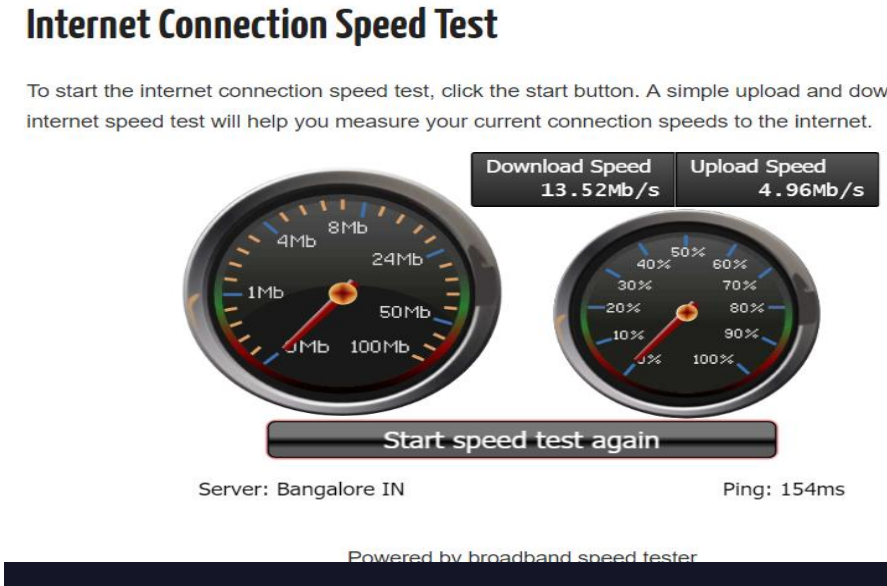
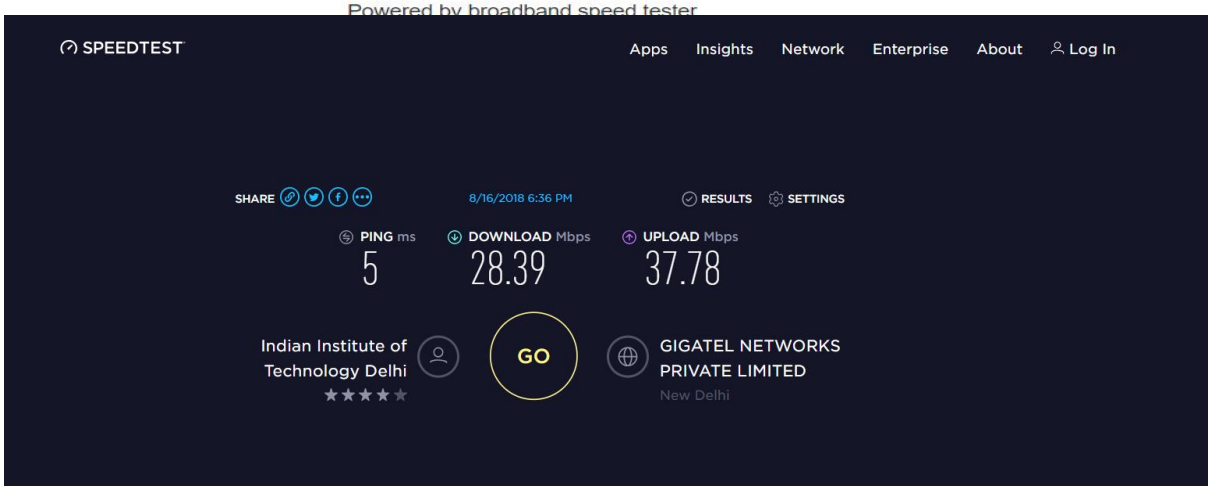
Que 1)

Ans.

Location for Speed testing :- Satpura Hostel, IITD





The download speed and upload speed for http://www.testmyspeed.com were 13.52 Mbps and 4.96 Mbps respectively. Whereas, for www.speedtest.net , the download speed and upload speed were 28.39 Mbps and 37.78 Mbps respectively.

The Results are drastically different for the speed tests.

Since Server on the one is Bangalore IN and the other is Gigatel Networks Private Limited New Delhi , we get different speeds due to there distances from our network receiver machine.

The Gigatel server is pinged in 5ms whereas the Bangalore IN server is pinged in 154ms, due to the traffic and congestion in transferring the data from Sender(ISPs) to receiver(such as mobile, laptops and computers). These both speed tests use different methodologies to deduce these results so this also can be treated as one of the reason for different speeds.

Que 2)

(a)

Ans.

Ping is used to test the reachability of a remote host on Internet Protocol(IP) Network. Ping measures the RTT for messages sent from originating host to a destination computer that are echoed back to the source.

Ping operates by sending Internet Control Message Protocol(ICMP) echo request packets to the target host and waiting for the ICMP reply.

(b)

Ans.

ping command to determine the RTT to www.google.com

```
C:\WINDOWS\system32>ping www.google.com
Pinging www.google.com [216.58.221.36] with 32 bytes of data:
Reply from 216.58.221.36: bytes=32 time=5ms TTL=51
Reply from 216.58.221.36: bytes=32 time=86ms TTL=51
Reply from 216.58.221.36: bytes=32 time=18ms TTL=51
Reply from 216.58.221.36: bytes=32 time=6ms TTL=51

Ping statistics for 216.58.221.36:
        Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 5ms, Maximum = 86ms, Average = 28ms
```

……

ping command to determine the RTT to www.harvard.edu

```
C:\WINDOWS\system32>ping www.harvard.edu
Pinging www.harvard.edu.cdn.cloudflare.net [104.16.151.6] with 32 bytes of data:
Reply from 104.16.151.6: bytes=32 time=42ms TTL=53
Reply from 104.16.151.6: bytes=32 time=2599ms TTL=53
Reply from 104.16.151.6: bytes=32 time=50ms TTL=53
Reply from 104.16.151.6: bytes=32 time=50ms TTL=53

Ping statistics for 104.16.151.6:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 42ms, Maximum = 2599ms, Average = 685ms
```

……

ping command to determine the RTT to www.iitd.ac.in

```
C:\WINDOWS\system32>ping www.iitd.ac.in
Pinging www.iitd.ac.in [10.7.174.111] with 32 bytes of data:
Reply from 10.7.174.111: bytes=32 time=77ms TTL=62
Reply from 10.7.174.111: bytes=32 time=4ms TTL=62
Reply from 10.7.174.111: bytes=32 time=3ms TTL=62
Reply from 10.7.174.111: bytes=32 time=15ms TTL=62

Ping statistics for 10.7.174.111:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 3ms, Maximum = 77ms, Average = 24ms
```

……

The closest server in terms of RTT is www.iitd.ac.in (the third one).
The farthest server in terms of RTT is www.harvard.edu (the second one).
RTT is the duration in milliseconds(ms) it takes for a network to go from a starting point to a destination and back again to the starting point. We get different RTT values for different servers because of various factors such as – nature of transmission medium, LAN traffic, server response time, node count, congestion and the physical distance between the servers.
In case of closest and farthest servers (in terms of RTT), the server of www.harvard.edu is in Cambridge and server for www.iitd.ac.in is in IITD this causes the former one to transfer the data across many different routers in different physical locations before terminating to IITD server whereas the later one is the same server to be accessed for data, which is the reason for such a change in RTT values while pinging both the sites through command line.

Que 3)

```
C:\WINDOWS\system32>ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : DESKTOP-LO4O3JN
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : iitd.ac.in
                                       cc.iitd.ac.in

Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Realtek PCIe FE Family Controller
   Physical Address. . . . . . . . . : EC-8E-B5-51-6D-CD
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter VirtualBox Host-Only Network:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : VirtualBox Host-Only Ethernet Adapter
   Physical Address. . . . . . . . . : 0A-00-27-00-00-03
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::b925:875c:ea8a:482c%3(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.56.1(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
   DHCPv6 IAID . . . . . . . . . . . : 738852903
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-22-CF-44-5E-EC-8E-B5-51-6D-CD
   DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1
                                       fec0:0:0:ffff::2%1
                                       fec0:0:0:ffff::3%1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter
   Physical Address. . . . . . . . . : 30-E3-7A-02-78-EA
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft Wi-Fi Direct Virtual Adapter #2
   Physical Address. . . . . . . . . : 32-E3-7A-02-78-E9
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter VMware Network Adapter VMnet1:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : VMware Virtual Ethernet Adapter for VMnet1
   Physical Address. . . . . . . . . : 00-50-56-C0-00-01
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::4c08:10f:8b43:9460%22(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.152.1(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 17 August 2018 13:11:26
   Lease Expires . . . . . . . . . . : 17 August 2018 16:41:25
   Default Gateway . . . . . . . . . :
   DHCP Server . . . . . . . . . . . : 192.168.152.254
   DHCPv6 IAID . . . . . . . . . . . : 704663638
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-22-CF-44-5E-EC-8E-B5-51-6D-CD
   DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1
                                       fec0:0:0:ffff::2%1
                                       fec0:0:0:ffff::3%1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Ethernet adapter VMware Network Adapter VMnet8:

   Connection-specific DNS Suffix  . :
```

```
   Description . . . . . . . . . . . : VMware Virtual Ethernet Adapter for VMnet8
   Physical Address. . . . . . . . . : 00-50-56-C0-00-08
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::d8ba:2df0:bd75:6026%10(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.254.1(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 17 August 2018 13:11:26
   Lease Expires . . . . . . . . . . : 17 August 2018 16:41:25
   Default Gateway . . . . . . . . . :
   DHCP Server . . . . . . . . . . . : 192.168.254.254
   DHCPv6 IAID . . . . . . . . . . . : 721440854
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-22-CF-44-5E-EC-8E-B5-51-6D-CD
   DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1
                                       fec0:0:0:ffff::2%1
                                       fec0:0:0:ffff::3%1
   Primary WINS Server . . . . . . . : 192.168.254.2
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : iitd.ac.in
   Description . . . . . . . . . . . : Intel(R) Dual Band Wireless-AC 3168
   Physical Address. . . . . . . . . : 30-E3-7A-02-78-E9
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::10d7:fe89:9e25:ad18%5(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.184.36.154(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.224.0
   Lease Obtained. . . . . . . . . . : 17 August 2018 12:38:45
   Lease Expires . . . . . . . . . . : 18 August 2018 03:28:06
   Default Gateway . . . . . . . . . : 10.184.32.1
   DHCP Server . . . . . . . . . . . : 10.7.10.2
   DHCPv6 IAID . . . . . . . . . . . : 53535610
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-22-CF-44-5E-EC-8E-B5-51-6D-CD
   DNS Servers . . . . . . . . . . . : 10.10.2.2
                                       10.10.1.2
   Primary WINS Server . . . . . . . : 10.8.2.3
   Secondary WINS Server . . . . . . : 10.8.2.8
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       iitd.ac.in
                                       cc.iitd.ac.in
```

(a)

Ethernet adapter VirtualBox Host-Only Network:

IPv4 Address. . . . . : 192.168.56.1

Ethernet adapter VMware Network Adapter VMnet1:

IPv4 Address. . . . . : 192.168.152.1

Ethernet adapter VMware Network Adapter VMnet8:

IPv4 Address. . . . . : 192.168.254.1

Wireless LAN adapter Wi-Fi:

IPv4 Address. . . . . : 10.184.36.154

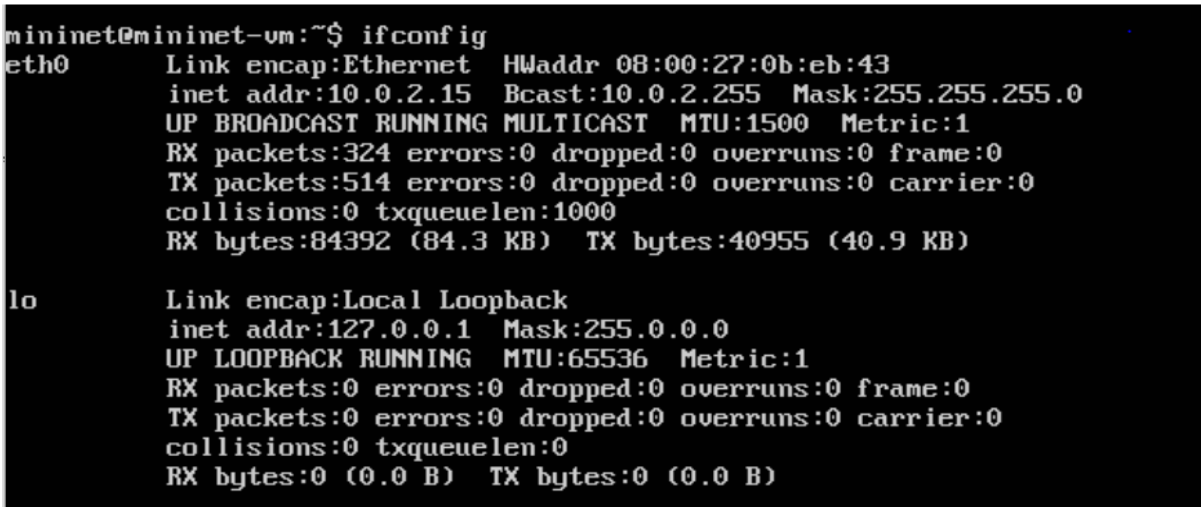
IP ADDRESS :- IP(Internet Protocol) Address uses Internet Protocol for communication. It is a numerical label assigned to each device connected to a computer network. Host or network interface identification and location addressing are two principals of it.

MAC/PHYSICAL ADDRESS :- MAC(Media Access Control) Address is used as a network address for various network technologies such as Ethernet and Wi-Fi. MAC address of a device is a unique identifier assigned to a network interface controller at data link layer of a network segment for communications.

SUBNET MASK :- A subnet mask separates the IP address into the network and host addresses (<network><host>) which are components of IP an address. Subnetting further divides the host part of an IP address into a subnet and host address (<network><subnet><host>) if additional subnetwork is needed.

GATEWAY :- It is a component which is part of two networks that use different protocols. It translates one protocol into the other(so called as protocol converter). It can operate at any network layer.

(b)



MTU (MAXIMUM TRANSMISSION UNIT) :- It is the size of largest protocol data unit(PDU) that can be communicated in a single network layer transaction.

(c)

Ethernet adapter VirtualBox Host-Only Network:

Link-local IPv6 Address . . . . . : fe80::b925:875c:ea8a:482c%3

Ethernet adapter VMware Network Adapter VMnet1:

Link-local IPv6 Address . . . . . : fe80::4c08:10f:8b43:9460%22

Ethernet adapter VMware Network Adapter VMnet8:

Link-local IPv6 Address . . . . . : fe80::d8ba:2df0:bd75:6026%10

Wireless LAN adapter Wi-Fi:

Link-local IPv6 Address . . . . . : fe80::10d7:fe89:9e25:ad18%5

IPv6 addresses are **128** bits in length and are made up of hexadecimal characters.

Que 4)

```
C:\WINDOWS\system32>tracert www.iitd.ac.in

Tracing route to www.iitd.ac.in [10.7.174.111]
over a maximum of 30 hops:

  1    4 ms    2 ms    3 ms  10.184.32.14
  2    2 ms    2 ms    2 ms  10.254.236.10
  3    1 ms    2 ms    2 ms  www.iitd.ac.in [10.7.174.111]

Trace complete.
```

```
C:\WINDOWS\system32>tracert www.cse.iitd.ac.in

Tracing route to bahar.cse.iitd.ac.in [10.208.20.4]
over a maximum of 30 hops:

  1    2 ms    2 ms    2 ms  10.184.32.14
  2   76 ms    4 ms   16 ms  10.254.208.2
  3    2 ms    5 ms    1 ms  10.208.20.4

Trace complete.
```

List of Common Routers :

- 10.184.32.14

List of Different Routers :

1) In www.iitd.ac.in :
   - 10.254.236.10
   - 10.7.174.111 [www.iitd.ac.in]
2) In www.cse.iitd.ac.in :
   - 10.254.208.2
   - 10.208.20.4 [bahar.cse.iitd.ac.in]

The Statement - “In theory the RTT to routers further along the path should be larger than for those closer to the source” does not hold always, since due to traffic, congestion and other factors routers in between the end servers may change to get efficient RTT.

So after experimenting at different times , it is found that RTT value cannot always hold less values for closer server distances, but keeps fluctuating by some milliseconds.

And it is observed that the difference between RTT values of www.iitd.ac.in and www.cse.iitd.ac.in is very minute in magnitude to be underestimated in such cases.

Que 5)

To find MAC address , default gateway is required.

It can be obtained using ipconfig as follows :

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : iitd.ac.in
   Link-local IPv6 Address . . . . . : fe80::10d7:fe89:9e25:ad18%5
   IPv4 Address. . . . . . . . . . . : 10.184.36.154
   Subnet Mask . . . . . . . . . . . : 255.255.224.0
   Default Gateway . . . . . . . . . : 10.184.32.1
```

Now using ARP command :

```
C:\WINDOWS\system32>arp -a
Interface: 192.168.56.1 --- 0x3
  Internet Address      Physical Address      Type
  192.168.56.255        ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  224.0.1.60            01-00-5e-00-01-3c     static
  239.255.255.250       01-00-5e-7f-ff-fa     static

Interface: 10.184.36.154 --- 0x5
  Internet Address      Physical Address      Type
  10.184.32.1           00-00-5e-00-01-f3     dynamic
  10.184.32.13          84-78-ac-19-a5-41     dynamic
  10.184.32.14          40-55-39-0c-9f-c1     dynamic
  10.184.63.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.254.1 --- 0xa
  Internet Address      Physical Address      Type
  192.168.254.254       00-50-56-f6-90-d3     dynamic
  192.168.254.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  224.0.1.60            01-00-5e-00-01-3c     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 192.168.152.1 --- 0x16
  Internet Address      Physical Address      Type
  192.168.152.254       00-50-56-f9-ec-24     dynamic
```

```
192.168.152.255      ff-ff-ff-ff-ff-ff     static
224.0.0.22           01-00-5e-00-00-16     static
224.0.0.251          01-00-5e-00-00-fb     static
224.0.0.252          01-00-5e-00-00-fc     static
224.0.1.60           01-00-5e-00-01-3c     static
239.255.255.250      01-00-5e-7f-ff-fa     static
255.255.255.255      ff-ff-ff-ff-ff-ff     static
```

Since our gateway is 10.184.32.1, therefore from above interface of 10.184.32.1 , it is observed that MAC(Physical) address is **00-00-5e-00-01-f3** .

Que 6)

The Domain Name System (DNS) is a distributed directory that resolves human-readable hostnames, such as www.google.com into machine-readable addresses like 216.58.221.36. DNS is like a phone-book for internet , we don't have to remember the IP address , just the website name should be remembered to visit. It is DNS which converts it into address and show us the required data on webpage or do other actions on the internet.

DNS works as per the following process:

1) Request information
2) Ask the recursive DNS servers
3) Ask the root name servers
4) Ask the TLD(Top-Level Domain) name servers
5) Ask the authoritative DNS servers
6) Retrieve the record
7) Receive the answer

(a)

```
C:\WINDOWS\system32>nslookup 128.42.204.11
Server:  dns1.cc.iitd.ac.in
Address:  10.10.2.2

Name:    www.netfu.rice.edu
Address:  128.42.204.11
```

Therefore URL corresponding to IP address 128.42.204.11 is www.netfu.rice.edu .

(b)

List Of Public DNS Providers :-

Provider	Primary DNS Server	Secondary DNS Server
Level3	209.244.0.3	209.244.0.4
Verisign	64.6.64.6	64.6.65.6
Google	8.8.8.8	8.8.4.4
Quad9	9.9.9.9	149.112.112.112
DNS.WATCH	84.200.69.80	84.200.70.40
Comodo Secure DNS	8.26.56.26	8.20.247.20
OpenDNS Home	208.67.222.222	208.67.220.220

Que 7)
(b)

```
$ nmap –n 10.208.26.0/24

Starting Nmap 7.60 ( https://nmap.org ) at 2018-08-17 23:23 IST
Failed to resolve "–n".
Nmap scan report for 10.208.26.1
Host is up (0.0040s latency).
Not shown: 997 closed ports
PORT   STATE SERVICE
22/tcp open  ssh
23/tcp open  telnet
80/tcp open  http

Nmap scan report for 10.208.26.127
Host is up (0.0053s latency).
Not shown: 998 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
3389/tcp open  ms-wbt-server

Nmap scan report for 10.208.26.145
Host is up (0.0027s latency).
Not shown: 998 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
3389/tcp open  ms-wbt-server

Nmap scan report for 10.208.26.146
Host is up (0.0031s latency).
Not shown: 995 filtered ports
PORT     STATE SERVICE
80/tcp   open  http
1801/tcp open  msmq
2103/tcp open  zephyr-clt
2105/tcp open  eklogin
2107/tcp open  msmq-mgmt

Nmap scan report for 10.208.26.148
Host is up (0.013s latency).
Not shown: 999 closed ports
PORT     STATE SERVICE
5900/tcp open  vnc

Nmap scan report for 10.208.26.160
Host is up (0.0098s latency).
All 1000 scanned ports on 10.208.26.160 are closed

Nmap scan report for 10.208.26.165
Host is up (0.032s latency).
Not shown: 998 closed ports
```

```
PORT     STATE SERVICE
22/tcp   open  ssh
3389/tcp open  ms-wbt-server

Nmap scan report for 10.208.26.175
Host is up (0.032s latency).
Not shown: 995 closed ports
PORT     STATE SERVICE
80/tcp   open  http
443/tcp  open  https
515/tcp  open  printer
631/tcp  open  ipp
9100/tcp open  jetdirect

Nmap scan report for 10.208.26.179
Host is up (0.029s latency).
Not shown: 995 closed ports
PORT     STATE SERVICE
80/tcp   open  http
554/tcp  open  rtsp
880/tcp  open  unknown
8000/tcp open  http-alt
9010/tcp open  sdr

Nmap scan report for 10.208.26.184
Host is up (0.032s latency).
Not shown: 999 closed ports
PORT   STATE SERVICE
22/tcp open  ssh

Nmap scan report for 10.208.26.201
Host is up (0.0030s latency).
Not shown: 998 closed ports
PORT     STATE SERVICE
80/tcp   open  http
5900/tcp open  vnc

Nmap scan report for 10.208.26.202
Host is up (0.031s latency).
All 1000 scanned ports on 10.208.26.202 are closed

Nmap scan report for 10.208.26.211
Host is up (0.032s latency).
All 1000 scanned ports on 10.208.26.211 are closed

Nmap scan report for 10.208.26.216
Host is up (0.0040s latency).
Not shown: 997 filtered ports
PORT     STATE SERVICE
80/tcp   open  http
515/tcp  open  printer
9100/tcp open  jetdirect
```

```
Nmap scan report for 10.208.26.221
Host is up (0.013s latency).
All 1000 scanned ports on 10.208.26.221 are closed

Nmap scan report for 10.208.26.222
Host is up (0.0096s latency).
Not shown: 995 closed ports
PORT     STATE SERVICE
80/tcp   open  http
554/tcp  open  rtsp
880/tcp  open  unknown
8000/tcp open  http-alt
9010/tcp open  sdr

Nmap scan report for 10.208.26.238
Host is up (0.0038s latency).
All 1000 scanned ports on 10.208.26.238 are closed

Nmap scan report for 10.208.26.241
Host is up (0.0048s latency).
Not shown: 998 closed ports
PORT     STATE SERVICE
22/tcp   open  ssh
3389/tcp open  ms-wbt-server

Nmap scan report for 10.208.26.247
Host is up (0.0032s latency).
Not shown: 998 filtered ports
PORT    STATE SERVICE
80/tcp  open  http
443/tcp open  https

Nmap scan report for 10.208.26.248
Host is up (0.0083s latency).
Not shown: 999 closed ports
PORT     STATE SERVICE
3389/tcp open  ms-wbt-server

Nmap scan report for 10.208.26.254
Host is up (0.028s latency).
Not shown: 993 closed ports
PORT      STATE SERVICE
135/tcp   open  msrpc
139/tcp   open  netbios-ssn
445/tcp   open  microsoft-ds
49152/tcp open  unknown
49153/tcp open  unknown
49154/tcp open  unknown
49160/tcp open  unknown

Nmap done: 256 IP addresses (21 hosts up) scanned in 16.08 seconds
```