

Q1)


a) IP address: 172.30.22.38


```
kartikeya@Kartikeya:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1400
    inet 172.30.22.38 netmask 255.255.240.0 broadcast 172.30.31.255
    inet6 fe80::215:5dff:fe77:958f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:77:95:8f txqueuelen 1000 (Ethernet)
    RX packets 2168 bytes 541231 (541.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 266 bytes 60381 (60.3 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 150 bytes 14345 (14.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 150 bytes 14345 (14.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```


b) No, my IP address through ifconfig is different from IP address shown on <https://www.whatismyip.com> because the IP address through ifconfig command is the private IP address that is used for the local network and cannot be used as a public IP address, it is assigned by the router for communication between the devices on the same network. The IP address on the website shown is different because it is assigned by the internet service provider and is used to for accessing data online.

What Is My IP?

My Public IPv4: [122.161.67.40](#) 

My Public IPv6: [2401:4900:1c23:4e92:f09b:250:b2a1:d635](#) 

My IP Location: New Delhi, DL IN 

My ISP: Bharti Airtel Ltd. 

Q2)

a)

```
kartikeya@Kartikeya:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1400
    inet 172.30.22.38 netmask 255.255.0.0 broadcast 172.30.255.255
    inet6 fe80::215:5dff:fe77:958f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:77:95:8f txqueuelen 1000 (Ethernet)
    RX packets 6597 bytes 4776973 (4.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1169 bytes 132985 (132.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

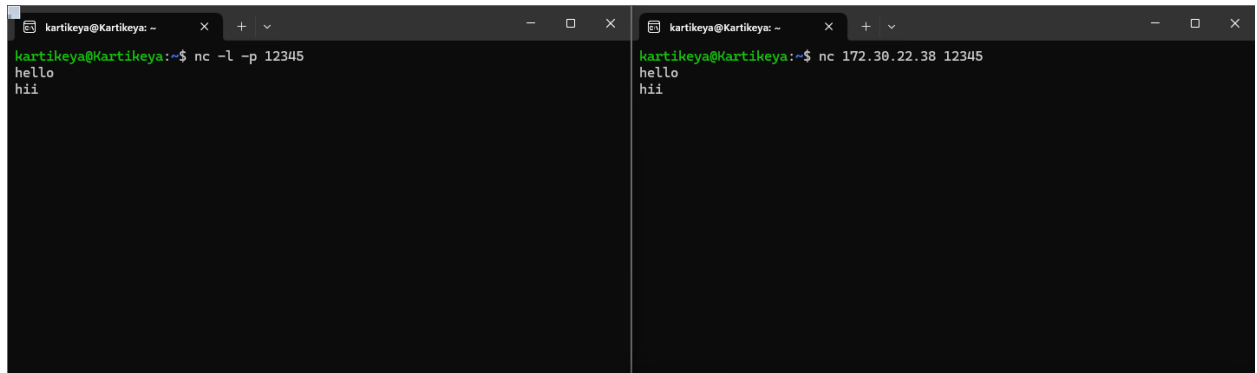
kartikeya@Kartikeya:~$ sudo ifconfig eth0 191.23.34.69
kartikeya@Kartikeya:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1400
    inet 191.23.34.69 netmask 255.255.0.0 broadcast 191.23.255.255
    inet6 fe80::215:5dff:fe77:958f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:77:95:8f txqueuelen 1000 (Ethernet)
    RX packets 6601 bytes 4777420 (4.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1169 bytes 132985 (132.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kartikeya@Kartikeya:~$ sudo ifconfig eth0 172.30.22.38
kartikeya@Kartikeya:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1400
    inet 172.30.22.38 netmask 255.255.0.0 broadcast 172.30.255.255
    inet6 fe80::215:5dff:fe77:958f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:77:95:8f txqueuelen 1000 (Ethernet)
    RX packets 6602 bytes 4777506 (4.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1169 bytes 132985 (132.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kartikeya@Kartikeya:~$ |
```

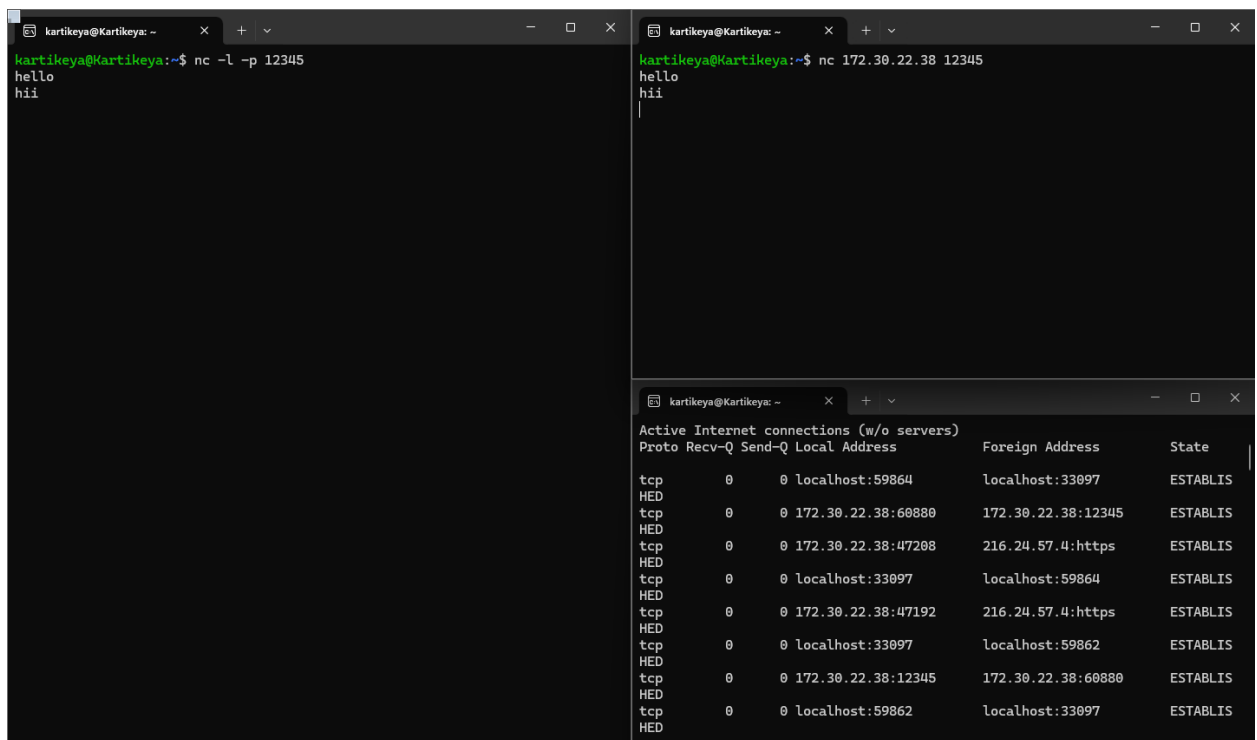
Q3)

a)



The image shows two terminal windows side-by-side. The left window has a title bar 'kartikeya@Kartikeya: ~' and contains the command 'nc -l -p 12345'. It has received two lines of input: 'hello' and 'hii'. The right window has a title bar 'kartikeya@Kartikeya: ~' and contains the command 'nc 172.30.22.38 12345'. It has sent two lines of output: 'hello' and 'hii'.

b) The state of the TCP connection is ESTABLISHED.



The image shows three terminal windows. The top-left window is the same netcat listener as in part (a). The top-right window is the same netcat client as in part (a). The bottom-right window has a title bar 'kartikeya@Kartikeya: ~' and displays the output of the 'netstat -t' command, showing active internet connections.

Proto	Recv-Q	Send-Q	Local Address	Foreign Address	State
tcp	0	0	localhost:59864	localhost:33097	ESTABLIS
HED					
tcp	0	0	172.30.22.38:60880	172.30.22.38:12345	ESTABLIS
HED					
tcp	0	0	172.30.22.38:47208	216.24.57.4:https	ESTABLIS
HED					
tcp	0	0	localhost:33097	localhost:59864	ESTABLIS
HED					
tcp	0	0	172.30.22.38:47192	216.24.57.4:https	ESTABLIS
HED					
tcp	0	0	localhost:33097	localhost:59862	ESTABLIS
HED					
tcp	0	0	172.30.22.38:12345	172.30.22.38:60880	ESTABLIS
HED					
tcp	0	0	localhost:59862	localhost:33097	ESTABLIS
HED					

(in the right bottom tab we can see

tcp 0 0 172.30.22.38:60880 172.30.22.38:12345 ESTABLIS)

Q4)

a)

```
kartikeya@Kartikeya:~$ nslookup -type=ns google.in
Server:          10.255.255.254
Address:         10.255.255.254#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

kartikeya@Kartikeya:~$ nslookup google.in ns3.google.com
Server:          ns3.google.com
Address:         216.239.36.10#53

Name:   google.in
Address: 142.250.194.196
Name:   google.in
Address: 2404:6800:4002:824::2004
```

I have set the flag type to `ns` because we wanted to retrieve the name servers for the domain `google.in`. After that, I used `nslookup` again with one of those name servers to obtain an authoritative answer for "google.in."

Q4)

b)

```

kartikya@Kartikya:~$ nslookup -debug google.com
Server:          10.255.255.254
Address:         10.255.255.254#53

-----
      QUESTIONS:
        google.com, type = A, class = IN
      ANSWERS:
-> google.com
    internet address = 142.250.206.174
    ttl = 48
    AUTHORITY RECORDS:
    ADDITIONAL RECORDS:
-----
Non-authoritative answer:
Name:   google.com
Address: 142.250.206.174
-----
      QUESTIONS:
        google.com, type = AAAA, class = IN
      ANSWERS:
-> google.com
    has AAAA address 2404:6800:4002:82d::200e
    ttl = 215
    AUTHORITY RECORDS:
    ADDITIONAL RECORDS:
-----
Name:   google.com
Address: 2404:6800:4002:82d::200e

```

I have used the nslookup -debug google.com to query DNS records for google.com entry which provides the ip address along with the TTL value.

The TTL value for IPv4 address is 48 seconds and the TTL value for IPv6 address is 215 seconds and these entries will expire from local DNS after this time.

Q5)

- a) We have total 10 visible intermediate hosts:
- 1) 172.30.16.1
 - 2) 192.168.32.254
 - 3) 192.168.1.99
 - 4) 103.25.231.1
 - 5) 10.119.234.162

- 6) 72.14.195.56 and 72.14.194.160
- 7) 192.178.80.159 and 142.251.54.111
- 8) 142.251.54.87 and 142.251.54.89

```
kartikeya@Kartikeya:~$ traceroute google.in
traceroute to google.in (142.250.193.4), 30 hops max, 60 byte packets
 1 Kartikeya.mshome.net (172.30.16.1)  1.142 ms  1.054 ms  1.035 ms
 2 192.168.32.254 (192.168.32.254)  23.687 ms *  23.653 ms
 3 auth.iiitd.edu.in (192.168.1.99)  11.051 ms * *
 4 103.25.231.1 (103.25.231.1)  11.634 ms  11.620 ms *
 5 * * *
 6 10.119.234.162 (10.119.234.162)  12.211 ms  10.627 ms  8.958 ms
 7 72.14.195.56 (72.14.195.56)  10.597 ms  72.14.194.160 (72.14.194.160)  22.643 ms  22.165 ms
 8 192.178.80.159 (192.178.80.159)  43.621 ms  42.974 ms  142.251.54.111 (142.251.54.111)  59.667 ms
 9 142.251.54.87 (142.251.54.87)  57.827 ms  142.251.54.89 (142.251.54.89)  39.313 ms  142.251.54.87 (142.251.54.87)  37.291 ms
10 dell1s14-in-f4.1e100.net (142.250.193.4)  28.565 ms  29.172 ms  35.628 ms
kartikeya@Kartikeya:~$ ^C
```

Average Latency to Each Intermediate Host:

Hop 1 (172.30.16.1): Average Latency: 1.077 ms

Hop 2 (192.168.32.254): Average Latency: 23.67 ms

Hop 3 (192.168.1.99): Average Latency: 11.051 ms

Hop 4 (103.25.231.1): Average Latency: 11.627 ms

Hop 5 (10.119.234.162): Average Latency: 10.59867 ms

Hop6:

Intermediate IP1(72.14.195.56)

Intermediate IP2(72.14.194.160)

Average Latency: 18.4683 ms

Hop7:

Intermediate IP1(192.178.80.159)

Intermediate IP2(142.251.54.111)

Average Latency: 48.754 ms

Hop8:

Intermediate IP1(142.251.54.87)

Intermediate IP2(142.251.54.89)

Average Latency: 44.8103 ms

b)

```
kartikeya@Kartikeya:~$ ping -c 50 google.in
PING google.in (142.250.193.4) 56(84) bytes of data:
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=1 ttl=113 time=27.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=2 ttl=113 time=29.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=3 ttl=113 time=35.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=4 ttl=113 time=29.8 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=5 ttl=113 time=36.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=6 ttl=113 time=29.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=7 ttl=113 time=32.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=8 ttl=113 time=28.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=9 ttl=113 time=32.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=10 ttl=113 time=29.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=11 ttl=113 time=28.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=12 ttl=113 time=32.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=13 ttl=113 time=86.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=14 ttl=113 time=30.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=15 ttl=113 time=28.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=16 ttl=113 time=36.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=17 ttl=113 time=29.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=18 ttl=113 time=27.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=19 ttl=113 time=30.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=20 ttl=113 time=29.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=21 ttl=113 time=29.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=22 ttl=113 time=31.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=23 ttl=113 time=38.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=24 ttl=113 time=33.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=25 ttl=113 time=32.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=26 ttl=113 time=30.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=27 ttl=113 time=32.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=28 ttl=113 time=33.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=29 ttl=113 time=29.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=30 ttl=113 time=32.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=31 ttl=113 time=36.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=32 ttl=113 time=50.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=33 ttl=113 time=47.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=34 ttl=113 time=31.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=35 ttl=113 time=30.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=36 ttl=113 time=39.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=37 ttl=113 time=30.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=38 ttl=113 time=29.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=39 ttl=113 time=35.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=40 ttl=113 time=30.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=41 ttl=113 time=28.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=42 ttl=113 time=30.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=43 ttl=113 time=32.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=44 ttl=113 time=30.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=45 ttl=113 time=29.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=46 ttl=113 time=35.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=47 ttl=113 time=30.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=48 ttl=113 time=30.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=49 ttl=113 time=27.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=50 ttl=113 time=35.3 ms

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49092ms
rtt min/avg/max/mdev = 27.228/33.233/86.295/8.765 ms
```

Average latency: 33.233 ms as shown in the photo in the end

c) Sum of the latencies of part(a) = 170.05627 ms

traceroute measures cumulative delays as packets traverse multiple hops, which can increase the total time as each hop adds a small delay. ping directly measures only the round trip to the final destination, not accounting for the delay at each intermediate hop. The sum of the latencies from traceroute is generally larger because it represents the cumulative delay of each hop to the destination. In contrast, ping provides a direct measure to the destination's average round-trip time, making the results different.

- d) Maximum latency in traceout=48.754 ms
Average latency in ping=33.233 ms

Traceout command maximum latency is greater than the average ping command latency because of its additional delays in each hop.

- e) Multiple entries for a single hop in a traceroute result indicate that the traceroute command sends multiple packets to the same hop to measure the time it takes for each packet to reach that hop. This helps in identifying network congestion, packet loss, or variability in the path taken by the packets.
- f)

```
kartikeya@Kartikeya:~$ 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=241 time=294 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=241 time=308 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=241 time=341 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=241 time=296 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=241 time=294 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=241 time=333 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=241 time=349 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=241 time=366 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=241 time=393 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=241 time=316 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=241 time=293 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=241 time=375 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=241 time=297 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=241 time=317 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=241 time=341 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=241 time=307 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=241 time=330 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=241 time=355 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=241 time=376 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=241 time=301 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=241 time=297 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=241 time=340 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=241 time=363 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=241 time=307 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=241 time=326 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=377 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=395 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=314 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=494 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=241 time=365 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=241 time=384 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=241 time=306 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=241 time=330 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=241 time=348 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=241 time=349 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=241 time=317 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=241 time=337 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=241 time=359 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=241 time=349 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=241 time=299 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=241 time=324 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=241 time=308 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=241 time=379 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49070ms
rtt min/avg/max/mdev = 289.227/331.586/494.277/39.307 ms
```


Average Latency = 331.586 ms as we can see at the end of the image.

g)

```
kartikeya@Kartikeya:~$ traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets
 1 kartikeya.mshome.net (172.30.16.1)  0.362 ms  0.273 ms  0.260 ms
 2 192.168.160.254 (192.168.160.254)  42.581 ms  42.511 ms  42.504 ms
 3 vpn.iiitd.edu.in (192.168.1.99)  15.776 ms  15.747 ms  15.734 ms
 4 103.25.231.1 (103.25.231.1)  15.698 ms  15.629 ms  15.580 ms
 5 10.1.209.201 (10.1.209.201)  52.531 ms  52.521 ms  52.491 ms
 6 * 10.1.200.137 (10.1.200.137)  50.794 ms  50.666 ms
 7 10.255.238.254 (10.255.238.254)  42.993 ms  36.673 ms  36.572 ms
 8 180.149.48.18 (180.149.48.18)  28.745 ms  36.321 ms  36.249 ms
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 campus-nw-rtr-vl1104.SUNet (171.66.255.200)  402.312 ms * *
25 * campus-ial-nets-b-vl1104.SUNet (171.66.255.200)  316.282 ms *
26 * web.stanford.edu (171.67.215.200)  299.819 ms *
```

For Stanford.edu there are 25 hops where as for google.in there are 9 hops.

h) Latency for google.in = 33.233 ms

Latency for Stanford.edu = 331.586 ms

We can see that to reach the google.in server we need 9 hops and for reaching Stanford.edu we need 25 hops. This may be because the direct routing path of google.in is more closer to my network as compared to standford.edu.

Q6)

```
kartikeya@Kartikeya:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.30.22.38 netmask 255.255.240.0 broadcast 172.30.31.255
    inet6 fe80::215:5dff:fe22:c86f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:22:c8:6f txqueuelen 1000 (Ethernet)
    RX packets 3355 bytes 646534 (646.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 590 bytes 86517 (86.5 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 440 bytes 40054 (40.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 440 bytes 40054 (40.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kartikeya@Kartikeya:~$ sudo ifconfig lo down
kartikeya@Kartikeya:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.30.22.38 netmask 255.255.240.0 broadcast 172.30.31.255
    inet6 fe80::215:5dff:fe22:c86f prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:22:c8:6f txqueuelen 1000 (Ethernet)
    RX packets 3355 bytes 646534 (646.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 591 bytes 86587 (86.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kartikeya@Kartikeya:~$ 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 ---
10 packets transmitted, 0 received, 100% packet loss, time 9323ms
```

So in this we have disabled the lookback interface (lo) because it is responsible for internal communication within the machine and 127.0.0.1 is its IPv4 address. Since it is disabled so in this case we would suffer 100% packet loss.