

Assignment 1

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1.

a) ifconfig is a system utility in linux for network interface configuration. It stands for interface configuration. Running ifconfig shows following output. IP is given as 192.168.56.101

```
[aayush@aayush-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.56.101 netmask 255.255.255.0 broadcast 192.168.56.255
        inet6 fe80::8801:bf17:6c88:1539 prefixlen 64 scopeid 0x20<link>
          ether 08:00:27:77:ba:2d txqueuelen 1000 (Ethernet)
            RX packets 43 bytes 8463 (8.4 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 57 bytes 7533 (7.5 KB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.3.15 netmask 255.255.255.0 broadcast 10.0.3.255
        inet6 fe80::64da:3d7b:d396:d75e prefixlen 64 scopeid 0x20<link>
          ether 08:00:27:b1:b3:06 txqueuelen 1000 (Ethernet)
            RX packets 81 bytes 11796 (11.7 KB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 129 bytes 17154 (17.1 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 83 bytes 9339 (9.3 KB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 83 bytes 9339 (9.3 KB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Here various network interfaces like enp0s3, enp0s8, lo are described.

b)

What Is My IP?
My Public IPv4 is:
180.151.15.242 
My Public IPv6 is:
Not Detected
My IP Location is:
Ludhiana, PB IN
My ISP is: Shyam Spectra Pvt Ltd

[My IP Information](#) [Hide My IP Address](#)

The ip is shown as 180.151.15.242.

The ip I got in previous step was 192.168.56.101.

Both these are not identical. This is because the ip I got from ifconfig is the private ip assigned to my computer by the local network while the public ip is the ip of the local network.

2.

a) nslookup returns non authoritative answer in default mode. So I first got a list of the authoritative name servers then I used these to get an authoritative answer from the server.

```
[aayush@aayush-VirtualBox:~$ nslookup -query=ns google.com
Server:      127.0.0.53
Address:     127.0.0.53#53

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

Authoritative answers can be found from:
ns2.google.com  internet address = 216.239.34.10
ns2.google.com  has AAAA address 2001:4860:4802:34::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
ns4.google.com  internet address = 216.239.38.10
ns4.google.com  has AAAA address 2001:4860:4802:38::a
```

So for google.com I got these servers. Using ns2.google.com I got the following result.

```
[aayush@aayush-VirtualBox:~$ nslookup google.com ns2.google.com
Server:      ns2.google.com
Address:     216.239.34.10#53

Name:    google.com
Address: 216.58.196.206
Name:    google.com
Address: 2404:6800:4002:805::200e
```

b) The time to live came 38 seconds. ttl is the time after which the dns server will refresh the dns records from the name servers.

```
[aayush@aayush-VirtualBox:~$ nslookup -debug google.com
Server:      127.0.0.53
Address:     127.0.0.53#53

-----
QUESTIONS:
    google.com, type = A, class = IN
ANSWERS:
->  google.com
    internet address = 142.250.66.14
    ttl = 38
AUTHORITY RECORDS:
ADDITIONAL RECORDS:

-----
Non-authoritative answer:
Name:   google.com
Address: 142.250.66.14

-----
QUESTIONS:
    google.com, type = AAAA, class = IN
ANSWERS:
->  google.com
    has AAAA address 2404:6800:4009:82e::200e
    ttl = 137
AUTHORITY RECORDS:
ADDITIONAL RECORDS:

-----
Name:   google.com
Address: 2404:6800:4009:82e::200e
```

3.

a) Running the traceroute command on google.in

```
[aayush@aayush-VirtualBox:~$ traceroute google.in
traceroute to google.in (142.250.183.4), 64 hops max
 1  10.0.3.2  0.228ms  0.190ms  0.319ms
 2  192.168.48.254  11.155ms  12.040ms  17.711ms
 3  192.168.1.99  26.904ms  11.096ms  6.351ms
 4  180.151.15.241  8.463ms  10.890ms  7.840ms
 5  72.14.194.202  12.266ms  15.020ms  28.222ms
 6  108.170.251.108  21.876ms  13.429ms  16.465ms
 7  172.253.69.58  36.855ms  50.198ms  48.047ms
 8  216.239.54.93  35.468ms  32.126ms  33.854ms
 9  108.170.248.193  50.629ms  34.588ms  55.067ms
10  142.250.214.107  35.970ms  41.803ms  50.991ms
11  142.250.183.4  55.992ms  31.133ms  28.166ms
```

The result of the command was 11 intermediate hosts. The average latency of each is as follows.

1. 0.24566667 ms
2. 13.6353333 ms
3. 14.7836667 ms
4. 9.06433333 ms
5. 18.5026667 ms
6. 17.2566667 ms
7. 45.0333333 ms

8. 33.81600 ms
9. 46.7613333 ms
10. 42.9213333 ms
11. 38.4303333 ms

The overall average is: 25.4955151 ms
Maximum latency is: 55.992ms

b) average latency for google.in is 25.973ms

```
[aayush@aayush-VirtualBox:~$ ping -c 100 google.in
PING google.in (142.250.192.164) 56(84) bytes of data.
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=1 ttl=63 time=9.59 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=2 ttl=63 time=14.6 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=3 ttl=63 time=10.7 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=4 ttl=63 time=25.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=5 ttl=63 time=11.2 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=6 ttl=63 time=8.75 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=7 ttl=63 time=14.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=8 ttl=63 time=15.2 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=9 ttl=63 time=12.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=10 ttl=63 time=9.57 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=11 ttl=63 time=6.78 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=12 ttl=63 time=10.8 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=13 ttl=63 time=8.18 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=14 ttl=63 time=17.3 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=15 ttl=63 time=13.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=16 ttl=63 time=8.71 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=17 ttl=63 time=8.47 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=18 ttl=63 time=14.1 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=19 ttl=63 time=7.15 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=20 ttl=63 time=43.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=21 ttl=63 time=6.91 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=22 ttl=63 time=4.48 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=23 ttl=63 time=17.6 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=24 ttl=63 time=13.8 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=25 ttl=63 time=18.1 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=26 ttl=63 time=29.2 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=27 ttl=63 time=26.1 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=28 ttl=63 time=16.2 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=29 ttl=63 time=23.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=30 ttl=63 time=12.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=32 ttl=63 time=117 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=33 ttl=63 time=9.21 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=34 ttl=63 time=5.95 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=35 ttl=63 time=11.8 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=36 ttl=63 time=11.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=37 ttl=63 time=27.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=38 ttl=63 time=23.0 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=39 ttl=63 time=58.5 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=40 ttl=63 time=18.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=41 ttl=63 time=35.7 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=42 ttl=63 time=36.1 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=43 ttl=63 time=19.6 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=44 ttl=63 time=13.9 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=45 ttl=63 time=11.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=46 ttl=63 time=10.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=47 ttl=63 time=17.0 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=48 ttl=63 time=11.4 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=49 ttl=63 time=9.65 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=50 ttl=63 time=33.1 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=52 ttl=63 time=190 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=53 ttl=63 time=107 ms
64 bytes from dell1s11-in-f4.le100.net (142.250.192.164): icmp_seq=54 ttl=63 time=11.1 ms
```

```
--- google.in ping statistics ---
100 packets transmitted, 96 received, 4% packet loss, time 99245ms
rtt min/avg/max/mdev = 5.945/25.973/190.095/32.384 ms
```

c) average latency for columbia.edu is 327.876ms

```
aayush@aayush-VirtualBox:~$ ping -c 100 columbia.edu
PING columbia.edu (128.59.105.24) 56(84) bytes of data.
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=1 ttl=63 time=301 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=2 ttl=63 time=325 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=3 ttl=63 time=339 ms
64 bytes from columbiaviversity.org (128.59.105.24): icmp_seq=4 ttl=63 time=259 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=5 ttl=63 time=375 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=6 ttl=63 time=309 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=7 ttl=63 time=331 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=8 ttl=63 time=356 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=9 ttl=63 time=380 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=10 ttl=63 time=294 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=11 ttl=63 time=317 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=12 ttl=63 time=335 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=13 ttl=63 time=355 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=14 ttl=63 time=310 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=15 ttl=63 time=304 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=16 ttl=63 time=320 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=17 ttl=63 time=342 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=18 ttl=63 time=372 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=19 ttl=63 time=287 ms
64 bytes from columbiaviversity.info (128.59.105.24): icmp_seq=20 ttl=63 time=420 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=21 ttl=63 time=333 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=22 ttl=63 time=353 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=23 ttl=63 time=272 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=24 ttl=63 time=290 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=25 ttl=63 time=323 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=26 ttl=63 time=356 ms
64 bytes from columbiaviversity.info (128.59.105.24): icmp_seq=27 ttl=63 time=374 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=28 ttl=63 time=253 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=29 ttl=63 time=273 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=30 ttl=63 time=336 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=31 ttl=63 time=361 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=32 ttl=63 time=383 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=34 ttl=63 time=304 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=34 ttl=63 time=322 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=35 ttl=63 time=348 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=36 ttl=63 time=366 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=37 ttl=63 time=289 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=38 ttl=63 time=305 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=39 ttl=63 time=321 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=40 ttl=63 time=357 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=41 ttl=63 time=281 ms
64 bytes from columbiaviversity.info (128.59.105.24): icmp_seq=42 ttl=63 time=254 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=43 ttl=63 time=334 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=44 ttl=63 time=347 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=45 ttl=63 time=367 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=46 ttl=63 time=289 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=47 ttl=63 time=305 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=48 ttl=63 time=267 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=49 ttl=63 time=356 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=50 ttl=63 time=277 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=51 ttl=63 time=302 ms
64 bytes from columbiaviversity.info (128.59.105.24): icmp_seq=52 ttl=63 time=257 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=53 ttl=63 time=254 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=54 ttl=63 time=311 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=55 ttl=63 time=296 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=56 ttl=63 time=303 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=57 ttl=63 time=431 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=58 ttl=63 time=362 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=59 ttl=63 time=279 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=60 ttl=63 time=433 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=61 ttl=63 time=324 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=62 ttl=63 time=465 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=63 ttl=63 time=376 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=64 ttl=63 time=287 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=65 ttl=63 time=318 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=66 ttl=63 time=259 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=67 ttl=63 time=358 ms
64 bytes from www-ltm.cc.columbia.edu (128.59.105.24): icmp_seq=68 ttl=63 time=381 ms
64 bytes from columbiaviversity.org (128.59.105.24): icmp_seq=69 ttl=63 time=303 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=70 ttl=63 time=299 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=73 ttl=63 time=285 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=74 ttl=63 time=307 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=75 ttl=63 time=316 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=76 ttl=63 time=344 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=77 ttl=63 time=367 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=78 ttl=63 time=296 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=79 ttl=63 time=314 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=80 ttl=63 time=340 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=81 ttl=63 time=357 ms
64 bytes from columbia.edu (128.59.105.24): icmp_seq=82 ttl=63 time=385 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=83 ttl=63 time=312 ms
64 bytes from childpolicy.org (128.59.105.24): icmp_seq=84 ttl=63 time=577 ms
64 bytes from p-i-r.org (128.59.105.24): icmp_seq=85 ttl=63 time=269 ms
64 bytes from columbiaviversity.us (128.59.105.24): icmp_seq=86 ttl=63 time=371 ms
64 bytes from columbiaviversity.org (128.59.105.24): icmp_seq=87 ttl=63 time=299 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=88 ttl=63 time=336 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=89 ttl=63 time=347 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=90 ttl=63 time=366 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=91 ttl=63 time=291 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=92 ttl=63 time=305 ms
64 bytes from gutenberg-e.org (128.59.105.24): icmp_seq=93 ttl=63 time=334 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=94 ttl=63 time=350 ms
64 bytes from neurotheory.columbia.edu (128.59.105.24): icmp_seq=95 ttl=63 time=280 ms
64 bytes from vii.org (128.59.105.24): icmp_seq=96 ttl=63 time=303 ms
64 bytes from www.neurotheory.columbia.edu (128.59.105.24): icmp_seq=97 ttl=63 time=278 ms
64 bytes from teachtechaward.org (128.59.105.24): icmp_seq=98 ttl=63 time=344 ms
64 bytes from old.columbia.university (128.59.105.24): icmp_seq=99 ttl=63 time=387 ms
64 bytes from columbiaviversity.net (128.59.105.24): icmp_seq=100 ttl=63 time=250 ms
```

```
--- columbia.edu ping statistics ---
100 packets transmitted, 98 received, 2% packet loss, time 99126ms
rtt min/avg/max/mdev = 249.615/327.876/577.326/49.600 ms
```

d) Adding the average latencies of intermediate hosts gives 280.45 ms while in part b ping average gives 25.973 ms.

There is difference because in ping it gives the direct latency following the fastest direct route. In traceroute The traceroute has timeout for each request to routers before moving to the next router and this results in more time. On other hand, ping sends data in continuously without stopping. So the latency of ping is smaller than traceroute.

e) The maximum latency in intermediate hosts is 55.992ms and ping latency is 25.973 ms.

There is difference because in ping it gives the direct latency following the fastest route. In traceroute we are using latencies for all intermediate hosts and we get the complete route so the value is higher. The traceroute also has timeout for each request to routers and this results in more time.

f) There are 11 hops in **google.in** whereas **columbia.edu** has 19 hops. This is because different servers can have different route and the route between source and destination can be different. The intermediate hosts are different for both servers.

The difference in latencies is caused by the different routes for both servers. Also latency depends on the length of route for both servers.

```
[aayush@aayush-VirtualBox:~$ traceroute columbia.edu
traceroute to columbia.edu (128.59.105.24), 64 hops max
 1  10.0.3.2  0.097ms  0.170ms  0.204ms
 2  192.168.48.254  10.936ms  7.401ms  4.439ms
 3  192.168.1.99  4.692ms  4.128ms  4.083ms
 4  180.151.15.241  6.326ms  6.881ms  4.355ms
 5  219.65.112.205  10.391ms  7.439ms  10.256ms
 6  172.23.183.121  33.079ms  29.823ms  33.043ms
 7  180.87.38.5  31.634ms  41.748ms  30.080ms
 8  195.219.174.16  159.311ms  *  *
 9  195.219.174.9  153.153ms  *  *
10  * 80.231.153.168  159.741ms  *
11  130.117.15.69  157.313ms  147.814ms  156.821ms
12  154.54.61.33  166.056ms  155.468ms  154.800ms
13  154.54.38.157  152.564ms  151.794ms  150.989ms
14  154.54.27.169  289.938ms  249.031ms  244.493ms
15  154.54.84.214  250.153ms  276.404ms  308.668ms
16  38.122.8.210  305.346ms  307.085ms  306.879ms
17  128.59.255.5  316.438ms  301.594ms  308.527ms
18  128.59.255.21  256.239ms  245.729ms  244.012ms
19  128.59.105.24  279.341ms  *  274.361ms]
```

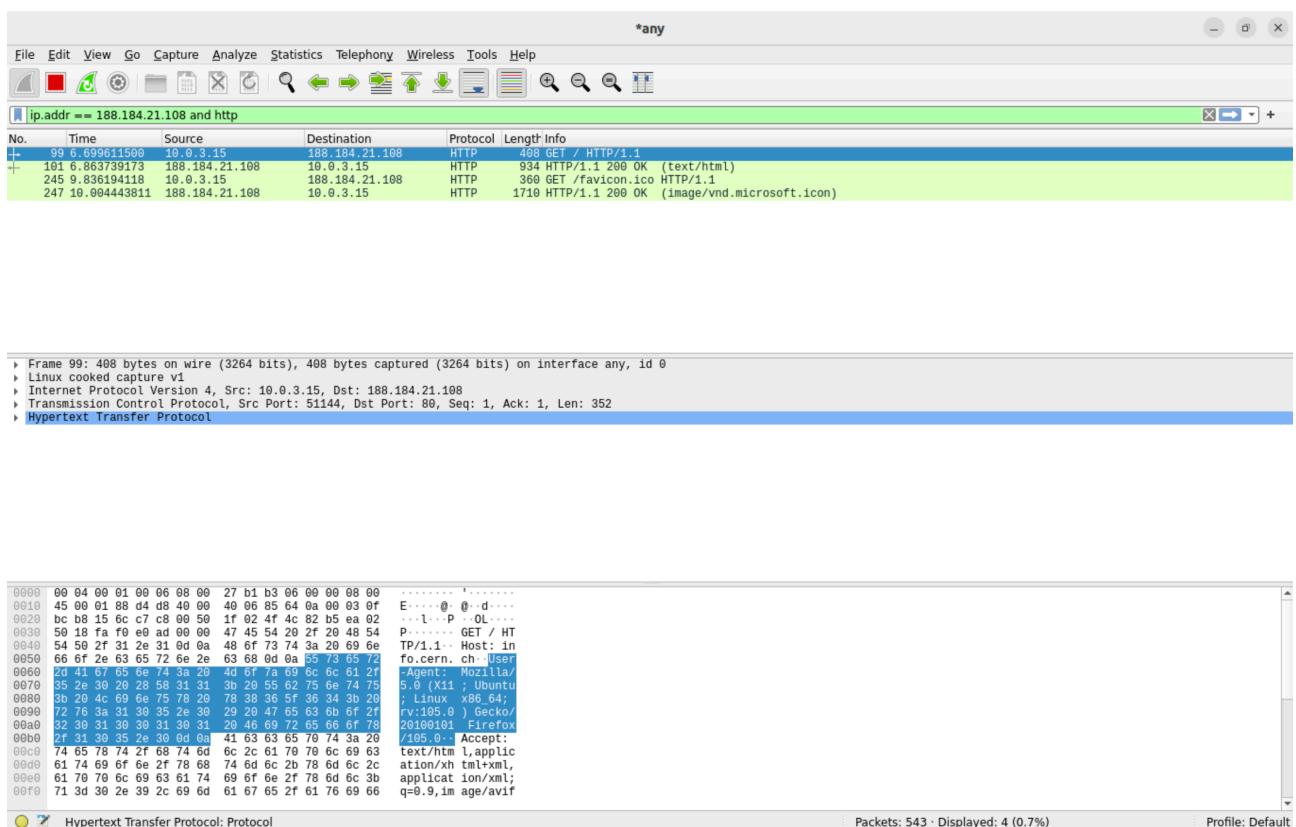
4.

```
[aayush@aayush-VirtualBox:~$ sudo ifconfig lo down
[[sudo] password for aayush:
[aayush@aayush-VirtualBox:~$ ping -c 10 127.0.0.1
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 9208ms
```

I used ifconfig command to shutdown the network interface and then the ping command gives 100% packet loss. This is because ping can't send any packets. So it results in packet loss being 100%.

5.

I capture following 4 packets. 2 are get requests and 2 are responses.



Wireshark - Packet 99 - any

```

Frame 99: 408 bytes on wire (3264 bits), 408 bytes captured (3264 bits) on interface any, id 0
Linux cooked capture v1
Internet Protocol Version 4, Src: 10.0.3.15, Dst: 188.184.21.108
Transmission Control Protocol, Src Port: 51144, Dst Port: 80, Seq: 1, Ack: 1, Len: 352
HTTP/1.1 200 OK<br/>
<[Expert Info (Chat/Sequence): GET / HTTP/1.1<br/><[GET / HTTP/1.1<br/>]<[Severity level: Chat]<[Group: Sequence]</Group></Severity level: Chat]><Request Method: GET><Request URI: /><Request Version: HTTP/1.1><Host: info.cern.ch><User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:105.0) Gecko/20100101 Firefox/105.0><Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8><Accept-Encoding: gzip, deflate><DNT: 1><Connection: keep-alive><Upgrade-Insecure-Requests: 1><[Full request URL: http://info.cern.ch/]><[HTTP request 1/1]><Response in frame: 101>

60000 60 64 00 01 00 06 88 00 27 b1 b3 66 00 09 88 00 ..... 0
60010 45 00 01 00 d4 d8 40 00 40 06 85 64 00 09 83 0f E.....@.0.d...
60020 bc b8 15 6c c7 c8 00 50 1f 02 47 4c 82 b5 ea 02 ..l..P..OL...
60030 50 18 fa f9 e0 ad 00 00 47 54 20 2f 29 48 54 p.....GET / HT
60040 66 67 2e 63 65 72 6e 2e 03 68 0d 0a 55 73 65 72 fo.cern. ch. User
60050 2d 41 67 65 66 74 20 4d 67 7a 6a 6c 6c 61 2f .Agent: Mozilla/
60060 35 2e 30 28 28 56 31 31 2b 20 55 62 75 6e 74 75 5.8 (X11; Ubuntu
60070 32 30 31 30 30 31 30 31 2b 20 55 62 75 6e 74 75 ;rv:105.0 ) Firefox
60080 72 76 3a 31 30 35 30 39 29 20 47 65 63 6b 6f 2f <rv:105.0 ) Gecko/
60090 32 30 31 30 30 31 30 31 2b 20 48 69 72 65 66 6f 78 20100101 Firefox
600a0 74 65 78 74 27 68 74 6d 2b 29 78 6d 6c 2c <action>xh tml+xml,
600b0 61 74 69 67 6e 27 78 68 74 6d 2b 29 78 6d 6c 2c application/xm
600c0 61 70 78 6c 69 63 61 74 69 67 6e 27 78 6d 6c 3b applicat ion/xml;
600d0 61 70 78 6c 69 63 61 74 69 67 6e 27 78 6d 6c 3b <pub>image/xp
600e0 2c 69 6d 61 67 65 2f 77 65 62 70 2c 2a 2f 2a 3b ,image/w ebp,/';q=0.8
600f0 71 3d 30 2e 38 0d 01 63 63 65 70 74 2d 63 0
60100 3b 71 3d 30 2e 38 0d 01 63 63 65 70 74 2d 45 0
60110 6e 63 6f 64 69 66 67 3a 20 67 7a 69 70 2c 20 64 0
60120 05 66 6c 61 74 65 6d 6a 44 4e 54 3a 20 31 0d 0a 0
60130 43 6f 6c 66 65 64 69 6f 6e 3a 29 6b 65 65 70 2d Connecti on: keep-
60140 2d 61 6c 66 76 74 65 0d 0a 55 70 07 72 61 64 65 2d -alive Upgrade-
60150
60160
60170

```

- HTTP request type - **GET**
- User agent type - **Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:105.0) Gecko/20100101 Firefox/105.0**
- HTTP request packet's URL - '**http://info.cern.ch/**'
- Name and version of the web server - **Apache**

Wireshark - Packet 245 - any

```

Frame 245: 360 bytes on wire (2880 bits), 360 bytes captured (2880 bits) on interface any, id 0
Linux cooked capture v1
Internet Protocol Version 4, Src: 10.0.3.15, Dst: 188.184.21.108
Transmission Control Protocol, Src Port: 51156, Dst Port: 80, Seq: 1, Ack: 1, Len: 364
HTTP/1.1 200 OK<br/>
<[Expert Info (Chat/Sequence): GET /favicon.ico HTTP/1.1<br/><[GET /favicon.ico HTTP/1.1<br/>]<[Severity level: Chat]<[Group: Sequence]</Group></Severity level: Chat]><Request Method: GET><Request URI: /favicon.ico><Request Version: HTTP/1.1><Host: info.cern.ch><User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:105.0) Gecko/20100101 Firefox/105.0><Accept: image/*,image/webp,*/*><Accept-Language: en-US,en;q=0.5><Accept-Encoding: gzip, deflate><DNT: 1><Connection: keep-alive><Referer: http://info.cern.ch/><[Full request URL: http://info.cern.ch/favicon.ico]><[HTTP request 1/1]><Response in frame: 247>

60000 60 64 00 00 00 27 b1 b3 66 00 09 88 00 ..... 0
60010 45 00 01 58 83 08 40 00 40 06 d7 64 0a 00 03 0f E.....@.0.d...
60020 bc b8 15 6c c7 d4 00 50 5d 7a 22 1d 82 bf ea 02 ..l..P.lz...
60030 50 18 fa f9 e0 7d 00 00 47 48 54 20 2f 66 64 76 p.....) GET /fav
60040 66 67 2e 63 68 04 00 55 73 65 72 2d 41 67 65 6e icon.ico HTTP/1.1
60050 31 0d 0a 08 6f 73 74 3a 29 69 6e 66 6f 2e 63 65 1. Host: info.c
60060 72 6e 2e 63 68 04 00 55 73 65 72 2d 41 67 65 6e rn.ch. U ser-Agen
60070 58 31 31 3b 20 55 62 75 6e 0d 75 3d 29 4c 69 6e t/; Pragma: no-cache
60080 75 78 20 78 38 35 57 36 34 3b 20 77 76 3a 31 30 ux x8.6_4; rv:10
60090 35 2e 30 29 28 47 65 63 6b 6f 27 32 39 31 39 5.0) Geck o/20100
600a0 66 67 2e 63 68 04 00 55 73 65 72 2d 41 67 65 6e 0d 75 3d 29 4c 69 6e
600b0 39 0d 0a 41 63 63 65 70 74 3a 20 69 6d 61 67 65 0 Accept t: image
600c0 2f 61 76 69 66 2c 69 6d 61 67 65 27 77 65 62 79 /avif,image/webp
600d0 66 67 2e 63 68 04 00 55 73 65 72 2d 41 67 65 6e ,/avif,image/webp
600e0 67 75 63 67 65 64 3a 20 65 6e 2d 55 53 2c 65 6e 6b ,/avif,image/webp
600f0 71 3d 30 2e 35 0d 0a 41 63 63 65 70 74 2d 45 6e gueage: en-US;en
60100 63 6f 64 69 66 67 3a 20 65 6e 2d 55 53 2c 65 6e 6b q=0.8
60110 63 6f 64 69 66 67 3a 20 65 6e 2d 55 53 2c 65 6e 6b coding: gzip, de
60120 63 6f 64 69 66 67 3a 20 65 6e 2d 55 53 2c 65 6e 6b flate: DNT: 1
60130 6f 66 65 63 74 69 6f 6e 3a 29 6b 65 65 70 2d onnection: n; keep-
60140 61 6c 69 76 65 0d 0a 66 66 65 72 65 73 20 alive: R eferer:
60150 68 74 74 70 3a 27 2f 69 6e 66 66 67 2e 63 65 72 6e http://info.cern
60160 .ch/

```

- HTTP request type - **GET**
- User agent type - **Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:105.0) Gecko/20100101 Firefox/105.0**
- HTTP request packet's URL - '**http://info.cern.ch/favicon.ico**'
- Name and version of the web server - **Apache**

- HTTP response code - 200
 - HTTP response description - OK

- HTTP response code - **200**
 - HTTP response description - **OK**

A total of 2 web objects were downloaded over 2 different tcp connections. This tells that it is non persistent HTTP.

6.

a)

command: sudo netstat -atp

```
[aayush@aayush-VirtualBox:~$ sudo netstat -atp
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address          Foreign Address        State      PID/Program name
tcp      0      0 localhost:ipp            0.0.0.0:*           LISTEN    698/cupsd
tcp      0      0 localhost:domain        0.0.0.0:*           LISTEN    406/systemd-resolve
tcp      0      0 0.0.0.0:ssh            0.0.0.0:*           LISTEN    736/sshd: /usr/sbin
tcp      0      0 aayush-VirtualBox:56944  117.18.237.29:http   TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:45624  201.181.244.35.bc:https ESTABLISHED 10455/firefox
tcp      0      0 aayush-VirtualBox:37572  102.115.120.34.bc:https TIME_WAIT  -
tcp      0      304 aayush-VirtualBox:ssh _gateway:50767       ESTABLISHED 2392/sshd: aayush [
tcp      0      0 aayush-VirtualBox:40906  36.75.98.34.bc.g:https TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:42058  ec2-44-240-140-78:https ESTABLISHED 10455/firefox
tcp      0      0 aayush-VirtualBox:60636  123.208.120.34.bc:https TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:48562  server-18-66-78-5:https ESTABLISHED 10455/firefox
tcp      0      0 aayush-VirtualBox:60850  82.221.107.34.bc.g:http  TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:60864  82.221.107.34.bc.g:http  TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:46144  server-18-66-78-5:https TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:42336  180.149.59.209:http   TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:43792  76.237.120.34.bc.:https TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:40670  221.5.120.34.bc.g:https TIME_WAIT  -
tcp      0      0 aayush-VirtualBox:39902  239.237.117.34.bc:https TIME_WAIT  -
tcp6     0      0 ip6-localhost:ipp       [::]:*                LISTEN    698/cupsd
tcp6     0      0 [::]:ssh              [::]:*                LISTEN    736/sshd: /usr/sbin
```

b)

The tcp connections state can be seen below.

The connection is established.

```
[aayush@aayush-VirtualBox:~$ sudo netstat -atp http://info.cern.ch
[sudo] password for aayush:
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address          Foreign Address        State      PID/Program name
tcp      0      0 localhost:ipp            0.0.0.0:*           LISTEN    698/cupsd
tcp      0      0 localhost:domain        0.0.0.0:*           LISTEN    406/systemd-resolve
tcp      0      0 0.0.0.0:ssh            0.0.0.0:*           LISTEN    736/sshd: /usr/sbin
tcp      0      36 aayush-VirtualBox:ssh _gateway:50767       ESTABLISHED 2392/sshd: aayush [
tcp6     0      0 ip6-localhost:ipp       [::]:*                LISTEN    698/cupsd
tcp6     0      0 [::]:ssh              [::]:*                LISTEN    736/sshd: /usr/sbin
```