

## Question 1)

a) Ip address marked with box

```
shashank-gadamsetty@shashank-gadamsetty:~$ ifconfig
eno2: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether d0:c5:d3:10:de:d5 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0x60100000-60120000

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 1018 bytes 111933 (111.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1018 bytes 111933 (111.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.42.190 netmask 255.255.224.0 broadcast 192.168.63.255
    inet6 fe80::bead:ebc4:273c:3334 prefixlen 64 scopeid 0x20<link>
    ether f4:26:79:2e:b7:0b txqueuelen 1000 (Ethernet)
    RX packets 51196 bytes 28842593 (28.8 MB)
    RX errors 0 dropped 164 overruns 0 frame 0
    TX packets 5803 bytes 1992283 (1.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

b) They are different. This is because the IP address in the ifconfig is for a private network. But the second one is IP address for a public network. IP address are unique over a network.

## What Is My IP?

My Public IPv4: [103.25.231.125](#) 

My Public IPv6: Not Detected

My IP Location: Noida, UP IN 

My ISP: Indraprastha Institute of Information Technology Delhi 

## Question 2)

```
Aug 27 10:51
shashank-gadamsetty@shashank-gadamsetty: ~
shashank-gadamsetty@shashank-gadamsetty:~$ sudo ifconfig wlo1 1.1.1.1
[sudo] password for shashank-gadamsetty:
shashank-gadamsetty@shashank-gadamsetty:~$ ifconfig
eno2: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether d0:c5:d3:10:de:d5 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0x60100000-60120000

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 5306 bytes 601013 (601.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 5306 bytes 601013 (601.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 1.1.1.1 netmask 255.0.0.0 broadcast 1.255.255.255
    inet6 fe80::bead:ebc4:273c:3334 prefixlen 64 scopeid 0x20<link>
    ether f4:26:79:2e:b7:0b txqueuelen 1000 (Ethernet)
    RX packets 360362 bytes 255250826 (255.2 MB)
    RX errors 0 dropped 1110 overruns 0 frame 0
    TX packets 37309 bytes 12259506 (12.2 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

a)

```
shashank-gadamsetty@shashank-gadamsetty:~$ sudo ifconfig wlo1 192.168.42.190
shashank-gadamsetty@shashank-gadamsetty:~$ ifconfig
eno2: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether d0:c5:d3:10:de:d5 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 16 memory 0x60100000-60120000

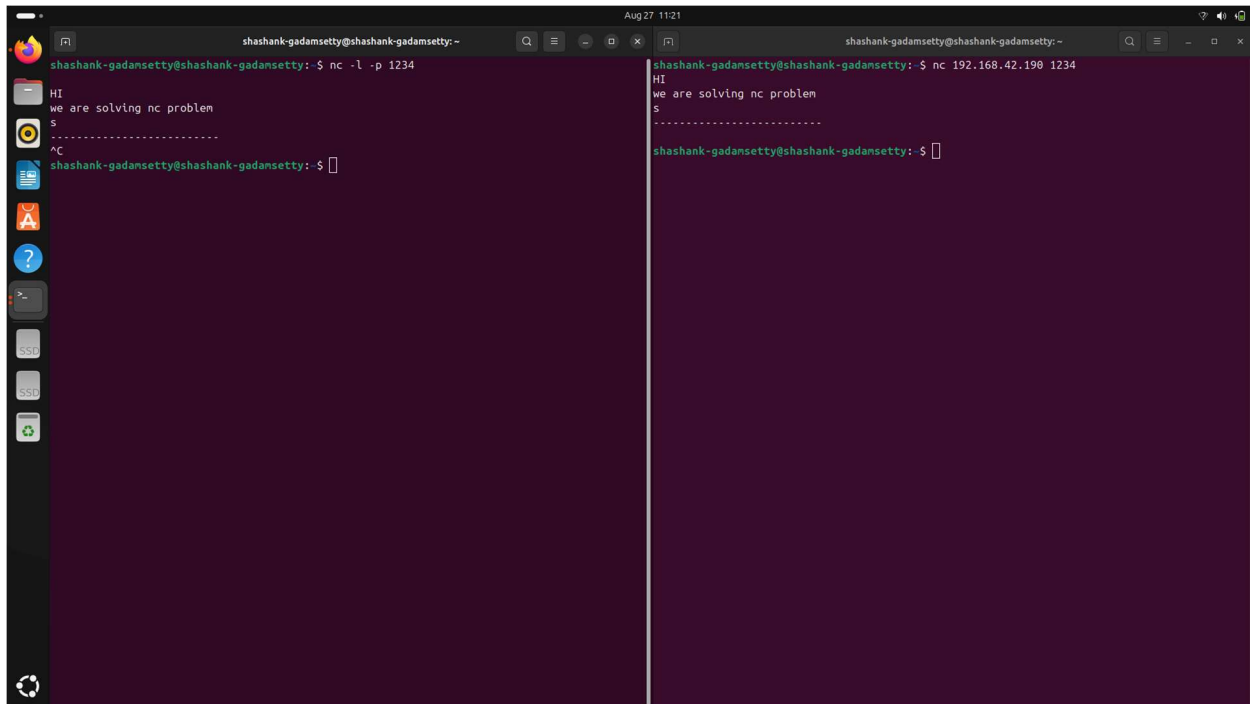
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 5564 bytes 617705 (617.7 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 5564 bytes 617705 (617.7 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.42.190 netmask 255.255.255.0 broadcast 192.168.42.255
    inet6 fe80::bead:ebc4:273c:3334 prefixlen 64 scopeid 0x20<link>
    ether f4:26:79:2e:b7:0b txqueuelen 1000 (Ethernet)
    RX packets 365146 bytes 257447357 (257.4 MB)
    RX errors 0 dropped 1130 overruns 0 frame 0
    TX packets 37544 bytes 12331099 (12.3 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

shashank-gadamsetty@shashank-gadamsetty:~$
```

## Question 3)

a)

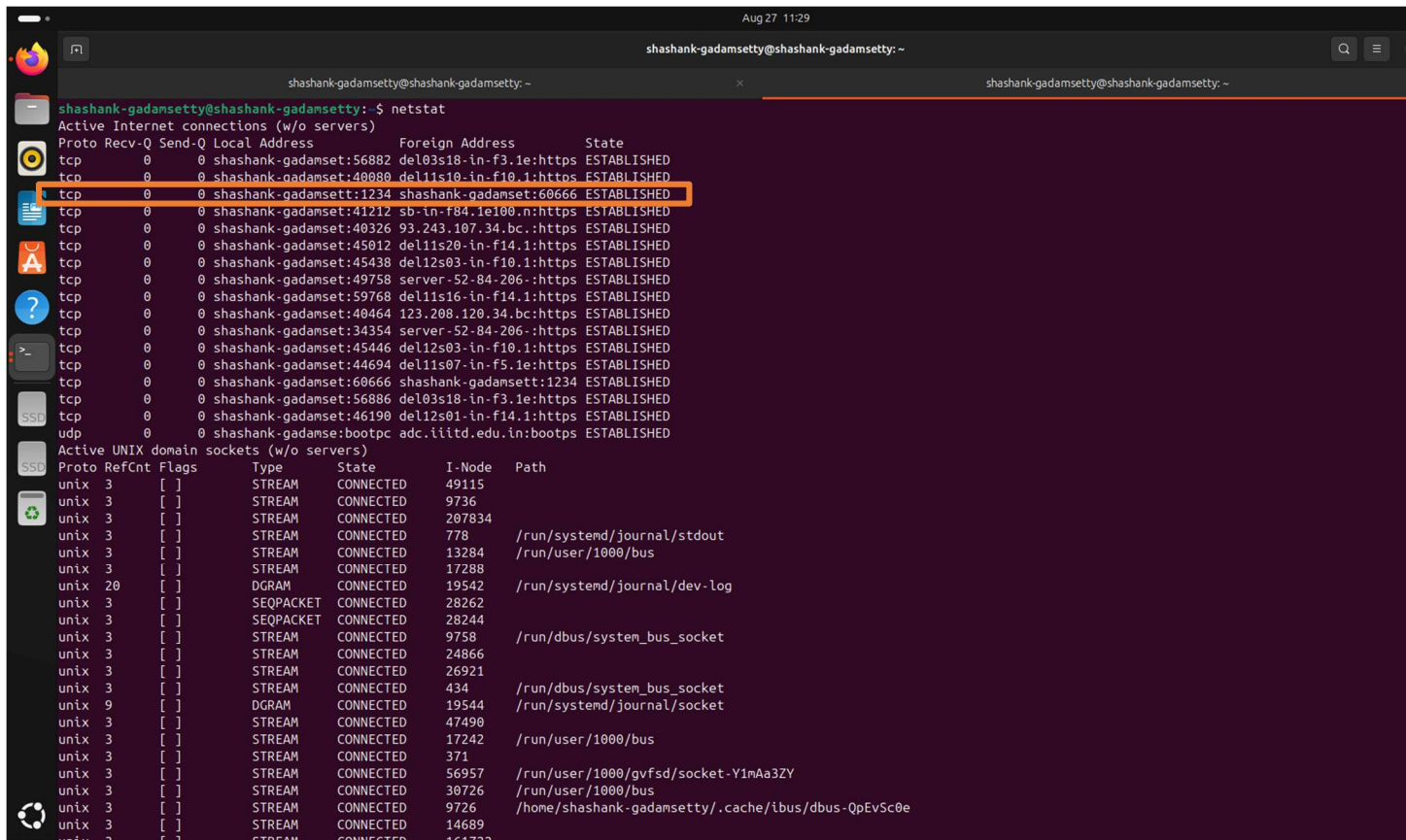


The image shows two terminal windows side-by-side. The left window is a netcat listener on port 1234. It receives a connection from 192.168.42.190. The user types 'HI', 'we are solving nc problem', and 's'. The right window is a netcat client connecting to 192.168.42.190 on port 1234. It sends 'HI', 'we are solving nc problem', and 's'.

```
shashank-gadamsetty@shashank-gadamsetty:~$ nc -l -p 1234
HI
we are solving nc problem
s
-----
shashank-gadamsetty@shashank-gadamsetty:~$

shashank-gadamsetty@shashank-gadamsetty:~$ nc 192.168.42.190 1234
HI
we are solving nc problem
s
-----
shashank-gadamsetty@shashank-gadamsetty:~$
```

b)



The image shows a terminal window with the command 'netstat' executed. The output displays active internet connections (w/o servers) and active UNIX domain sockets (w/o servers). The connection to shashank-gadamset:1234 is highlighted with a red box.

```
shashank-gadamsetty@shashank-gadamsetty:~$ netstat
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 shashank-gadamset:56882 del03s18-in-f3.1e:https ESTABLISHED
tcp        0      0 shashank-gadamset:40080 del11s10-in-f10.1:https ESTABLISHED
tcp        0      0 shashank-gadamset:1234 shashank-gadamset:60666 ESTABLISHED
tcp        0      0 shashank-gadamset:41212 sb-in-f84.1e100.n:https ESTABLISHED
tcp        0      0 shashank-gadamset:40326 93.243.107.34.bc:https ESTABLISHED
tcp        0      0 shashank-gadamset:45012 del11s20-in-f14.1:https ESTABLISHED
tcp        0      0 shashank-gadamset:45438 del12s03-in-f10.1:https ESTABLISHED
tcp        0      0 shashank-gadamset:49758 server-52-84-206:https ESTABLISHED
tcp        0      0 shashank-gadamset:59768 del11s16-in-f14.1:https ESTABLISHED
tcp        0      0 shashank-gadamset:40464 123.208.120.34.bc:https ESTABLISHED
tcp        0      0 shashank-gadamset:34354 server-52-84-206:https ESTABLISHED
tcp        0      0 shashank-gadamset:45446 del12s03-in-f10.1:https ESTABLISHED
tcp        0      0 shashank-gadamset:44694 del11s07-in-f5.1e:https ESTABLISHED
tcp        0      0 shashank-gadamset:60666 shashank-gadamset:1234 ESTABLISHED
tcp        0      0 shashank-gadamset:56886 del03s18-in-f3.1e:https ESTABLISHED
tcp        0      0 shashank-gadamset:46190 del12s01-in-f14.1:https ESTABLISHED
udp        0      0 shashank-gadamse:bootpc adc.iiitd.edu.in:bootps ESTABLISHED

Active UNIX domain sockets (w/o servers)
Proto RefCnt Flags       Type       State I-Node Path
unix    3      [ ]         STREAM     CONNECTED 49115
unix    3      [ ]         STREAM     CONNECTED 9736
unix    3      [ ]         STREAM     CONNECTED 207834
unix    3      [ ]         STREAM     CONNECTED 778 /run/systemd/journal/stdout
unix    3      [ ]         STREAM     CONNECTED 13284 /run/user/1000/bus
unix    3      [ ]         STREAM     CONNECTED 17288
unix    20    [ ]         DGRAM      CONNECTED 19542 /run/systemd/journal/dev-log
unix    3      [ ]         SEQPACKET  CONNECTED 28262
unix    3      [ ]         SEQPACKET  CONNECTED 28244
unix    3      [ ]         STREAM     CONNECTED 9758 /run/dbus/system_bus_socket
unix    3      [ ]         STREAM     CONNECTED 24866
unix    3      [ ]         STREAM     CONNECTED 26921
unix    3      [ ]         STREAM     CONNECTED 434 /run/dbus/system_bus_socket
unix    9      [ ]         DGRAM      CONNECTED 19544 /run/systemd/journal/socket
unix    3      [ ]         STREAM     CONNECTED 47490
unix    3      [ ]         STREAM     CONNECTED 17242 /run/user/1000/bus
unix    3      [ ]         STREAM     CONNECTED 371
unix    3      [ ]         STREAM     CONNECTED 56957 /run/user/1000/gvfsd/socket-Y1nAa3ZY
unix    3      [ ]         STREAM     CONNECTED 30726 /run/user/1000/bus
unix    3      [ ]         STREAM     CONNECTED 9726 /home/shashank-gadamsetty/.cache/ibus/dbus-QpEvSc0e
unix    3      [ ]         STREAM     CONNECTED 14689
unix    3      [ ]         STREAM     CONNECTED 161222
```

## Question 4)

- **Run nslookup in Interactive Mode:** Start nslookup without any arguments to enter interactive mode
- **Set the Query Type to NS (Name Server):** Specify that you want to query for the name servers
- **Query for the Domain:** Now, enter the domain name to query.

a)

```
shashank-gadamsetty@shashank-gadamsetty:~$ nslookup
> set type=ns
> google.in
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
google.in    nameserver = ns3.google.com.
google.in    nameserver = ns2.google.com.
google.in    nameserver = ns1.google.com.
google.in    nameserver = ns4.google.com.

Authoritative answers can be found from:
ns3.google.com internet address = 216.239.36.10
ns3.google.com has AAAA address 2001:4860:4802:36::a
ns2.google.com internet address = 216.239.34.10
ns2.google.com has AAAA address 2001:4860:4802:34::a
ns1.google.com internet address = 216.239.32.10
ns1.google.com has AAAA address 2001:4860:4802:32::a
ns4.google.com internet address = 216.239.38.10
ns4.google.com has AAAA address 2001:4860:4802:38::a
> █
```

b)

```
shashank-gadamsetty@shashank-gadamsetty:~$ nslookup -debug google.in
Server:      127.0.0.53
Address:     127.0.0.53#53

-----
QUESTIONS:
  google.in, type = A, class = IN
ANSWERS:
-> google.in
  internet address = 142.250.193.4
  ttl = 300
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Non-authoritative answer:
Name:  google.in
Address: 142.250.193.4
-----
QUESTIONS:
  google.in, type = AAAA, class = IN
ANSWERS:
-> google.in
  has AAAA address 2404:6800:4002:819::2004
  ttl = 300
AUTHORITY RECORDS:
ADDITIONAL RECORDS:
-----
Name:  google.in
Address: 2404:6800:4002:819::2004
```



## Question 5)

a)

```
shashank-gadamsetty@shashank-gadamsetty:~$ traceroute google.in
traceroute to google.in (142.250.193.4), 64 hops max
 1  192.168.32.254  8.288ms  4.343ms  3.098ms
 2  192.168.1.99   3.580ms  3.590ms  3.044ms
 3  103.25.231.1   3.797ms  3.322ms  4.814ms
 4  * * *
 5  10.119.234.162 6.814ms  6.309ms  6.094ms
 6  72.14.194.160  7.599ms  38.036ms 7.295ms
 7  192.178.80.159 31.806ms 63.782ms 31.146ms
 8  142.251.54.89  32.467ms 30.766ms 32.125ms
 9  142.250.193.4  29.283ms 28.790ms 29.335ms
```

There are 6 intermediate hosts as we are ignoring the \*\*\* for this assignment. Their IP addresses are:

192.168.1.99	3.404
103.25.231.1	3.977
10.119.234.162	6.406
72.14.194.160	17.643
192.178.80.159	42.244
142.251.54.89	31.786

b)

```
shashank-gadamsetty@shashank-gadamsetty:~$ ping -c 50 google.com
PING google.com (142.250.206.174) 56(84) bytes of data:
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=1 ttl=114 time=83.2 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=2 ttl=114 time=74.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=3 ttl=114 time=29.2 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=4 ttl=114 time=28.1 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=5 ttl=114 time=27.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=6 ttl=114 time=29.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=7 ttl=114 time=29.2 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=8 ttl=114 time=29.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=9 ttl=114 time=26.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=10 ttl=114 time=26.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=11 ttl=114 time=37.8 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=12 ttl=114 time=35.5 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=13 ttl=114 time=28.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=14 ttl=114 time=28.7 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=15 ttl=114 time=40.4 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=16 ttl=114 time=33.2 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=17 ttl=114 time=27.1 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=18 ttl=114 time=27.3 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=19 ttl=114 time=28.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=20 ttl=114 time=36.8 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=21 ttl=114 time=50.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=22 ttl=114 time=28.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=23 ttl=114 time=63.5 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=24 ttl=114 time=63.9 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=25 ttl=114 time=35.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=26 ttl=114 time=62.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=27 ttl=114 time=29.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=28 ttl=114 time=30.7 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=29 ttl=114 time=41.7 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=30 ttl=114 time=37.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=31 ttl=114 time=29.1 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=32 ttl=114 time=44.3 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=33 ttl=114 time=29.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=34 ttl=114 time=29.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=35 ttl=114 time=28.5 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=36 ttl=114 time=32.5 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=37 ttl=114 time=29.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=38 ttl=114 time=50.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=39 ttl=114 time=49.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=40 ttl=114 time=28.8 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=41 ttl=114 time=32.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=42 ttl=114 time=30.3 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=43 ttl=114 time=35.1 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=44 ttl=114 time=28.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=45 ttl=114 time=28.3 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=46 ttl=114 time=29.1 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=47 ttl=114 time=33.6 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=48 ttl=114 time=30.0 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=49 ttl=114 time=29.3 ms
64 bytes from dell1s22-in-f14.1e100.net (142.250.206.174): icmp_seq=50 ttl=114 time=32.2 ms

--- google.com ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49058ms
rtt min/avg/max/ndev = 26.892/36.213/83.229/12.802 ms
```

c) The average is 36.213 ms for ping, while for trace route it is 139.842 ms. This is because ping measures direct round-trip time to the destination without detailing every hop, while traceroute breaks down the trip into multiple hops and measures the time taken to each intermediate host.

#### d) Comparison of Maximum Traceroute Latency with Ping Latency

The highest average latency from the traceroute results is **42.245 ms** (Hop 7: 192.178.80.159).

But the average latency from the ping command is **36.213 ms**.

They are not matching.

The maximum latency in traceroute could be due to specific network congestion or delays at that particular hop (Hop 7). The ping command measures the latency for the entire round trip to the destination, which might take a different path or be optimized, thus showing a lower average latency.

e) When using the traceroute command, you might see multiple entries for a single hop. These multiple entries indicate that the router or device at that hop is using **load balancing** or has multiple network interfaces.

- **Load Balancing:** The router may have multiple paths (routes) to the next hop or the destination, and it distributes packets across these paths to balance the load.
- **Multiple Interfaces:** The router might have several interfaces (e.g., different physical or virtual ports), and each probe from the traceroute command takes a different route through these interfaces.



This results in multiple round-trip times being recorded for the same hop. Each RTT corresponds to a different path that the probe packets have taken to get through that hop. These entries help to diagnose network behavior such as redundant paths or network resilience but may complicate direct comparisons of latency across hops.

f)

```
shashank-gadamsetty@shashank-gadamsetty:~$ ping -c 50 stanford.edu
PING stanford.edu (171.67.215.200) 56(84) bytes of data:
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=1 ttl=242 time=712 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=242 time=426 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=242 time=333 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=242 time=367 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=242 time=532 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=242 time=321 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=242 time=333 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=242 time=577 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=242 time=380 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=242 time=497 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=242 time=438 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=242 time=367 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=242 time=392 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=242 time=367 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=242 time=452 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=242 time=865 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=242 time=467 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=242 time=387 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=242 time=418 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=242 time=427 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=242 time=470 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=242 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=242 time=308 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=242 time=300 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=242 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=242 time=367 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=242 time=497 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=242 time=328 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=242 time=343 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=242 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=242 time=396 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=242 time=314 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=242 time=335 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=242 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=242 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=242 time=513 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=242 time=435 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=242 time=354 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=242 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=242 time=411 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=242 time=444 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=242 time=753 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=242 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=242 time=400 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=242 time=311 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=242 time=651 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=242 time=378 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=242 time=394 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=242 time=421 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=242 time=331 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49009ms
rtt min/avg/max/mdev = 287.127/410.607/865.048/123.028 ms
```

Average latency is 410.607

g)

```
shashank-gadamsetty@shashank-gadamsetty:~$ traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 64 hops max
 1  192.168.32.254  4.433ms  8.237ms  14.289ms
 2  192.168.1.99  2.656ms  2.970ms  2.840ms
 3  103.25.231.1  5.828ms  3.403ms  3.947ms
 4  10.1.209.201  31.785ms  30.349ms  31.547ms
 5  10.1.200.137  50.265ms  34.373ms  33.639ms
 6  10.255.238.122  33.986ms  32.917ms  34.757ms
 7  180.149.48.18  31.537ms  28.319ms  28.506ms
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  171.64.255.232  674.859ms  518.057ms  437.200ms
24  171.66.255.200  625.793ms  368.197ms  325.715ms
25  171.67.215.200  399.920ms  402.599ms  301.325ms
```

There are 9 hops (not counting \* \* \*) as outputted by traceroute Stanford.edu. There are 7 hops in traceroute google.in. This can be because of direct route may not be available so readily in router tables for Stanford.edu as compared to google.in.

Google.in might have more optimized or direct routes available due to Google's extensive and well-distributed global infrastructure, which could lead to fewer hops. Google, being a global tech giant, likely has servers that are closer to your location or more integrated into various ISP networks. This result in fewer hops.

g) The servers for google.in are likely geographically closer to your location, possibly even within your country or region, due to Google's extensive global infrastructure.

The servers for stanford.edu on the other hand are likely located in California, USA, which could be much farther from your location. Greater geographical distance generally results in higher latency due to the longer physical distance that data must travel.



## Question 6)

```
shashank-gadamsetty@shashank-gadamsetty:~$ sudo ifconfig lo down
shashank-gadamsetty@shashank-gadamsetty:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
^C
--- 127.0.0.1 ping statistics ---
60 packets transmitted, 0 received, 100% packet loss, time 60434ms
```

First down the local host. Then send a ping to the address.

# OR

```
shashank-gadamsetty@shashank-gadamsetty:~$ sudo iptables -I INPUT -p icmp --icmp-type echo-
request -j DROP
shashank-gadamsetty@shashank-gadamsetty:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
^C
--- 127.0.0.1 ping statistics ---
115 packets transmitted, 0 received, 100% packet loss, time 116750ms

shashank-gadamsetty@shashank-gadamsetty:~$ █
```

To simulate a ping failure to 127.0.0.1

On Linux systems, you can use iptables or ufw to block ICMP packets.

### Linux Example with iptables:

```
sudo iptables -I INPUT -p icmp --icmp-type echo-request -j DROP
```

This command drops incoming ICMP echo requests (which are used by the ping command).