

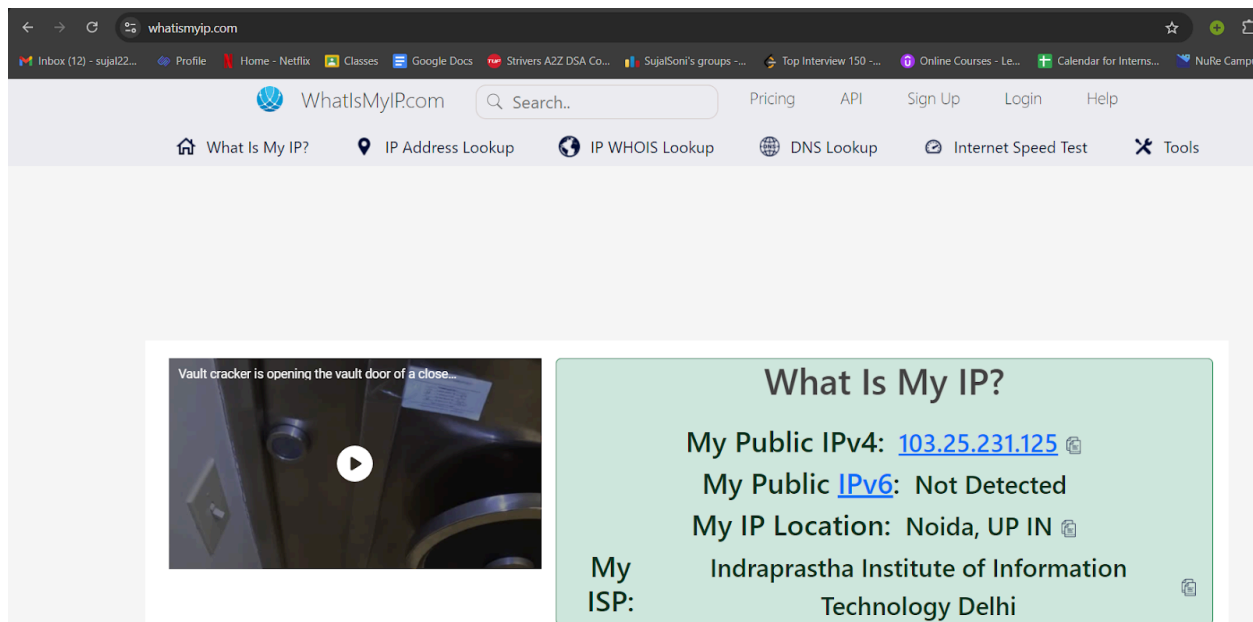
# Assignment - 1

- Sujal Soni (2022513)

Q1. a.) Ip address of my network interface using ifconfig command is 172.24.242.173

```
sujal26@Sujals-Playtop: ~  
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.153.1-microsoft-standard-WSL2 x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:        https://ubuntu.com/advantage  
  
This message is shown once a day. To disable it please create the  
/home/sujal26/.hushlogin file.  
sujal26@Sujals-Playtop:~$ ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500  
    inet 172.24.242.173  netmask 255.255.240.0  broadcast 172.255.255  
    inet6 fe80::215:5dff:feb5:73ec  prefixlen 64  scopeid 0x20<link>  
    ether 00:15:5d:b5:73:ec  txqueuelen 1000  (Ethernet)  
    RX packets 213  bytes 299750 (299.7 KB)  
    RX errors 0  dropped 0  overruns 0  frame 0  
    TX packets 100  bytes 8202 (8.2 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 12  bytes 1343 (1.3 KB)  
    RX errors 0  dropped 0  overruns 0  frame 0  
    TX packets 12  bytes 1343 (1.3 KB)  
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
sujal26@Sujals-Playtop:~$
```

b.) My IP address is as shown on [whatismyip.com](https://whatismyip.com) is 103.25.231.125



The screenshot shows the homepage of WhatIsMyIP.com. The main content area displays the following information:

- What Is My IP?**
- My Public IPv4:** [103.25.231.125](https://whatismyip.com/ip/103.25.231.125)
- My Public IPv6:** Not Detected
- My IP Location:** Noida, UP IN
- My ISP:** Indraprastha Institute of Information Technology Delhi

The website also features a navigation bar with links to Home, Profile, Classes, Google Docs, Strivers A2Z DSA Co., SujalSoni's groups, Top Interview 150, Online Courses, Calendar for Interns, and NuRe Camp. The footer includes a video player showing a vault door being opened.

Both of these addresses are not identical. This is because ifconfig gives the private IP address of the machine and [whatismyip.com](https://whatismyip.com) gives the public IP address of our machine and these both are different.

**Q2.** Changed the private IP address to 172.24.242.101 from 172.24.242.173

```
sujal26@Sujals-Playtop:~$ sudo ifconfig eth0 172.24.242.101
[sudo] password for sujal26:
sujal26@Sujals-Playtop:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 172.24.242.101  netmask 255.255.0.0  broadcast 172.24.255.255
    inet6 fe80::215:5dff:feb5:73ec  prefixlen 64  scopeid 0x20<link>
    ether 00:15:5d:b5:73:ec  txqueuelen 1000  (Ethernet)
    RX packets 12635  bytes 18665002 (18.6 MB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 1446  bytes 154752 (154.7 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

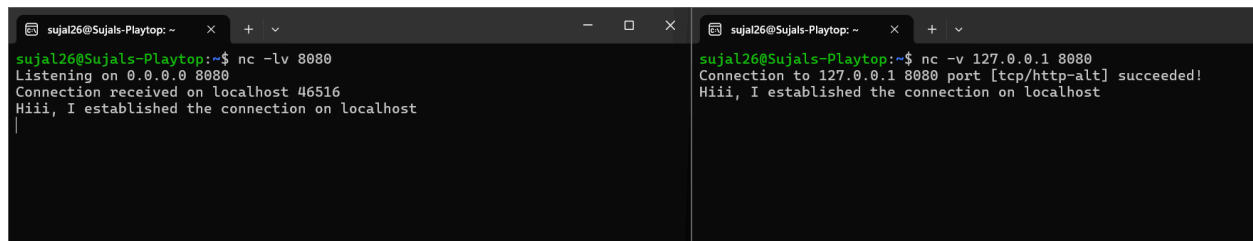
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop txqueuelen 1000  (Local Loopback)
    RX packets 36  bytes 3641 (3.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 36  bytes 3641 (3.6 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Reverting back to original ip address

```
sujal26@Sujals-Playtop:~$ sudo ifconfig eth0 172.24.242.173
sujal26@Sujals-Playtop:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 172.24.242.173  netmask 255.255.0.0  broadcast 172.24.255.255
    inet6 fe80::215:5dff:feb5:73ec  prefixlen 64  scopeid 0x20<link>
    ether 00:15:5d:b5:73:ec  txqueuelen 1000  (Ethernet)
    RX packets 12643  bytes 18666742 (18.6 MB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 1446  bytes 154752 (154.7 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 36  bytes 3641 (3.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 36  bytes 3641 (3.6 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

**Q3.** a.) Connection established using 'nc' command on localhost.

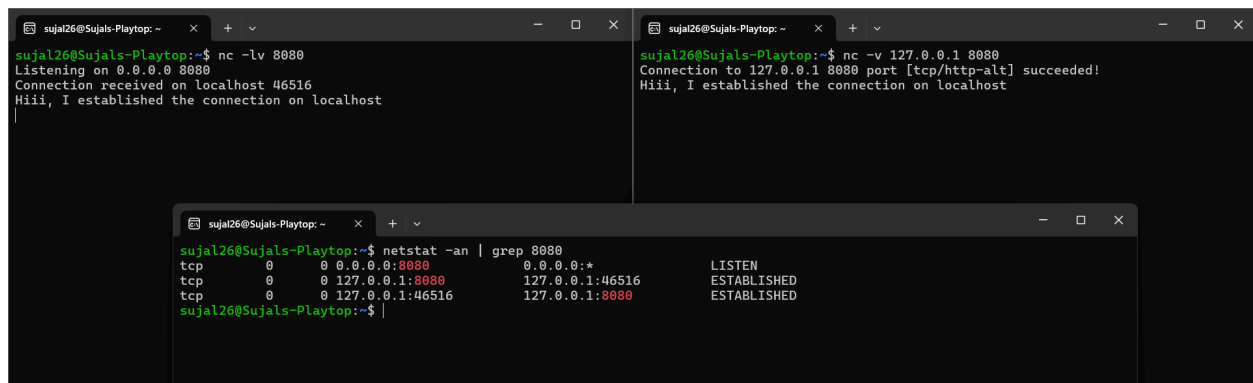


The image shows two terminal windows side-by-side. The left window is a netcat listener on port 8080, showing a connection from localhost at port 46516. The right window is a netcat client connecting to 127.0.0.1:8080, showing a successful connection.

```
sujal26@Sujals-Playtop: ~$ nc -lv 8080
Listening on 0.0.0.0 8080
Connection received on localhost 46516
Hiii, I established the connection on localhost

sujal26@Sujals-Playtop: ~$ nc -v 127.0.0.1 8080
Connection to 127.0.0.1 8080 port [tcp/http-alt] succeeded!
Hiii, I established the connection on localhost
```

b.) The state of tcp connections are shown in the screenshot below.



The image shows three terminal windows. The top-left window is a netcat listener on port 8080, showing a connection from localhost at port 46516. The top-right window is a netcat client connecting to 127.0.0.1:8080, showing a successful connection. The bottom window shows the output of the netstat command, displaying the state of TCP connections.

```
sujal26@Sujals-Playtop: ~$ nc -lv 8080
Listening on 0.0.0.0 8080
Connection received on localhost 46516
Hiii, I established the connection on localhost

sujal26@Sujals-Playtop: ~$ nc -v 127.0.0.1 8080
Connection to 127.0.0.1 8080 port [tcp/http-alt] succeeded!
Hiii, I established the connection on localhost

sujal26@Sujals-Playtop: ~$ netstat -an | grep 8080
tcp        0      0 0.0.0.0:8080         0.0.0.0:*            LISTEN
tcp        0      0 127.0.0.1:8080       127.0.0.1:46516       ESTABLISHED
tcp        0      0 127.0.0.1:46516      127.0.0.1:8080       ESTABLISHED
```

**Q4.**

a.) We get the authoritative answers for google.in by using SOA(Start of Authority) records.

The SOA record provides administrative information about the zone, including the primary authoritative name server and contact details and various timers. Then by using nslookup for authoritative nameserver (in this case ns1.google.com) we got authoritative results for google.in.

```
suja126@Sujals-Playtop: ~  
suja126@Sujals-Playtop:~$ nslookup -type=soa google.in  
Server:          10.255.255.254  
Address:         10.255.255.254#53  
  
Non-authoritative answer:  
google.in  
    origin = ns1.google.com  
    mail addr = dns-admin.google.com  
    serial = 668368175  
    refresh = 900  
    retry = 900  
    expire = 1800  
    minimum = 60  
  
Authoritative answers can be found from:  
ns1.google.com  internet address = 216.239.32.10  
ns1.google.com  has AAAA address 2001:4860:4802:32::a  
  
suja126@Sujals-Playtop:~$ nslookup google.in ns1.google.com  
Server:          ns1.google.com  
Address:         216.239.32.10#53  
  
Name:   google.in  
Address: 142.250.182.164  
Name:   google.in  
Address: 2404:6800:4002:815::2004  
  
suja126@Sujals-Playtop:~$
```

b.) I looked up Time To Live(ttl) for chatgpt.com using the nslookup command using -debug flag.

For A records it shows ttl = 257. This value is in seconds.

Therefore in 257 seconds this entry will be removed from the Local DNS server.

```
sujal26@Sujals-Playtop: ~  
sujal26@Sujals-Playtop:~$ nslookup -debug chatgpt.com  
Server:      10.255.255.254  
Address:     10.255.255.254#53  
  
-----  
QUESTIONS:  
  chatgpt.com, type = A, class = IN  
ANSWERS:  
-> chatgpt.com  
   internet address = 172.64.155.209  
   ttl = 257  
-> chatgpt.com  
   internet address = 104.18.32.47  
   ttl = 257  
AUTHORITY RECORDS:  
ADDITIONAL RECORDS:  
-----  
Non-authoritative answer:  
Name:   chatgpt.com  
Address: 172.64.155.209  
Name:   chatgpt.com  
Address: 104.18.32.47  
-----  
QUESTIONS:  
  chatgpt.com, type = AAAA, class = IN  
ANSWERS:  
-> chatgpt.com  
   has AAAA address 2606:4700:4400::6812:202f  
   ttl = 34  
-> chatgpt.com  
   has AAAA address 2606:4700:4400::ac40:9bd1  
   ttl = 34  
AUTHORITY RECORDS:  
ADDITIONAL RECORDS:  
-----  
Name:   chatgpt.com  
Address: 2606:4700:4400::6812:202f  
Name:   chatgpt.com  
Address: 2606:4700:4400::ac40:9bd1  
sujal26@Sujals-Playtop:~$
```

## Q5

a.) On running “traceroute google.in” we see 10 intermediate hosts out of which 1 is “\* \* \*”.

The IP addresses of these are

- Sujals-Playtop.mshome.net (172.24.240.1)
- 192.168.32.254 (192.168.32.254)
- vpn.iiitd.edu.in (192.168.1.99)
- 103.25.231.1 (103.25.231.1)
- 10.119.234.162 (10.119.234.162)
- 72.14.194.160 (72.14.194.160)
- 192.178.80.159 (192.178.80.159)
- 142.251.54.65 (142.251.54.65)
- del11s13-in-f4.1e100.net (142.250.192.228)

Average Latency to each intermediate hosts are :-

Hosts	Avg. Latency
Sujals-Playtop.mshome.net (172.24.240.1)	0.676 ms
192.168.32.254 (192.168.32.254)	20.106 ms
vpn.iiitd.edu.in (192.168.1.99)	11.992 ms
103.25.231.1 (103.25.231.1)	11.953 ms
10.119.234.162 (10.119.234.162)	11.502 ms
72.14.194.160 (72.14.194.160)	9.475 ms
192.178.80.159 (192.178.80.159)	33.846 ms
142.251.54.65 (142.251.54.65)	39.872 ms
del11s13-in-f4.1e100.net (142.250.192.228)	30.001 ms

```

sujal26@Sujals-Playtop: ~$ traceroute google.in
traceroute to google.in (142.250.192.228), 30 hops max, 60 byte packets
 1 Sujals-Playtop.mshome.net (172.24.240.1) 0.696 ms 0.670 ms 0.662 ms
 2 192.168.32.254 (192.168.32.254) 20.118 ms 20.105 ms 20.095 ms
 3 vpn.iiitd.edu.in (192.168.1.99) 11.996 ms 12.000 ms 11.982 ms
 4 103.25.231.1 (103.25.231.1) 11.940 ms 11.933 ms 11.927 ms
 5 * * *
 6 10.119.234.162 (10.119.234.162) 11.737 ms 10.863 ms 11.907 ms
 7 72.14.194.160 (72.14.194.160) 11.983 ms 8.234 ms 8.208 ms
 8 192.178.80.159 (192.178.80.159) 33.943 ms 142.251.54.111 (142.251.54.111) 33.676 ms 192.178.80.159 (192.178.80.159) 33.919 ms
 9 142.251.54.65 (142.251.54.65) 33.909 ms 142.251.54.63 (142.251.54.63) 53.354 ms 142.251.54.65 (142.251.54.65) 32.354 ms
10 del11s13-in-f4.1e100.net (142.250.192.228) 31.036 ms 31.016 ms 27.951 ms
sujal26@Sujals-Playtop: ~$

```

b.) Average round trip time of 50 ping messages to [google.in](https://www.google.in) is 48.391 ms.

```
sujal26@Sujals-Playtop: ~  
sujal26@Sujals-Playtop:~$ ping -c 50 google.in  
PING google.in (142.250.192.228) 56(84) bytes of data.  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=1 ttl=111 time=30.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=2 ttl=111 time=62.9 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=3 ttl=111 time=46.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=4 ttl=111 time=67.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=5 ttl=111 time=32.7 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=6 ttl=111 time=43.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=7 ttl=111 time=61.1 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=8 ttl=111 time=56.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=9 ttl=111 time=32.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=10 ttl=111 time=29.7 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=11 ttl=111 time=58.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=12 ttl=111 time=71.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=13 ttl=111 time=65.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=14 ttl=111 time=32.7 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=15 ttl=111 time=34.5 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=16 ttl=111 time=84.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=17 ttl=111 time=51.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=18 ttl=111 time=35.5 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=19 ttl=111 time=30.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=20 ttl=111 time=48.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=21 ttl=111 time=61.1 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=22 ttl=111 time=59.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=23 ttl=111 time=35.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=24 ttl=111 time=30.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=25 ttl=111 time=62.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=26 ttl=111 time=80.5 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=27 ttl=111 time=31.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=28 ttl=111 time=39.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=29 ttl=111 time=36.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=30 ttl=111 time=64.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=31 ttl=111 time=53.1 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=32 ttl=111 time=30.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=33 ttl=111 time=29.7 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=34 ttl=111 time=53.9 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=35 ttl=111 time=75.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=36 ttl=111 time=61.2 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=37 ttl=111 time=29.0 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=38 ttl=111 time=30.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=39 ttl=111 time=54.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=40 ttl=111 time=49.7 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=41 ttl=111 time=28.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=42 ttl=111 time=33.9 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=43 ttl=111 time=41.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=44 ttl=111 time=65.6 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=45 ttl=111 time=58.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=46 ttl=111 time=34.8 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=47 ttl=111 time=28.4 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=48 ttl=111 time=61.3 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=49 ttl=111 time=74.6 ms  
64 bytes from del11s13-in-f4.1e100.net (142.250.192.228): icmp_seq=50 ttl=111 time=52.1 ms  
  
--- google.in ping statistics ---  
50 packets transmitted, 50 received, 0% packet loss, time 49087ms  
rtt min/avg/max/mdev = 28.393/48.391/84.160/15.968 ms  
sujal26@Sujals-Playtop:~$
```

c.) No, adding up the latencies of part a) does not match with average latency found in part b), rather the difference is noticeable. Adding latencies of part (a) gives 169.423 ms whereas part (b) gives 48.391 ms.

The ping command measures the round-trip time directly to google.in, while the traceroute shows the cumulative latency to each intermediate hop. Some differences can arise due to network congestion, different routing paths, or how the ping and traceroute commands measure time.

d.) Maximum latency from traceroute google.in is 53.354 ms  
Avg ping latency using ping google.in is 48.391 ms.

The traceroute shows the latency to intermediate hosts, while the ping measures the round-trip time to the final destination (Google.in).

Network conditions may fluctuate, causing variations in response times.

Some intermediate routers or hosts may introduce delays that are not representative of the end-to-end path.

e.) Multiple entries for a single hop in traceroute represent the round-trip times for multiple probe packets sent to that hop.

These entries help give a more detailed view of the variability in network performance at each step along the route to the destination.

This allows you to see how consistent or variable the latency is for a given hop, which can help diagnose network issues such as congestion or instability.

f.) The average ping latency for 50 ping messages to stanford.edu is 300.606 ms





sujal26@Sujals-Playtop: ~



```
sujal26@Sujals-Playtop:~$ 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=330 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=241 time=327 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=241 time=289 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=319 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=241 time=343 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=241 time=311 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=241 time=337 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=241 time=360 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=241 time=291 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=241 time=302 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=241 time=293 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=241 time=311 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=241 time=316 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=241 time=297 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=241 time=298 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=303 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=241 time=305 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=241 time=304 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=241 time=289 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=241 time=288 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=241 time=292 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=241 time=294 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=241 time=304 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=241 time=290 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=241 time=305 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=241 time=329 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=241 time=353 ms
```

```
--- stanford.edu ping statistics ---
```

```
50 packets transmitted, 50 received, 0% packet loss, time 49024ms
```

```
rtt min/avg/max/mdev = 287.346/300.606/359.661/18.166 ms
```

```
sujal26@Sujals-Playtop:~$
```

g.) Number of hops for traceroute stanford.edu is 27 out of which 17 are hidden.  
Number of hops for traceroute google.in were 10 out of which 1 was hidden.

```
sujal26@Sujals-Playtop:~$ traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets
 1 172.24.240.1 (172.24.240.1) 0.935 ms 0.908 ms 0.895 ms
 2 192.168.32.254 (192.168.32.254) 10.225 ms 10.214 ms 10.206 ms
 3 vpn.iiitd.edu.in (192.168.1.99) 10.149 ms 10.140 ms 10.247 ms
 4 103.25.231.1 (103.25.231.1) 11.933 ms 11.922 ms 11.918 ms
 5 10.1.209.201 (10.1.209.201) 34.083 ms 38.868 ms 38.861 ms
 6 10.1.200.137 (10.1.200.137) 38.981 ms 36.080 ms 36.056 ms
 7 10.255.238.122 (10.255.238.122) 35.940 ms 10.255.238.254 (10.255.238.254) 36.461 ms 34.164 ms
 8 180.149.48.18 (180.149.48.18) 56.354 ms 56.346 ms 56.340 ms
 9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 campus-nw-rtr-vl1004.SUNet (171.64.255.200) 294.368 ms * campus-nw-rtr-vl1104.SUNet (171.66.255.200) 294.446 ms
25 * * *
26 * * *
27 web.stanford.edu (171.67.215.200) 298.999 ms 298.986 ms 298.979 ms
sujal26@Sujals-Playtop:~$
```

h.) Average ping latency for ping google.in is 48.391 ms  
Average ping latency for ping stanford.edu 300.606 ms

Possible Possible Reasons for Latency Differences :-

Geographical Distance: The physical distance between me and the servers can significantly affect latency. Google.in has its servers in India whereas stanford.edu has its servers in California.

Network Path and Routing: The number of hops and the efficiency of the routing path can impact latency. More hops or less optimized paths can increase latency. In this case google.in has 10 hops which is significantly lower than 27 hops for stanford.edu.

### Q6.

To make the ping command fail for 127.0.0.1 which is the private IP address for 'lo' Network interface I just turned down the network interface. Now as the interface is down no probe packets will be received, Hence we will get 100% packet loss.

```
suja126@Sujals-Playtop: ~  
suja126@Sujals-Playtop:~$ ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 172.24.242.173 netmask 255.255.240.0 broadcast 172.24.255.255  
    inet6 fe80::215:5dff:feb5:76ba prefixlen 64 scopeid 0x20<link>  
    ether 00:15:5d:b5:76:ba txqueuelen 1000 (Ethernet)  
    RX packets 3429 bytes 4107677 (4.1 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 994 bytes 117278 (117.2 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 176 bytes 16367 (16.3 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 176 bytes 16367 (16.3 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
suja126@Sujals-Playtop:~$ sudo ifconfig lo down  
[sudo] password for suja126:  
suja126@Sujals-Playtop:~$ ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 172.24.242.173 netmask 255.255.240.0 broadcast 172.24.255.255  
    inet6 fe80::215:5dff:feb5:76ba prefixlen 64 scopeid 0x20<link>  
    ether 00:15:5d:b5:76:ba txqueuelen 1000 (Ethernet)  
    RX packets 3438 bytes 4112124 (4.1 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 1001 bytes 118111 (118.1 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
suja126@Sujals-Playtop:~$ 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 ---  
17 packets transmitted, 0 received, 100% packet loss, time 16631ms  
  
suja126@Sujals-Playtop:~$
```