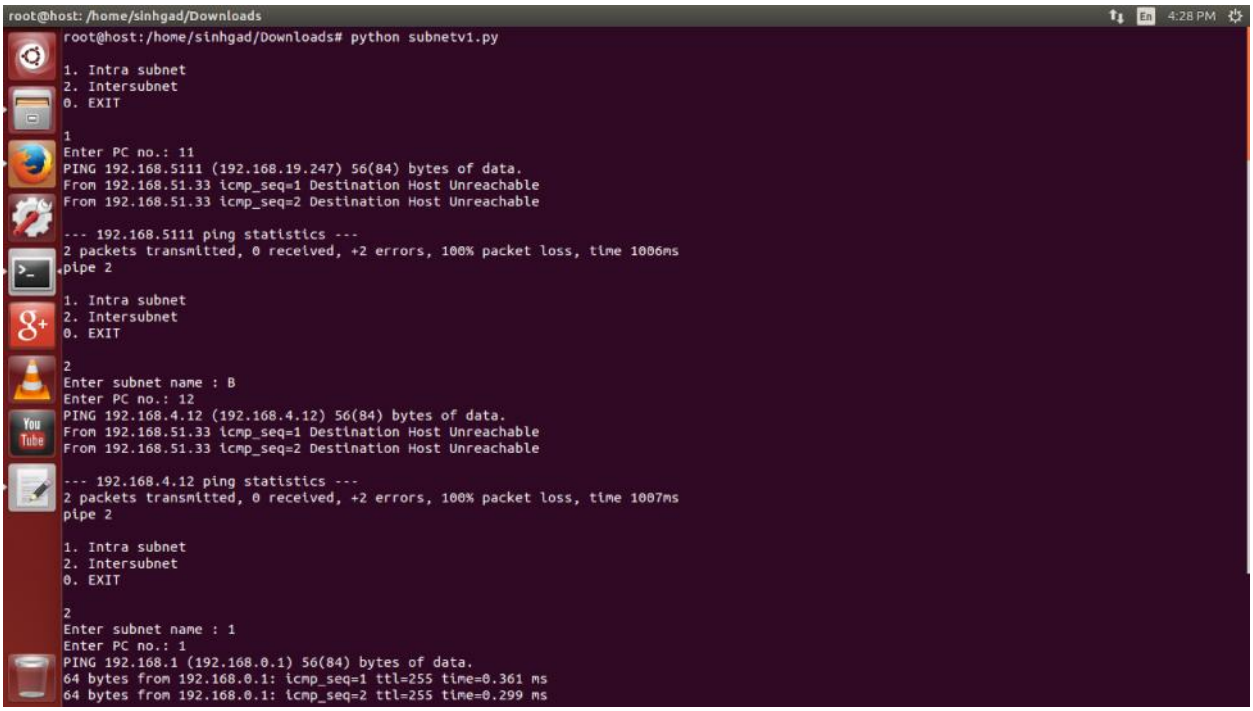
Conclusion:

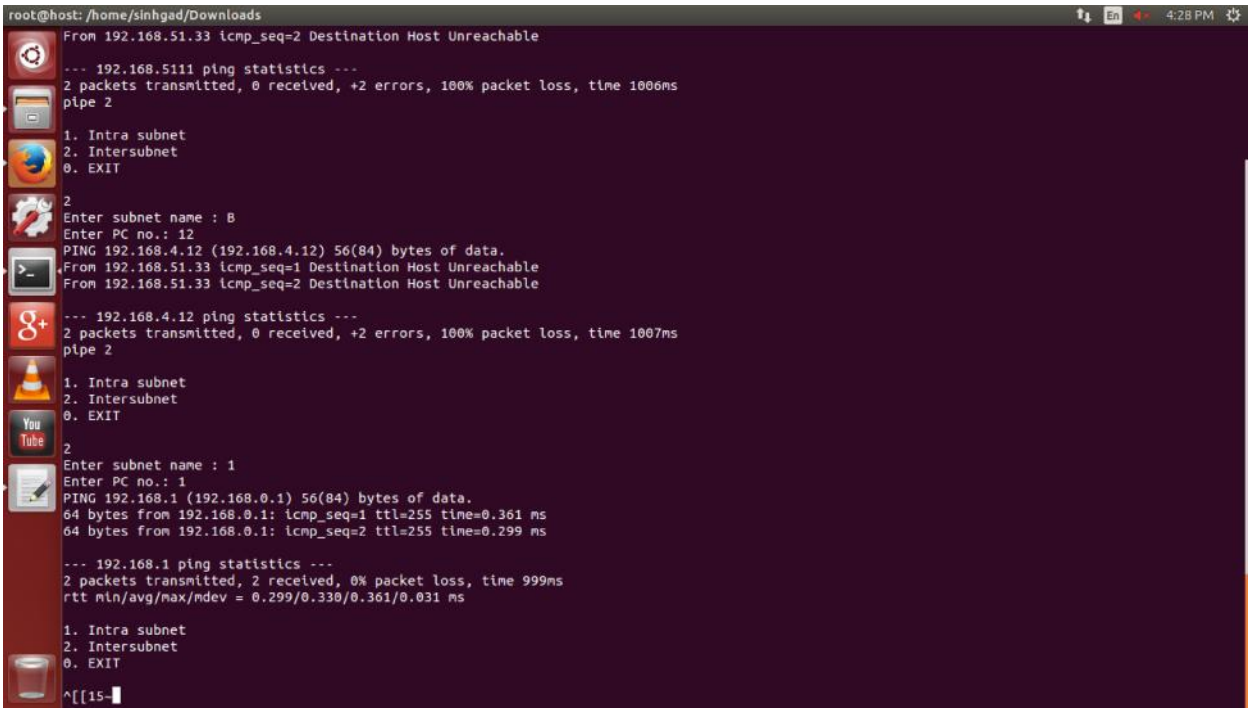
By this assignment we have studied subnetting of class C networks.

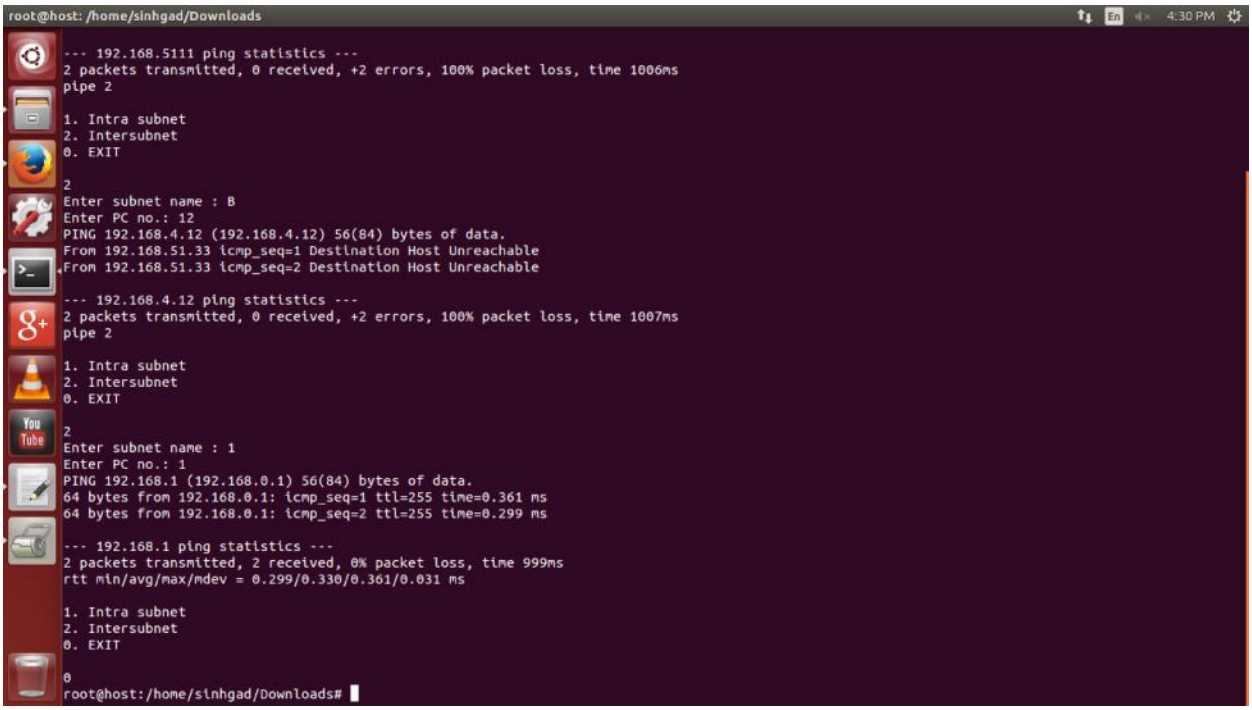
CODE:

```
import sys, os
import socket
import fcntl
import struct

#function to get ip addr of local machine
def get_ip_address(ifname):
   s = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
   return socket.inet_ntoa(fcntl.ioctl(
      s.fileno(),
      0x8915,  # SIOCGIFADDR
      struct.pack('256s', ifname[:15])
   )[20:24])

MyIP = get_ip_address('eth0')
subnet = int(MyIP[8:9])
#print subnet
if subnet==6:
        print "Subnet A.\nIP address: ", MyIP
elif subnet==4:
        print "Subnet B.\nIP address: ", MyIP
elif subnet==3:
        print "Subnet C.\nIP address: ", MyIP
elif subnet==2:
        print "Subnet D.\nIP address: ", MyIP

option=32       # random number. Doesn't have any logic
while option!=0:
```

```
option = int(raw_input("\n1. Intra subnet\n2. Intersubnet\n0. EXIT\n\n"))
if option==1:
        PING=MyIP[:10]
        PCNo=raw_input("Enter PC no.: ")
        PING=PING+PCNo
        os.system("ping -c 2 "+PING)
elif option==2:
        name=raw_input("Enter subnet name : ")
        PCNo=raw_input("Enter PC no.: ")
        PING=MyIP[:8]
        if name=="A":
                PING=PING+"6."
        elif name=="B":
                PING=PING+"4."
        elif name=="C":
                PING=PING+"3."
        elif name=="D":
                PING=PING+"2."
        PING=PING+PCNo
        os.system("ping -c 2 "+PING)
elif option!=1 or option!=2:
        break
```


root@host: /home/sinhgad/Downloads
4:28 PM
root@host:/home/sinhgad/Downloads# python subnetv1.py
1. Intra subnet
2. Intersubnet
0. EXIT
1
Enter PC no.: 11
PING 192.168.5111 (192.168.19.247) 56(84) bytes of data.
From 192.168.51.33 icmp_seq=1 Destination Host Unreachable
From 192.168.51.33 icmp_seq=2 Destination Host Unreachable
--- 192.168.5111 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1006ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : B
Enter PC no.: 12
PING 192.168.4.12 (192.168.4.12) 56(84) bytes of data.
From 192.168.51.33 icmp_seq=1 Destination Host Unreachable
From 192.168.51.33 icmp_seq=2 Destination Host Unreachable
--- 192.168.4.12 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1007ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : 1
Enter PC no.: 1
PING 192.168.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=255 time=0.361 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=255 time=0.299 ms


root@host: /home/sinhgad/Downloads
4:28 PM
From 192.168.51.33 icmp_seq=2 Destination Host Unreachable
--- 192.168.5111 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1006ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : B
Enter PC no.: 12
PING 192.168.4.12 (192.168.4.12) 56(84) bytes of data.
From 192.168.51.33 icmp_seq=1 Destination Host Unreachable
From 192.168.51.33 icmp_seq=2 Destination Host Unreachable
--- 192.168.4.12 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1007ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : 1
Enter PC no.: 1
PING 192.168.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=255 time=0.361 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=255 time=0.299 ms
--- 192.168.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.299/0.330/0.361/0.031 ms
1. Intra subnet
2. Intersubnet
0. EXIT
^[[15~


root@host: /home/sinhgad/Downloads
4:30 PM
--- 192.168.5111 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1006ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : B
Enter PC no.: 12
PING 192.168.4.12 (192.168.4.12) 56(84) bytes of data.
From 192.168.51.33 icmp_seq=1 Destination Host Unreachable
From 192.168.51.33 icmp_seq=2 Destination Host Unreachable
--- 192.168.4.12 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 1007ms
pipe 2
1. Intra subnet
2. Intersubnet
0. EXIT
2
Enter subnet name : 1
Enter PC no.: 1
PING 192.168.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=255 time=0.361 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=255 time=0.299 ms
--- 192.168.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.299/0.330/0.361/0.031 ms
1. Intra subnet
2. Intersubnet
0. EXIT
0
root@host:/home/sinhgad/Downloads#