

Assignment 1

Q1

- a) Since I am using WSL as of now, my IP address shown below is not my real IP address. The IP address of my network is 192.168.41.178.

```
fakepickle@Harsh-Laptop: ~  
fakepickle@Harsh-Laptop:~$ ifconfig  
docker0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
    inet 172.17.0.1 netmask 255.255.0.0 broadcast 172.17.255.255  
    ether 02:42:1d:13:03:14 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 172.28.208.124 netmask 255.255.240.0 broadcast 172.28.223.255  
    inet6 fe80::215:5dff:fe6a:7e00 prefixlen 64 scopeid 0x20<link>  
    ether 00:15:5d:6a:7e:00 txqueuelen 1000 (Ethernet)  
    RX packets 6 bytes 344 (344.0 B)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 13 bytes 942 (942.0 B)  
    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 27 bytes 8432 (8.4 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 27 bytes 8432 (8.4 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

- b) The IP address from the webpage <https://www.whatismyip.com> is different from the IP address above. This is because the IP address above is assigned by the college network and is used to identify my device within the college. The IP address shown on the website is my public IP address and is used to identify my device on the internet.

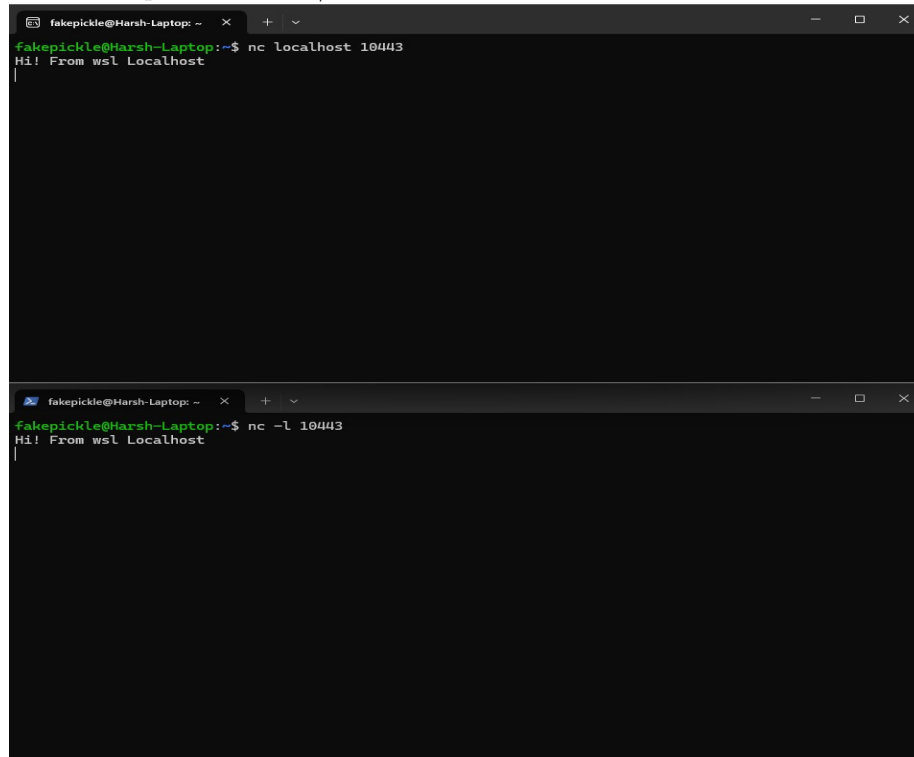
Q2

- a) In Q1 part A, my IP address is 172.28.208.124. I changed it to 192.168.3.168. To reset my IP address, I exit out of the WSL terminal and type in `wsl --shutdown`. This resets my IP address of my WSL system.

```
fakepickle@Harsh-Laptop: ~  
fakepickle@Harsh-Laptop:~$ sudo ifconfig eth0 192.168.3.168  
[sudo] password for fakepickle:  
fakepickle@Harsh-Laptop:~$ ifconfig  
docker0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
    inet 172.17.0.1 netmask 255.255.0.0 broadcast 172.17.255.255  
    ether 02:42:25:27:76:f7 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 192.168.3.168 netmask 255.255.255.0 broadcast 192.168.3.255  
    inet6 fe80::215:5dff:fe6a:7ef8 prefixlen 64 scopeid 0x20<link>  
    ether 00:15:5d:6a:7e:f8 txqueuelen 1000 (Ethernet)  
    RX packets 22 bytes 2912 (2.9 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 15 bytes 1082 (1.0 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 29 bytes 8573 (8.5 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 29 bytes 8573 (8.5 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

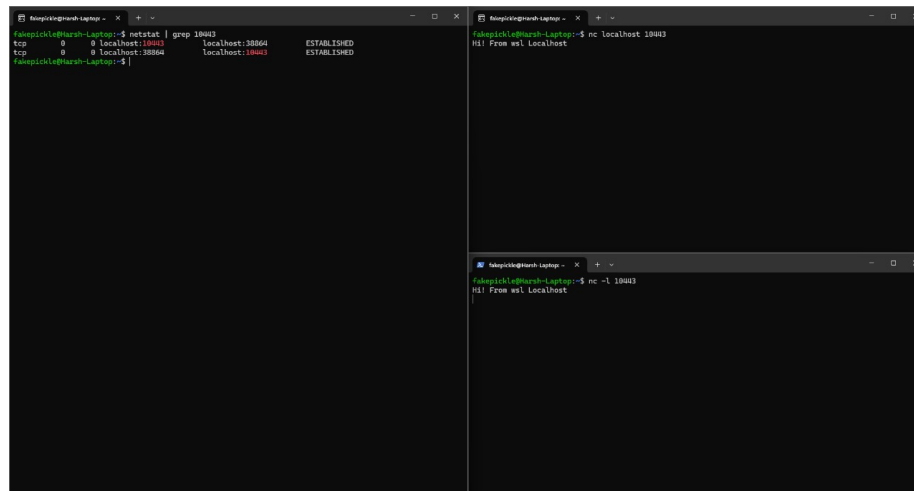
Q3

a) I have set up a TCP client/server connection with localhost.



The image shows two terminal windows. The top window is a Netcat client running the command `nc localhost 10443`. It receives a message: `Hi! From wsl Localhost`. The bottom window is a Netcat server running the command `nc -l 10443`. It also receives the same message: `Hi! From wsl Localhost`.

b) I used netstat to find the state of the client Node.



The image shows three terminal windows. The left window displays the output of `netstat | grep 10443`, showing two established connections: `tcp 0 0 localhost:10443 localhost:38864 ESTABLISHED` and `tcp 0 0 localhost:38864 localhost:10443 ESTABLISHED`. The top right window shows a Netcat client running `nc localhost 10443` and receiving `Hi! From wsl Localhost`. The bottom right window shows a Netcat server running `nc -l 10443` and receiving `Hi! From wsl Localhost`.

Q4

- a) The way to get authoritative answer for "google.in" using nslookup is by getting the start-of-authority for a DNS. We can do that by first going in command line mode for nslookup and then typing `set querytype=soa` and then type in google.in. There will be a section which says that authoritative answers can be found from ns1.google.com. Then we run the command `nslookup google.in ns1.google.com`. It will provide me with authoritative answer.

```
fakpickle@Harsh-Laptop: ~  
fakpickle@Harsh-Laptop:~$ nslookup  
> set querytype=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 = 665792918  
    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  
> ^D  
fakpickle@Harsh-Laptop:~$ nslookup google.in ns1.google.com  
Server:      ns1.google.com  
Address:     216.239.32.10#53  
  
Name:   google.in  
Address: 142.250.207.228  
Name:   google.in  
Address: 2404:6800:4002:82f::2004
```

- b) The local DNS byld.iiitd.edu.in will expire after 3600 seconds or 1 hour. So the cache will get cleared after every 1 hour in the server. I have passed one more parameter `ttlunits` to give me the time to live in hour format for this entry.

```
fakpickle@Harsh-Laptop:~$ dig +ttlid byld.iiitd.edu.in  
;<<<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<<>> +ttlid byld.iiitd.edu.in  
;; global options: +cmd  
;; Got answer:  
;; -->HEADER<< opcode: QUERY, status: NOERROR, id: 11000  
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1  
  
;; OPT PSEUDOSECTION:  
;; EDNS: version: 0, flags:; udp: 4096  
;; QUESTION SECTION:  
;; byld.iiitd.edu.in. IN A  
  
;; ANSWER SECTION:  
byld.iiitd.edu.in. 3600 IN A 192.168.3.70  
  
;; Query time: 0 msec  
;; SERVER: 10.255.255.254#53(10.255.255.254) (UDP)  
;; WHEN: Fri Aug 23 02:47:36 IST 2024  
;; MSG SIZE rcvd: 62  
  
fakpickle@Harsh-Laptop:~$ dig +ttlid +ttlunits byld.iiitd.edu.in  
;<<<>> DiG 9.18.28-0ubuntu0.22.04.1-Ubuntu <<<>> +ttlid +ttlunits byld.iiitd.edu.in  
;; global options: +cmd  
;; Got answer:  
;; -->HEADER<< opcode: QUERY, status: NOERROR, id: 56338  
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1  
  
;; OPT PSEUDOSECTION:  
;; EDNS: version: 0, flags:; udp: 4096  
;; QUESTION SECTION:  
;; byld.iiitd.edu.in. IN A  
  
;; ANSWER SECTION:  
byld.iiitd.edu.in. 1h IN A 192.168.3.70  
  
;; Query time: 0 msec  
;; SERVER: 10.255.255.254#53(10.255.255.254) (UDP)  
;; WHEN: Fri Aug 23 02:47:44 IST 2024  
;; MSG SIZE rcvd: 62
```

Q5

a) There are in total 10 intermediate hosts visible. Their IP addresses are as follows:-

- 1) 192.168.224.254 Average Latency to communicate:- 2.475 ms
- 2) 192.168.1.99 Average Latency to communicate:- 0.1083 ms
- 3) 103.25.231.1 Average Latency to communicate:- 0.443 ms
- 4) *** Ignored
- 5) 10.119.234.162 Average Latency to communicate:- 2.6687 ms
- 6) 72.14.195.56 Average Latency to communicate:- 5.112 ms
- 7) 142.251.54.87 Average Latency to communicate:- 26.3923 ms
- 8) 142.251.54.87 Average Latency to communicate:- 28.7863 ms
- 9) Destination 142.250.192.228 Average Latency to communicate:- 26.7596 ms

```
> traceroute google.in
traceroute to google.in (142.250.193.4), 30 hops max, 60 byte packets
 1 192.168.224.254 (192.168.224.254)  2.330 ms  2.495 ms  2.600 ms
 2 auth.iiitd.edu.in (192.168.1.99)  0.112 ms  0.110 ms  0.103 ms
 3 103.25.231.1 (103.25.231.1)  0.417 ms  0.461 ms  0.451 ms
 4 * * *
 5 10.119.234.162 (10.119.234.162)  2.734 ms  2.688 ms  2.664 ms
 6 72.14.195.56 (72.14.195.56)  3.954 ms 72.14.194.160 (72.14.194.160)  7.414 ms 72.14.195.56 (72.14.195.56)  3.968 ms
 7 192.178.80.159 (192.178.80.159)  24.066 ms 142.251.54.111 (142.251.54.111)  27.274 ms 27.837 ms
 8 142.251.54.87 (142.251.54.87)  25.985 ms 142.251.54.89 (142.251.54.89)  30.196 ms 30.178 ms
 9 dell1s14-in-f4.1e100.net (142.250.193.4)  27.115 ms 26.458 ms 26.705 ms
< >
```

22:51:35

- b) The average Latency for 50 ping messages to **google.in** is 26.676 ms

```
> ping -c 50 google.in
PING google.in (142.250.193.4) 56(84) bytes of data:
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=1 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=2 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=3 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=4 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=5 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=6 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=7 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=8 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=9 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=10 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=11 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=12 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=13 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=14 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=15 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=16 ttl=55 time=26.9 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=17 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=18 ttl=55 time=26.8 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=19 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=20 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=21 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=22 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=23 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=24 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=25 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=26 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=27 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=28 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=29 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=30 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=31 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=32 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=33 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=34 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=35 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=36 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=37 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=38 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=39 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=40 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=41 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=42 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=43 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=44 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=45 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=46 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=47 ttl=55 time=26.9 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=48 ttl=55 time=26.6 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=49 ttl=55 time=26.7 ms
64 bytes from dell1s14-in-f4.1e100.net (142.250.193.4): icmp_seq=50 ttl=55 time=26.7 ms

--- google.in ping statistics ---
50 packets transmitted, 50 received, 0% packet loss, time 4908ms
rtt min/avg/max/mdev = 26.602/26.676/26.927/0.058 ms
~/Pictures/Screenshots 49s > █
```

- c) The total latency of ‘traceroute’ is 92.7452, but it doesn’t match the latency from (b). This discrepancy occurs because ‘traceroute’ sequentially pings each router along the route to the destination, showing the path packets take. Additionally, ‘traceroute’ waits for a response from each router before moving to the next, which adds overhead that is not present in a simple ping measurement.
- d) The maximum latency in traceroute (28.7863 ms) does not match the average ping latency (26.676 ms) because traceroute measures the time to each intermediate hop, while ping measures the total round-trip time to the final destination. As the distance to each hop increases, the latency typically increases as well, leading to this discrepancy.

e) There are multiple reason for more than one entry in intermediate hosts. They are:-

- 1) Load Balancing:- It distributes traffic across multiple IP address.
- 2) Parallel Path:- The particular route may have parallel paths between two nodes. Traceroute can detect these paths and report the IP addresses of the interfaces along each path.
- 3) Routing changes:- If the routing changes during the traceroute, different IP addresses may be reported for the same hop.
- 4) Multipath routing:- Networks can use multipath routing protocol that allow equal cost paths between two nodes. Traceroute can detect and report the IP addresses across each path.

f) The average Latency for 50 ping messages to **stanford.edu** is 293.299 ms

```
fakepickle@Harsh-Laptop: ~  
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=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=2 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=3 ttl=241 time=291 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=4 ttl=241 time=294 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=5 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=6 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=7 ttl=241 time=289 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=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=10 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=11 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=12 ttl=241 time=290 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=13 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=14 ttl=241 time=292 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=15 ttl=241 time=289 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=294 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=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=20 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=21 ttl=241 time=289 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=292 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=24 ttl=241 time=290 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=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=27 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=28 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=29 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=30 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=31 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=32 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=33 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=34 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=35 ttl=241 time=296 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=36 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=37 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=38 ttl=241 time=326 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=39 ttl=241 time=301 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=296 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=295 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=44 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=45 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=46 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=47 ttl=241 time=289 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=48 ttl=241 time=326 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=49 ttl=241 time=325 ms  
64 bytes from web.stanford.edu (171.67.215.200): icmp_seq=50 ttl=241 time=328 ms
```

- g) There are 26 hops while running **traceroute stanford.edu** whereas there are 10 hops while running **traceroute google.in**

```
fakepickle@Harsh-Laptop: ~  
fakepickle@Harsh-Laptop:~$ traceroute stanford.edu  
traceroute to stanford.edu (171.67.215.200), 30 hops max, 60 byte packets  
 1 Harsh-Laptop.mshome.net (172.28.208.1)  0.342 ms  0.298 ms  0.250 ms  
 2 192.168.224.254 (192.168.224.254)  5.717 ms  5.573 ms  5.772 ms  
 3 vpn.iiitd.edu.in (192.168.1.99)  0.304 ms  0.274 ms  0.395 ms  
 4 103.25.231.1 (103.25.231.1)  0.539 ms  0.622 ms  0.594 ms  
 5 10.1.209.201 (10.1.209.201)  24.675 ms  24.685 ms  24.616 ms  
 6 10.1.200.137 (10.1.200.137)  44.733 ms  45.060 ms  44.644 ms  
 7 10.255.238.122 (10.255.238.122)  24.706 ms  10.255.238.254 (10.255.238.254)  23.587 ms  10.255.238.1  
22 (10.255.238.122)  24.841 ms  
 8 180.149.48.18 (180.149.48.18)  26.420 ms  26.146 ms  26.349 ms  
 9 * * *  
10 * * *  
11 * * *  
12 * * *  
13 * * *  
14 * * *  
15 * * *  
16 * * *  
17 * * *  
18 * * *  
19 * * *  
20 * * *  
21 * * *  
22 * * *  
23 * * *  
24 * * campus-ial-nets-a-vl1020.SUNet (171.64.255.232)  283.292 ms  
25 * campus-nw-rtr-vl1004.SUNet (171.64.255.200)  283.323 ms campus-east-rtr-vl1120.SUNet (171.66.255  
.232)  283.229 ms  
26 * web.stanford.edu (171.67.215.200)  283.948 ms  283.176 ms
```

- h) There are two major reasons for latency difference between google.in and stanford.edu. They could be:-

- 1) Due to the distance of the servers from my local machine. Since we are trying to ping the google servers located in India. Hence, the latency of google is lower than latency of Stanford as all the servers of Stanford are located in USA.
- 2) Also the google servers may be better optimized for lower latency and they would have better server equipment than Stanford server equipment.

Q6

1. To make the localhost or 127.0.0.1 fail with 100% packet loss, we need to disable the loopback interface. To achieve this we can type the following command '**sudo ifconfig lo down**'. This disables the loopback interface. Hence, it prevents traffic to 127.0.0.1, which would result in the 'ping' command failing.

```
fakepickle@Harsh-Laptop: ~  
fakepickle@Harsh-Laptop:~$ ping localhost  
PING localhost (127.0.0.1) 56(84) bytes of data:  
^C  
--- localhost ping statistics ---  
7 packets transmitted, 0 received, 100% packet loss, time 6248ms  
fakepickle@Harsh-Laptop:~$ |
```