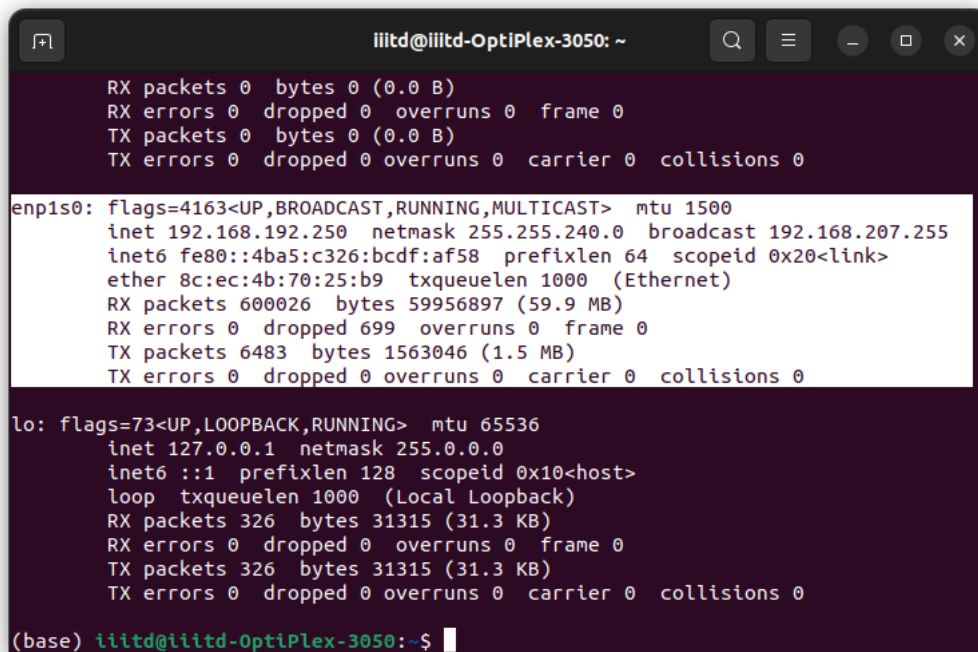


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2022527

# CN Assignment 1

## Q1.a

-----




```
liitd@liitd-OptiPlex-3050: ~  
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  
  
enp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.192.250 netmask 255.255.240.0 broadcast 192.168.207.255  
inet6 fe80::4ba5:c326:bcdf:af58 prefixlen 64 scopeid 0x20<link>  
ether 8c:ec:4b:70:25:b9 txqueuelen 1000 (Ethernet)  
RX packets 600026 bytes 59956897 (59.9 MB)  
RX errors 0 dropped 699 overruns 0 frame 0  
TX packets 6483 bytes 1563046 (1.5 MB)  
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 326 bytes 31315 (31.3 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 326 bytes 31315 (31.3 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
(base) liitd@liitd-OptiPlex-3050:~$
```

The IP address is '192.168.192.250'.

Q1.b


---

## What Is My IP?

**My Public IPv4:** [103.25.231.106](#) 

**My Public IPv6:** Not Detected

**My IP Location:** Noida, UP IN 

**My ISP:** Indraprastha Institute of Information Technology Delhi 

The IP address from whatismyip.com is '103.25.231.106'.

The IP addresses shown by the 'ifconfig' command and the whatismyip.com website are different. The 'ifconfig' command shows the local IP address assigned to the lab pc within the local network by the router. This is a private IP address used only within iitd. On the other hand, the IP address displayed on whatismyip.com is the public IP address, which is assigned to the network by the Internet Service Provider (ISP). This is the IP address visible to the outside world, i.e., the internet. The difference arises because the router uses Network Address Translation (NAT) to translate between private and public IP addresses.

## Q2

---

```
liitd@liitd-OptiPlex-3050: ~  
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  
  
enp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.192.247 netmask 255.255.255.0 broadcast 192.168.192.255  
inet6 fe80::4ba5:c326:bcdf:af58 prefixlen 64 scopeid 0x20<link>  
ether 8c:ec:4b:70:25:b9 txqueuelen 1000 (Ethernet)  
RX packets 614850 bytes 68266051 (68.2 MB)  
RX errors 0 dropped 699 overruns 0 frame 0  
TX packets 11720 bytes 2588996 (2.5 MB)  
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 917 bytes 95095 (95.0 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 917 bytes 95095 (95.0 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
(base) liitd@liitd-OptiPlex-3050:~$
```

Changed IP address to '192.168.192.247'.

```
liitd@liitd-OptiPlex-3050: ~  
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  
  
enp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.192.250 netmask 255.255.255.0 broadcast 192.168.192.255  
inet6 fe80::4ba5:c326:bcdf:af58 prefixlen 64 scopeid 0x20<link>  
ether 8c:ec:4b:70:25:b9 txqueuelen 1000 (Ethernet)  
RX packets 618786 bytes 68576913 (68.5 MB)  
RX errors 0 dropped 699 overruns 0 frame 0  
TX packets 12053 bytes 2622197 (2.6 MB)  
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 1174 bytes 114303 (114.3 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 1174 bytes 114303 (114.3 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
(base) liitd@liitd-OptiPlex-3050:~$
```

Reverted IP address to '192.168.192.250'.

## Q3.a

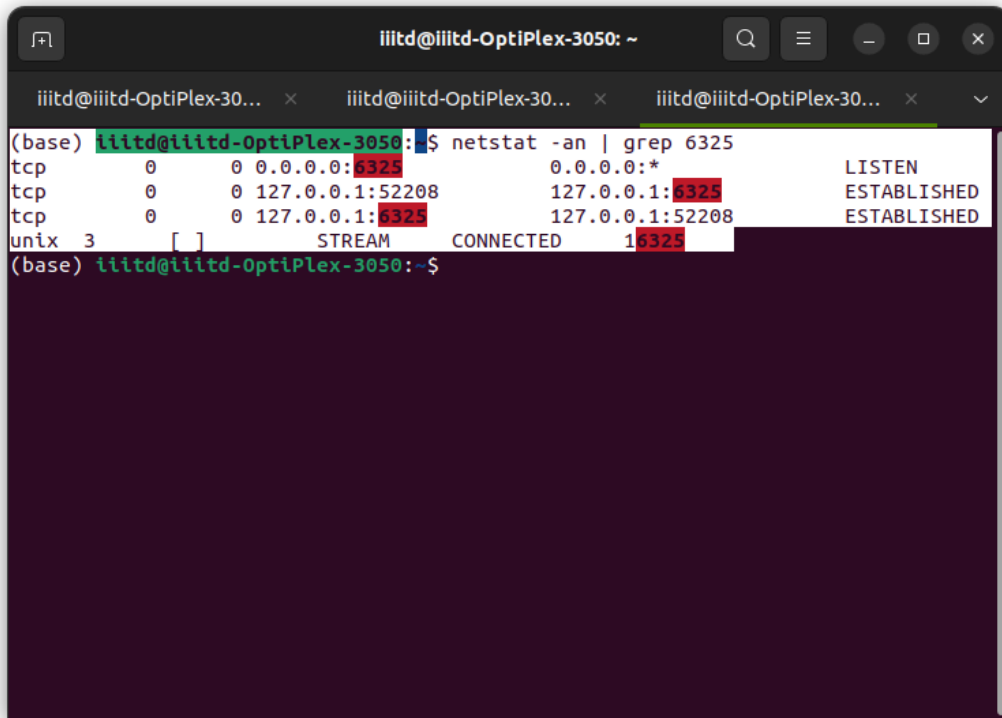
---

```
iiitd@iiitd-OptiPlex-3050: ~  
iiitd@iiitd-OptiPlex-3050: ~  
(base) iiitd@iiitd-OptiPlex-3050:~$ nc localhost 6325  
msg from client www
```

```
iiitd@iiitd-OptiPlex-3050: ~  
iiitd@iiitd-OptiPlex-3050: ~  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp1s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.192.250 netmask 255.255.255.0 broadcast 192.168.192.255  
inet6 fe80::4ba5:c326:bcd:f58 prefixlen 64 scopeid 0x20<link>  
ether 8c:ec:4b:70:25:b9 txqueuelen 1000 (Ethernet)  
RX packets 618786 bytes 68576913 (68.5 MB)  
RX errors 0 dropped 699 overruns 0 frame 0  
TX packets 12053 bytes 2622197 (2.6 MB)  
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 1174 bytes 114303 (114.3 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 1174 bytes 114303 (114.3 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
(base) iiitd@iiitd-OptiPlex-3050:~$ nc -l 6325  
msg from client www
```

## Q3.b

---



A terminal window titled 'iiitd@iiitd-OptiPlex-3050: ~' showing the output of the command 'netstat -an | grep 6325'. The output is as follows:

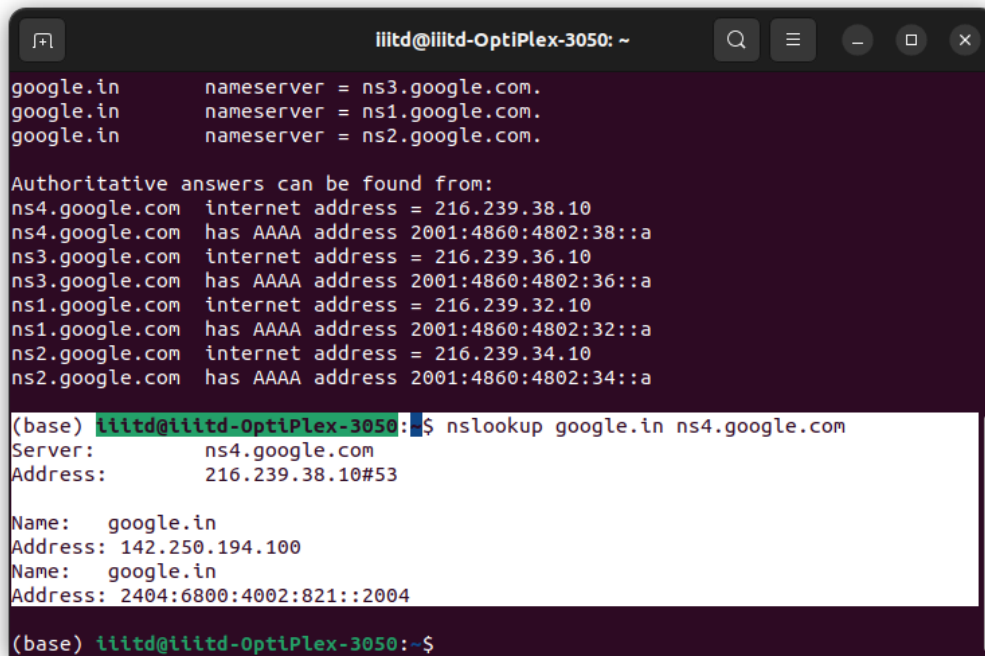
tcp	0	0	0.0.0.0:6325	0.0.0.0:*	LISTEN
tcp	0	0	127.0.0.1:52208	127.0.0.1:6325	ESTABLISHED
tcp	0	0	127.0.0.1:6325	127.0.0.1:52208	ESTABLISHED
unix	3	[ ]	STREAM	CONNECTED	16325

The terminal prompt is '(base) iiitd@iiitd-OptiPlex-3050:~\$'.

It's 'ESTABLISHED'.

## Q4.a

---

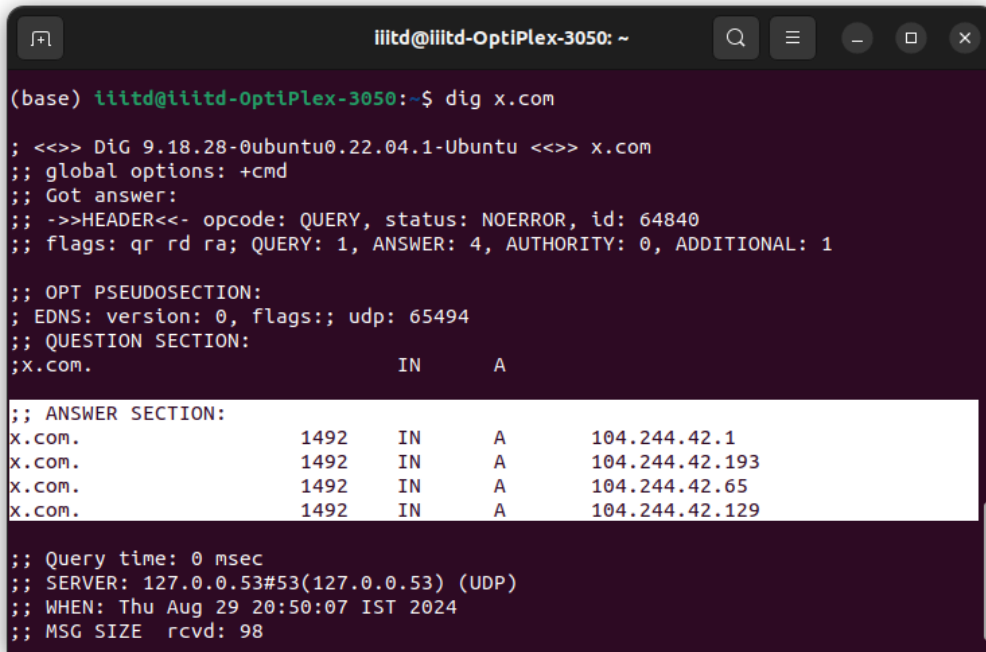


```
liitd@liitd-OptiPlex-3050: ~  
google.in      nameserver = ns3.google.com.  
google.in      nameserver = ns1.google.com.  
google.in      nameserver = ns2.google.com.  
  
Authoritative answers can be found from:  
ns4.google.com internet address = 216.239.38.10  
ns4.google.com has AAAA address 2001:4860:4802:38::a  
ns3.google.com internet address = 216.239.36.10  
ns3.google.com has AAAA address 2001:4860:4802:36::a  
ns1.google.com internet address = 216.239.32.10  
ns1.google.com has AAAA address 2001:4860:4802:32::a  
ns2.google.com internet address = 216.239.34.10  
ns2.google.com has AAAA address 2001:4860:4802:34::a  
  
(base) liitd@liitd-OptiPlex-3050:~$ nslookup google.in ns4.google.com  
Server:      ns4.google.com  
Address:     216.239.38.10#53  
  
Name:   google.in  
Address: 142.250.194.100  
Name:   google.in  
Address: 2404:6800:4002:821::2004  
  
(base) liitd@liitd-OptiPlex-3050:~$
```

To obtain an authoritative result for google.in using 'nslookup', I first identified the authoritative nameservers for google.in by running 'nslookup -type=ns google.in'. Then, I queried one of these nameservers directly using the command 'nslookup google.in ns4.google.com'. This direct query provided an authoritative DNS response for google.in, ensuring that the data is directly retrieved from the DNS server responsible for the domain.

## Q4.b

---



```
(base) iitd@iitd-OptiPlex-3050:~$ dig x.com

; <<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<>> x.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 64840
;; flags: qr rd ra; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;x.com.                                IN      A

;; ANSWER SECTION:
x.com.      1492    IN      A       104.244.42.1
x.com.      1492    IN      A       104.244.42.193
x.com.      1492    IN      A       104.244.42.65
x.com.      1492    IN      A       104.244.42.129

;; Query time: 0 msec
;; SERVER: 127.0.0.53#53(127.0.0.53) (UDP)
;; WHEN: Thu Aug 29 20:50:07 IST 2024
;; MSG SIZE rcvd: 98
```

The TTL (Time to Live) value represents the duration in seconds that a DNS entry is cached by a local DNS server before it expires and needs to be refreshed. For example, if the TTL is 300 seconds, the entry will expire in 5 minutes. After this time, the DNS server will query the authoritative DNS server again to refresh the entry.

## Q5.a

```
iiitd@iiitd-OptiPlex-3050: ~  
update-alternatives: using /usr/bin/traceroute6.db to provide /usr/bin/traceroute6 (traceroute6) in auto mode  
update-alternatives: using /usr/bin/lft.db to provide /usr/bin/lft (lft) in auto mode  
update-alternatives: using /usr/bin/traceproto.db to provide /usr/bin/traceproto (traceproto) in auto mode  
update-alternatives: using /usr/sbin/tcptraceroute.db to provide /usr/sbin/tcptraceroute (tcptraceroute) in auto mode  
Processing triggers for man-db (2.10.2-1) ...  
(base) iiitd@iiitd-OptiPlex-3050:~$ traceroute google.in  
traceroute to google.in (142.250.193.4), 30 hops max, 60 byte packets  
 1 * * *  
 2 auth.iiitd.edu.in (192.168.1.99) 0.660 ms 0.627 ms 0.588 ms  
 3 103.25.231.1 (103.25.231.1) 1.319 ms 1.338 ms 1.287 ms  
 4 * * *  
 5 10.119.234.162 (10.119.234.162) 5.311 ms 5.397 ms 5.403 ms  
 6 72.14.194.160 (72.14.194.160) 3.292 ms 72.14.195.56 (72.14.195.56) 3.316 ms  
 7 72.14.194.160 (72.14.194.160) 3.160 ms  
 8 142.251.54.111 (142.251.54.111) 29.664 ms 192.178.80.159 (192.178.80.159) 30.409 ms 30.403 ms  
 9 142.251.54.87 (142.251.54.87) 26.997 ms 142.251.54.89 (142.251.54.89) 24.324 ms 27.317 ms  
10 del11s14-in-f4.1e100.net (142.250.193.4) 47.367 ms 45.047 ms 45.057 ms  
(base) iiitd@iiitd-OptiPlex-3050:~$
```

Number of Intermediate Hosts: 5

IP address 1	Latency 1	IP address 2	Latency 2	IP address 3	Latency 3	Average Latency
103.25.231.1	1.319 ms	103.25.231.1	1.338 ms	103.25.231.1	1.287 ms	1.314 ms
10.119.234.162	5.311 ms	10.119.234.162	5.397 ms	10.119.234.162	5.403 ms	5.370 ms
72.14.194.160	3.292 ms	72.14.194.56	3.316 ms	72.14.194.160	3.160 ms	3.256 ms
142.251.54.111	29.664 ms	142.251.54.159	30.409 ms	142.251.54.159	30.403 ms	30.158 ms
142.251.54.87	26.997 ms	142.251.54.89	24.324 ms	142.251.54.87	27.317 ms	26.212 ms



# Q5.b

```
llttd@llttd-OptiPlex-3050: ~
9 del11s14-in-f4.1e100.net (142.250.193.4) 47.367 ms 45.047 ms 45.057 ms
(base) llttd@llttd-OptiPlex-3050: ~$ 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=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=2 ttl=55 time=47.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=3 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=4 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=5 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=6 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=7 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=8 ttl=55 time=47.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=9 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=10 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=11 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=12 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=13 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=14 ttl=55 time=47.5 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=15 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=16 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=17 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=18 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=19 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=20 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=21 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=22 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=23 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=24 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=25 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=26 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=27 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=28 ttl=55 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=29 ttl=55 time=47.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=30 ttl=55 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=31 ttl=55 time=47.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=32 ttl=55 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=33 ttl=55 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=34 ttl=55 time=47.1 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=35 ttl=55 time=47.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=36 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=37 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=38 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=39 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=40 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=41 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=42 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=43 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=44 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=45 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=46 ttl=55 time=47.4 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=47 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=48 ttl=55 time=47.2 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=49 ttl=55 time=47.3 ms
64 bytes from del11s14-in-f4.1e100.net (142.250.193.4): icmp_seq=50 ttl=55 time=47.4 ms

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49073ms
rtt min/avg/max/mdev = 47.079/47.338/47.522/0.103 ms
(base) llttd@llttd-OptiPlex-3050: ~$
```

Average Latency: 47.338 ms

## Q5.c

-----  
Sum of Avg Intermediate Latencies in a): 66.31 ms

Avg Ping Latency in b): 47.338 ms

Comparison: 18.972 ms

The sum of the ping latencies to all intermediate hosts obtained in the traceroute command and the average latency from the direct ping to google.in does not match exactly. This discrepancy occurs because the sum of latencies in a traceroute represents the cumulative delay across each hop. However, the direct ping measures the round-trip time to the destination and back, bypassing the detailed intermediate calculations. The routing paths and possible load balancing can also introduce differences.

## Q5.d

-----  
Maximum Hop Latency in a): 47.367 ms

Avg Ping Latency in b): 47.338 ms

Comparison: 0.029 ms

The maximum hop latency from the traceroute and the average ping latency to google.in are nearly equal. This close match suggests that the hop with the maximum latency is likely the most significant contributor to the overall round-trip time measured by the ping command. Since the ping command measures the total round-trip time, which includes the time taken to reach the furthest hop and return, it's expected that the highest hop latency would closely align with the overall average latency observed during the ping test.

## Q5.e

-----  
Multiple entries for a single hop in the traceroute output usually indicate that load balancing is being used by routers at that particular hop. This means that the packets are being routed through multiple paths, potentially via different routers, which leads to different IP addresses or latencies being recorded for the same hop. Traceroute sends three packets per hop by default.

## Q5.f

```
rtt_min/avg/max/ndev = 47.079/47.338/47.522/0.103 ms
(base) llltd@llltd-OptiPlex-3050: ~$ 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=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=8 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=9 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=16 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=17 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=18 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=19 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=22 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=23 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=25 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=26 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=40 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=41 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=42 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=43 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=242 time=284 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=242 time=283 ms
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=242 time=283 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 49017ms
rtt min/avg/max/ndev = 283.091/283.410/283.892/0.166 ms
(base) llltd@llltd-OptiPlex-3050: ~$
```

Average Latency: 283.410 ms

## Q5.g

---

```
iiitd@iiitd-OptiPlex-3050: ~
5 10.1.200.137 (10.1.200.137) 45.504 ms 50.400 ms 45.402 ms
6 10.255.238.122 (10.255.238.122) 24.580 ms 24.702 ms 10.255.238.254 (10.255.238.254) 24.316 ms
7 180.149.48.18 (180.149.48.18) 27.074 ms 27.582 ms 27.603 ms
8 * * *
9 * * *
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 campus-lal-nets-b-vl1104.SUNet (171.66.255.200) 284.279 ms * *
24 * campus-east-rtr-vl1120.SUNet (171.66.255.232) 283.004 ms campus-lal-nets-b-vl1104.SUNet (171.66.255.200) 285.109 ms
25 web.stanford.edu (171.67.215.200) 280.263 ms 280.171 ms *
```

Number of Hops for google.in: 9

Number of Hops for stanford.edu: 25

The number of hops for stanford.edu is higher than for google.in, indicating a longer or more complex routing path to stanford.edu.

## Q5.h

---

The latency difference between google.in and stanford.edu can be attributed to several factors. Geographical distance is a primary factor—google.in and stanford.edu are hosted in different regions, so the physical distance data needs to travel is different. Additionally, the network paths to reach these servers might have varying numbers of hops and differing levels of congestion or efficiency, leading to differences in latency. The routing policies and the quality of the internet service along these paths also contribute to the observed latency differences.

## Q6

```
l1: 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 197 bytes 17953 (17.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 197 bytes 17953 (17.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

(base) l1td@l1td-OptiPlex-3050:~$ sudo iptables -A OUTPUT -p icmp --icmp-type
echo-request -d 127.0.0.1 -j DROP
[sudo] password for l1td:
(base) l1td@l1td-OptiPlex-3050:~$ 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 ---
58 packets transmitted, 0 received, 100% packet loss, time 5837ms

(base) l1td@l1td-OptiPlex-3050:~$
```

To make the ping command fail for 127.0.0.1 with 100% packet loss, I used the iptables command to create a firewall rule that blocks ICMP echo requests to the loopback address 127.0.0.1. The command 'sudo iptables -A OUTPUT -p icmp --icmp-type echo-request -d 127.0.0.1 -j DROP' adds a rule that drops all outgoing ICMP echo requests directed to 127.0.0.1. As a result, when I tried to ping 127.0.0.1, the ping command failed because the requests were blocked by the firewall, leading to 100% packet loss.