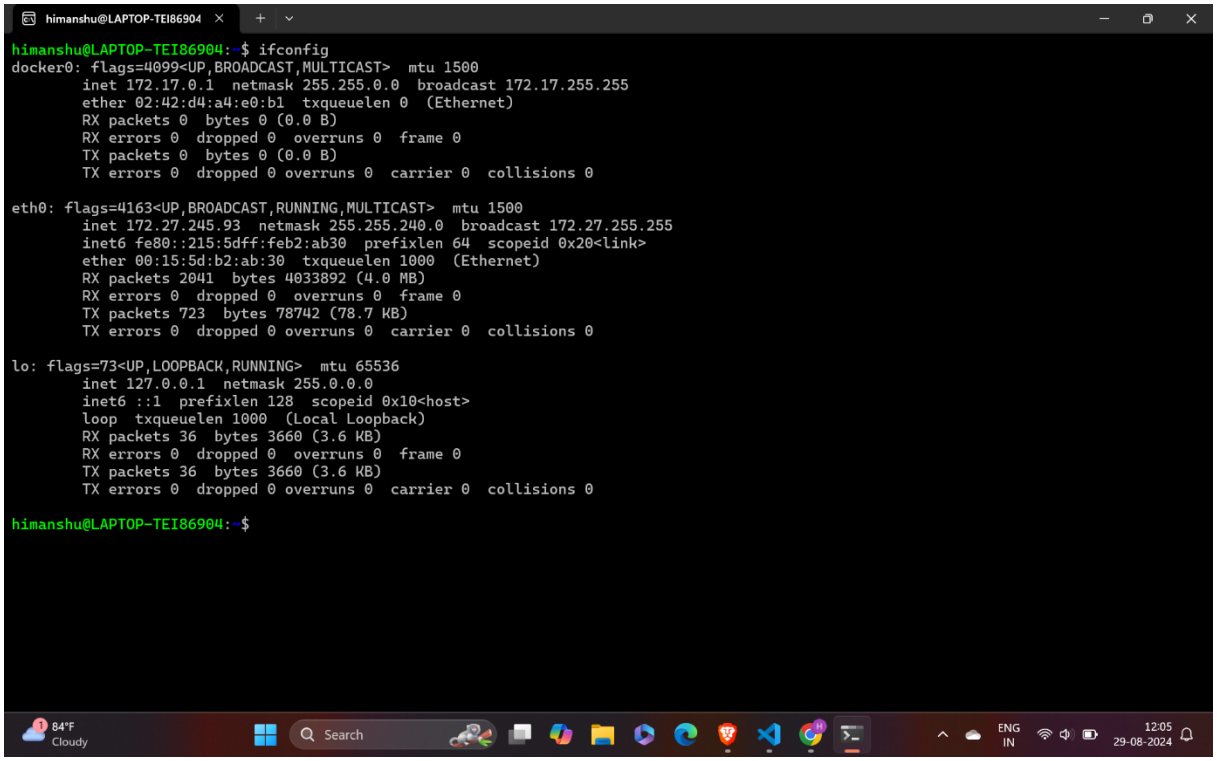
CN Assignment 1

Himanshu Kumar 2022215

Question 1

a) ifconfig image is given below.




Here ip address is 172.27.245.93

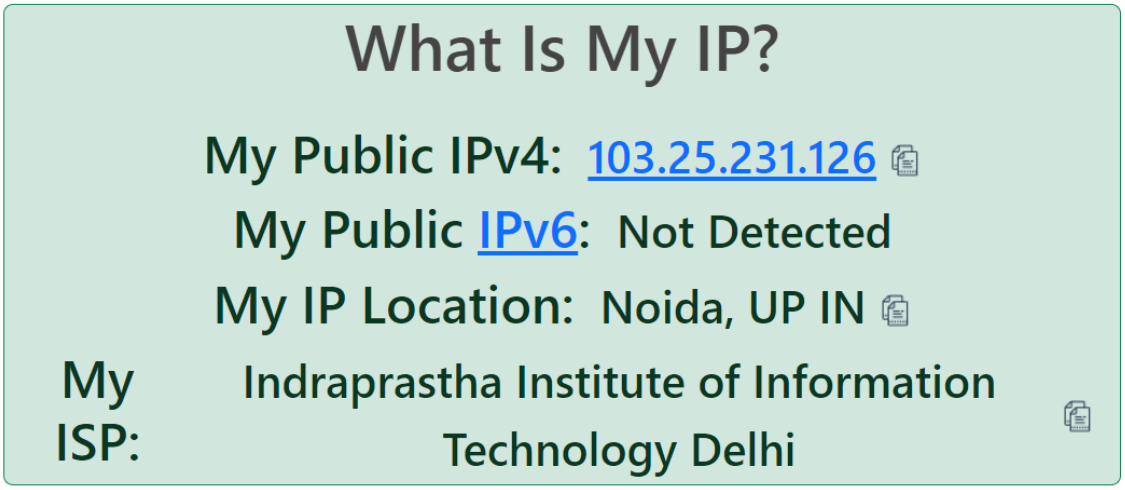
b) It shows ip address is 103.25.231.126 which is different shown from command ifconfig(it show ip address is 172.27.245.93). it means they both are different.

Reason :

Local IP Address ( 172.27.245.93 from ifconfig): This is my private IP address within my local network. This IP is assigned to my device by local router via DHCP and is only visible within my local network.

Public IP Address ( 103.25.231.126 from whatismyip.com): This is my public IP address, which is assigned to your network by my Internet Service Provider (ISP). It is the IP address that is visible to the outside world when you access websites and services on the internet.

The difference occurs because my router uses a technology called Network Address Translation (NAT) to translate the private IP address of my device to the public IP address assigned by ISP. This process allows multiple devices on local network to share a single public IP address.




Question 2

ifconfig -a : it gives this

Primary Network Interface: eth0 -- this is main ip address

Docker Virtual Interface: docker0

Loopback Interface: lo

sudo ifconfig eth0 155.13.12.11 netmask 255.255.255.0 : it changes ip to 155.13.12.11

ifconfig eth0 : here check changes

sudo ifconfig eth0 172.27.245.93 netmask 255.255.255.0: again, change to original ip address

ifconfig eth0 : again, check the ip address

```
himanshu@LAPTOP-TEI86904:~$ ifconfig -a
docker0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        ether 02:42:37:a7:45:74  txqueuelen 0  (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

eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.27.245.93  netmask 255.255.255.0  broadcast 172.27.245.255
        inet6 fe80::215:5dff:feb2:a705  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:b2:a7:05  txqueuelen 1000  (Ethernet)
        RX packets 21  bytes 3286 (3.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 18  bytes 1288 (1.2 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 4  bytes 616 (616.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 4  bytes 616 (616.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

himanshu@LAPTOP-TEI86904:~$ sudo ifconfig eth0 155.13.12.11 netmask 255.255.255.0
himanshu@LAPTOP-TEI86904:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 155.13.12.11  netmask 255.255.255.0  broadcast 155.13.12.255
        inet6 fe80::215:5dff:feb2:a705  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:b2:a7:05  txqueuelen 1000  (Ethernet)
        RX packets 29  bytes 5022 (5.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 18  bytes 1288 (1.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
himanshu@LAPTOP-TEI86904:~$ sudo ifconfig eth0 155.13.12.11 netmask 255.255.255.0
himanshu@LAPTOP-TEI86904:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 155.13.12.11  netmask 255.255.255.0  broadcast 155.13.12.255
        inet6 fe80::215:5dff:feb2:a705  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:b2:a7:05  txqueuelen 1000  (Ethernet)
        RX packets 29  bytes 5022 (5.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 18  bytes 1288 (1.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

himanshu@LAPTOP-TEI86904:~$ sudo ifconfig eth0 172.27.245.93 netmask 255.255.255.0
himanshu@LAPTOP-TEI86904:~$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.27.245.93  netmask 255.255.255.0  broadcast 172.27.245.255
        inet6 fe80::215:5dff:feb2:a705  prefixlen 64  scopeid 0x20<link>
        ether 00:15:5d:b2:a7:05  txqueuelen 1000  (Ethernet)
        RX packets 33  bytes 5890 (5.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 18  bytes 1288 (1.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

himanshu@LAPTOP-TEI86904:~$
```

Question 3

a) We type nc -l 12345 in host server . then we find nc server_ip 12345 in clint server . now we are able to send message from host to clint and vice-versa.

```
himanshu@LAPTOP-TEI86904:~$ nc -l 12345
hello
world
i am sending data from client
i am sending data from host
```

```
himanshu@LAPTOP-TEI86904:~$ nc 172.27.245.93 12345
hello
world
i am sending data from client
i am sending data from host
```

b) We can use this command netstat -tn . it will give all state of the TCP connection .

```
himanshu@LAPTOP-TEI86904:~$ netstat -tn
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 172.27.245.93:12345     172.27.245.93:39668     ESTABLISHED
tcp        0      0 172.27.245.93:39668     172.27.245.93:12345     ESTABLISHED
himanshu@LAPTOP-TEI86904:~$
```

```
himanshu@LAPTOP-TEI86904:~$ netstat -tn
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 172.27.245.93:12345     172.27.245.93:39668     ESTABLISHED
tcp        0      0 172.27.245.93:39668     172.27.245.93:12345     ESTABLISHED
himanshu@LAPTOP-TEI86904:~$ netstat -tn
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        1      0 172.27.245.93:39668     172.27.245.93:12345     CLOSE_WAIT
tcp        0      1 172.27.245.93:36558     185.125.188.59:443      SYN_SENT
tcp        0      1 172.27.245.93:36562     185.125.188.59:443      SYN_SENT
himanshu@LAPTOP-TEI86904:~$
```

Question 4

a) The nslookup command with the -type=soa option queries the DNS to find the authoritative server for the google.in domain. The authoritative DNS server is responsible for the domain's DNS records, ensuring the response is accurate and up-to-date.

```
himanshu@LAPTOP-TEI86904:~$ nslookup -type=ns google.in
Server:         10.255.255.254
Address:        10.255.255.254#53

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

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

himanshu@LAPTOP-TEI86904:~$ nslookup -type=soa google.in ns1.google.com
Server:         ns1.google.com
Address:        216.239.32.10#53

google.in
        origin = ns1.google.com
        mail addr = dns-admin.google.com
        serial = 668858537
        refresh = 900
        retry = 900
        expire = 1800
        minimum = 60

himanshu@LAPTOP-TEI86904:~$
```

To get an authoritative result for google.in, we need to specify that we want an authoritative answer by querying the authoritative DNS servers directly.

The -type=soa option tells nslookup to query for the Start of Authority (SOA) record, which provides information about the authoritative DNS server for the domain.

The output will show the primary name server (the authoritative server) for the domain, among other details.

b ) The TTL value of 300 seconds indicates that the DNS entry for google.in will be stored in the local DNS cache for 300 seconds. After this time, the DNS server will remove the cached entry and will have to query the authoritative DNS server again for the IP address if requested.

```
himanshu@LAPTOP-TEI86904:~$ nslookup -debug google.in
Server:         10.255.255.254
Address:        10.255.255.254#53

------------
    QUESTIONS:
        google.in, type = A, class = IN
    ANSWERS:
    ->  google.in
        internet address = 142.250.207.196
        ttl = 300
    AUTHORITY RECORDS:
    ADDITIONAL RECORDS:
------------
Non-authoritative answer:
Name:   google.in
Address: 142.250.207.196
------------
    QUESTIONS:
        google.in, type = AAAA, class = IN
    ANSWERS:
    ->  google.in
        has AAAA address 2404:6800:4002:82e::2004
        ttl = 300
    AUTHORITY RECORDS:
    ADDITIONAL RECORDS:
------------
Name:   google.in
Address: 2404:6800:4002:82e::2004

himanshu@LAPTOP-TEI86904:~$
```

For IPv4 (A record): google.in

Internet address = 142.250.207.196

TTL = 300 seconds

---

For IPv6 (AAAA record): google.in

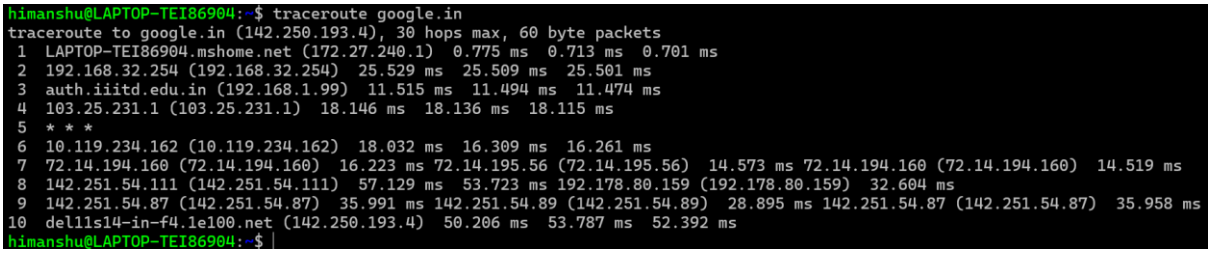
Has AAAA address = 2404:6800:4002:82e::2004

TTL = 300 seconds

---

Question 5

a) There are 8 intermediate host(except the last host server).




| s.no. | I.p address | average latency |
|---|---|---|
| 1 | 172.27.240.1 | (0.775 + 0.713 + 0.701) / 3 = 0.73 ms |
| 2 | 192.168.32.254 | (25.529 + 25.509 + 25.501) / 3 = 25.51 ms |
| 3 | 192.168.1.99 | (11.515 + 11.494 + 11.474) / 3 = 11.49 ms |
| 4 | 103.25.231.1 | (18.146 + 18.136 + 18.115) / 3 = 18.13 ms |
| 5 | 10.119.234.162 | (18.032 + 16.309 + 16.261) / 3 = 16.87 ms |
| 6 | 72.14.194.160 | (16.223 + 14.573 + 14.519) / 3 = 15.11 ms |
| 7 | 142.251.54.111 | (57.129 + 53.723 + 32.604) / 3 = 47.15 ms |
| 8 | 142.251.54.87 | (35.991 + 28.895 + 35.958) / 3 = 33.61 ms |

b) Here average latency is 56.786 ms. Image is given below.

we send 50 packet using command ping -c 50 google.in

```
himanshu@LAPTOP-TEI86904:~$ 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=111 time=54.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=2 ttl=111 time=52.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=3 ttl=111 time=56.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=4 ttl=111 time=87.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=5 ttl=111 time=47.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=6 ttl=111 time=56.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=7 ttl=111 time=77.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=8 ttl=111 time=64.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=9 ttl=111 time=54.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=10 ttl=111 time=58.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=11 ttl=111 time=52.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=12 ttl=111 time=49.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=13 ttl=111 time=62.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=14 ttl=111 time=48.8 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=15 ttl=111 time=48.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=16 ttl=111 time=49.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=17 ttl=111 time=63.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=18 ttl=111 time=70.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=19 ttl=111 time=67.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=20 ttl=111 time=46.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=21 ttl=111 time=48.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=22 ttl=111 time=57.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=23 ttl=111 time=52.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=24 ttl=111 time=51.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=25 ttl=111 time=52.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=26 ttl=111 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=27 ttl=111 time=62.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=28 ttl=111 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=29 ttl=111 time=62.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=30 ttl=111 time=53.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=31 ttl=111 time=51.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=32 ttl=111 time=55.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=33 ttl=111 time=51.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=34 ttl=111 time=86.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=35 ttl=111 time=56.2 ms
```

```
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=33 ttl=111 time=51.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=34 ttl=111 time=86.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=35 ttl=111 time=56.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=36 ttl=111 time=56.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=37 ttl=111 time=50.0 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=38 ttl=111 time=48.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=39 ttl=111 time=57.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=40 ttl=111 time=59.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=41 ttl=111 time=63.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=42 ttl=111 time=46.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=43 ttl=111 time=58.7 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=44 ttl=111 time=47.8 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=45 ttl=111 time=60.9 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=46 ttl=111 time=63.6 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=47 ttl=111 time=52.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=48 ttl=111 time=48.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=49 ttl=111 time=49.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=50 ttl=111 time=72.9 ms

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49088ms
rtt min/avg/max/mdev = 46.524/56.786/87.587/9.430 ms
himanshu@LAPTOP-TEI86904:~$
```

c) Total Latency of a= 0.73 + 25.51 + 11.49 + 18.13 + 16.87 + 15.11 + 47.15 + 33.61 = 168.6 ms
Avg. latency of b = 56.786 ms
Total latency of a is much higher than average latency of b.

Reason:

Traceroute Latencies: The latencies measured in traceroute are the round-trip times for packets between my machine and each intermediate router. These include the delays at each hop along the route.

Ping Latencies: The average latency measured by ping is typically the round-trip time between my machine and the final destination (in this case, google.in), which can include the sum of delays across all intermediate hops but is usually averaged over a larger set of packets.

d) maximum ping latency of all the host in a is 57.129 ms .
Avg. latency of b = 56.786 ms.
It is almost equal.

Small Difference: The difference between the two values is only 0.343 ms. This small difference is within the range of normal network variability, such as slight fluctuations in network traffic, routing paths, or timing of the measurements.

Practical Consideration: In networking, such a minor difference is often considered negligible, as it doesn't significantly impact the overall network performance or user experience. Therefore, for practical purposes, these two values can be treated as equal.

e) When using the traceroute command, we may see multiple entries for a single hop. Here's what these entries represent:

Multiple Entries for a Single Hop

Purpose:

Traceroute works by sending a series of packets with increasing Time-To-Live (TTL) values. Each hop along the route decrements the TTL, and when TTL reaches zero, the router returns a "Time Exceeded" message. This process helps identify the path taken by packets.

Entries in Output:

Multiple Response Times: Each line of output for a hop typically shows the round-trip times (RTTs) for three different packets sent to that hop. This is done to provide a more accurate representation of latency and to observe variations in response times.

f) here average latency is 371.286 ms

```
himanshu@LAPTOP-TEI86904:~$ 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=364 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=241 time=352 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=241 time=285 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=241 time=502 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=241 time=420 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=241 time=353 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=241 time=285 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=241 time=299 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=241 time=428 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=241 time=338 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=241 time=369 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=241 time=376 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=241 time=410 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=241 time=381 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=241 time=370 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=241 time=363 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=241 time=406 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=241 time=317 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=241 time=348 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=241 time=359 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=241 time=391 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=241 time=406 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=241 time=345 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=241 time=358 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=241 time=373 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=241 time=332 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=241 time=317 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=241 time=374 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=241 time=388 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=241 time=398 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=241 time=414 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=382 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=406 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=366 ms
```

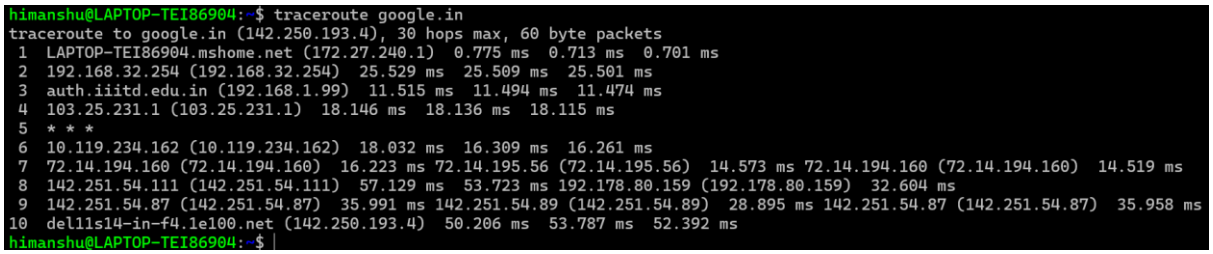
```
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=287 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=382 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=406 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=366 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=241 time=328 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=241 time=354 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=241 time=379 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=241 time=412 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=241 time=458 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=241 time=350 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=241 time=399 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=241 time=295 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=241 time=324 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=501 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=241 time=392 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=241 time=344 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=241 time=443 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=241 time=365 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49024ms
rtt min/avg/max/mdev = 285.216/371.286/501.793/47.654 ms
himanshu@LAPTOP-TEI86904:~$
```

g) traceroute Stanford.edu give 26 hop (it means data pass from 26 different router or intermediate device) including host .

```
himanshu@LAPTOP-TEI86904:~$ traceroute stanford.edu.
traceroute to stanford.edu. (171.67.215.200), 30 hops max, 60 byte packets
 1  LAPTOP-TEI86904.mshome.net (172.27.240.1)  0.640 ms  0.528 ms  0.419 ms
 2  192.168.32.254 (192.168.32.254)  23.092 ms  23.069 ms  22.996 ms
 3  vpn.iiitd.edu.in (192.168.1.99)  22.899 ms  22.808 ms  22.505 ms
 4  103.25.231.1 (103.25.231.1)  17.551 ms  17.511 ms  17.497 ms
 5  10.1.209.201 (10.1.209.201)  36.446 ms  35.664 ms  39.466 ms
 6  10.1.200.137 (10.1.200.137)  35.628 ms  36.947 ms  42.900 ms
 7  10.255.238.122 (10.255.238.122)  57.547 ms  63.413 ms  63.293 ms
 8  180.149.48.18 (180.149.48.18)  36.348 ms  31.799 ms  35.669 ms
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * campus-ial-nets-b-vl1120.SUNet (171.66.255.232)  297.366 ms
25  * * campus-east-rtr-vl1020.SUNet (171.64.255.232)  288.989 ms
26  web.stanford.edu (171.67.215.200)  287.622 ms *  290.324 ms
```

traceroute google.in give 10 hop (it means data pass from  26 different router or intermediate device) including host.




The difference in the number of hops can be due to :

1) Network Paths: Different routes or paths are taken by packets to reach different destinations.
2) Routing Policies: Network policies and routing configurations may vary between networks, resulting in different numbers of hops.
3) May be google server much closer to me than Stanford server.

h) The latency difference between google.in and stanford.edu can be attributed to several factors:

1) Geographic Distance : Latency often increases with physical distance between my machine and the destination. If stanford.edu is geographically closer to me than google.in, you might expect lower latency for stanford.edu. Conversely, a greater distance can result in higher latency.

2) Network Path Complexity

   Number of Hops: As observed, the number of hops can affect latency. More hops typically introduce more potential points of delay. If google.in has more hops than stanford.edu, the additional routers and network segments could contribute to higher latency.

3) Routing and Network Congestion

   Network Path: Different destinations might have different network paths with varying levels of congestion. If the path to google.in encounters more congestion or delays, it would result in higher latency.

   Network Load: The load on intermediate routers and links can impact latency. A more congested network can cause higher latency.

4) Network Infrastructure

Different Networks: google.in and stanford.edu might be served by different ISPs or network infrastructures with varying performance characteristics. For instance, Google's infrastructure might be optimized for lower latency due to its extensive network and data center locations, while Stanford's network might have different performance characteristics.

Question 6

We are using three commands :

1) sudo ifconfig lo down
2) ping 127.0.0.1
3) sudo ifconfig lo up

```
himanshu@LAPTOP-TEI86904:~$ sudo ifconfig lo down
himanshu@LAPTOP-TEI86904:~$ 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 ---
70 packets transmitted, 0 received, 100% packet loss, time 71788ms

himanshu@LAPTOP-TEI86904:~$ sudo ifconfig lo up
```

We are doing this by :

1) Disabling the Loopback Interface: The loopback interface (lo on Linux or lo0 on macOS) is responsible for handling packets addressed to 127.0.0.1. By disabling this interface, packets to 127.0.0.1 are dropped, resulting in 100% packet loss.
2)
3) Ping Command: When you ping 127.0.0.1, you are sending packets to the local machine. With the loopback interface down, the packets cannot be transmitted or received, leading to packet loss.
4)
5) Re-enabling: After testing, bringing the loopback interface back up restores normal functionality, allowing pings to 127.0.0.1 to succeed again.