Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

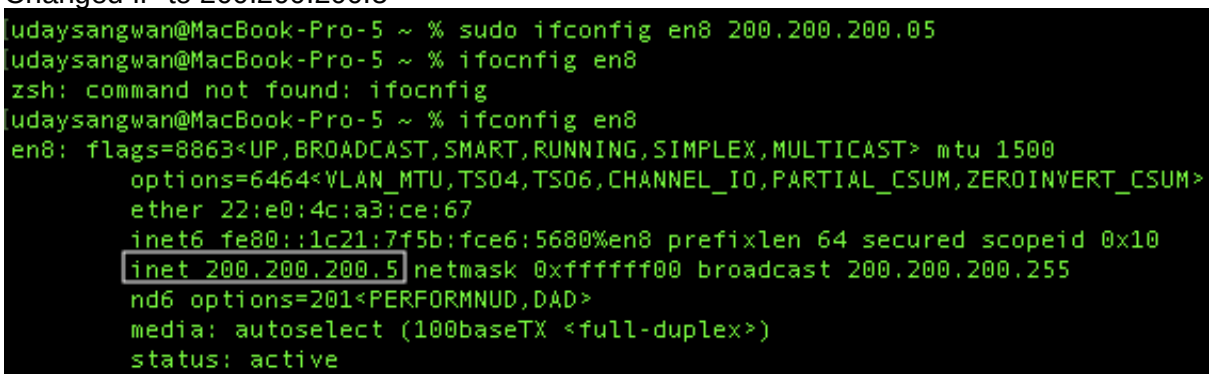
Question 1:

a) The difference in IP addresses occurs because the terminal displays the private network IP address assigned to your device within your local network, whereas whatismyip.com provides public IP address, which is assigned by the ISP and is shown to the external internet.

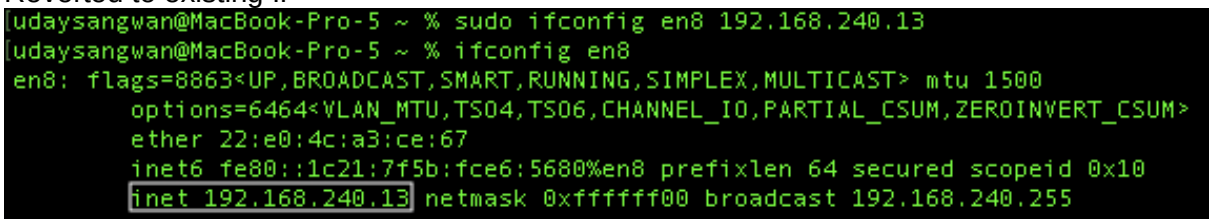
b) Website: 103.25.231.122

Question 2:

a) Changed IP to 200.200.200.5



b) Reverted to existing IP



Question 3:

I used another laptop of mine, which has Linux Ubuntu to establish the connection to my MacBook.

Screenshots attached below.

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
uday_jatt@jatt-da-laptop:~$ nc -lv 8080
Listening on 0.0.0.0 8080
Connection received on 192.168.240.13 61333
Hello
I am Uday
```

```
[udaysangwan@MacBook-Pro-5 ~ % nc -v 192.168.75.13 8080
 Connection to 192.168.75.13 port 8080 [tcp/http-alt] succeeded!
 Hello
 I am Uday
```

Netstat Result to determine TCP connection:

```
uday_jatt@jatt-da-laptop:~$ netstat -t
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 jatt-da-laptop:http-alt 192.168.240.13:61333    TIME_WAIT
tcp        0      0 jatt-da-laptop:41956    93.243.107.34.bc.:https ESTABLISHED
tcp        0      1 jatt-da-laptop:53306    ec2-52-35-150-14.:https SYN_SENT
tcp        0      0 jatt-da-laptop:43640    209.100.149.34.bc:https ESTABLISHED
tcp        0      0 jatt-da-laptop:58392    216.72.190.35.bc.:https ESTABLISHED
tcp        0      1 jatt-da-laptop:60268    ec2-52-35-150-14.:https SYN_SENT
tcp        0      1 jatt-da-laptop:53296    ec2-52-35-150-14.:https SYN_SENT
tcp        0      0 jatt-da-laptop:44040    whatsapp-cdn-shv-:https ESTABLISHED
tcp        0      0 jatt-da-laptop:51914    123.208.120.34.bc:https ESTABLISHED
```

Question 4:

a) To find out the authoritative result through nslookup we have to give it a flag of type. The type flag gives a specification on the type of DNS query required. For figuring out only the authoritative answers we can use
type=NS label. It provides all the servers from which authoritative answers can be found. To specify only a
particular address type=soa (State of Authority Record) can be used. Both commands return the IP Address.

Screenshots are attached below

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
udaysangwan@MacBook-Pro-5 ~ % nslookup -type=NS google.in
Server:         192.168.1.7
Address:        192.168.1.7#53

Non-authoritative answer:
google.in       nameserver = ns4.google.com.
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
ns3.google.com  internet address = 216.239.36.10
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
```

```
udaysangwan@MacBook-Pro-5 ~ % nslookup -type=soa google.in
Server:         192.168.1.7
Address:        192.168.1.7#53

Non-authoritative answer:
google.in
        origin = ns1.google.com
        mail addr = dns-admin.google.com
        serial = 667287868
        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
```

b) TTL: 3600 seconds (60 minutes or 1 hour), this entry will expire after 1 hour.

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
udaysangwan@MacBook-Pro-5 ~ % dig iiitd.ac.in

; <<>> DiG 9.10.6 <<>> iiitd.ac.in
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 10818
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4000
;; QUESTION SECTION:
;iiitd.ac.in.                   IN      A

;; ANSWER SECTION:
iiitd.ac.in.            3600    IN      A       192.168.2.127

;; Query time: 59 msec
;; SERVER: 192.168.1.7#53(192.168.1.7)
;; WHEN: Mon Aug 26 13:18:55 IST 2024
;; MSG SIZE  rcvd: 56
```

Question 5:

a) Number of Hops (google.in): 7 hops (includes final hop). (1 ignored)

```
udaysangwan@MacBook-Pro-5 ~ % traceroute google.in
traceroute to google.in (142.250.192.228), 64 hops max, 52 byte packets
 1  192.168.224.254 (192.168.224.254)  33.200 ms  15.282 ms  20.875 ms
 2  auth.iiitd.edu.in (192.168.1.99)  0.452 ms  0.478 ms  0.621 ms
 3  103.25.231.1 (103.25.231.1)  0.623 ms  1.068 ms  0.549 ms
 4  * * *
 5  10.119.234.162 (10.119.234.162)  16.481 ms  20.041 ms  21.429 ms
 6  72.14.194.160 (72.14.194.160)  26.710 ms  5.485 ms  5.755 ms
 7  192.178.80.159 (192.178.80.159)  32.547 ms  32.639 ms  32.925 ms
 8  142.251.54.63 (142.251.54.63)  23.237 ms  23.526 ms  37.077 ms
 9  del11s13-in-f4.1e100.net (142.250.192.228)  41.422 ms  38.241 ms  42.739 ms
```

Hop 1: 23.119 ms
Hop 2: 0.517 ms
Hop 3: 0.747 ms
Hop 4: Ignored
Hop 5: 19.317 ms
Hop 6: 12.983 ms
Hop 7: 32.704 ms
Hop 8: 27.613 ms
Hop 9: 40.801 ms

b) Average Latency: 28.602 ms (google.in)
Screenshot attached below

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
udaysangwan@MacBook-Pro-5 ~ % ping -c 50 google.in
PING google.in (142.250.192.228): 56 data bytes
64 bytes from 142.250.192.228: icmp_seq=0 ttl=56 time=28.326 ms
64 bytes from 142.250.192.228: icmp_seq=1 ttl=56 time=28.454 ms
64 bytes from 142.250.192.228: icmp_seq=2 ttl=56 time=28.582 ms
64 bytes from 142.250.192.228: icmp_seq=3 ttl=56 time=28.507 ms
64 bytes from 142.250.192.228: icmp_seq=4 ttl=56 time=28.695 ms
64 bytes from 142.250.192.228: icmp_seq=5 ttl=56 time=28.163 ms
64 bytes from 142.250.192.228: icmp_seq=6 ttl=56 time=28.752 ms
64 bytes from 142.250.192.228: icmp_seq=7 ttl=56 time=28.558 ms
64 bytes from 142.250.192.228: icmp_seq=8 ttl=56 time=28.771 ms
64 bytes from 142.250.192.228: icmp_seq=9 ttl=56 time=28.593 ms
64 bytes from 142.250.192.228: icmp_seq=10 ttl=56 time=28.792 ms
64 bytes from 142.250.192.228: icmp_seq=11 ttl=56 time=28.527 ms
64 bytes from 142.250.192.228: icmp_seq=12 ttl=56 time=28.540 ms
64 bytes from 142.250.192.228: icmp_seq=13 ttl=56 time=28.049 ms
64 bytes from 142.250.192.228: icmp_seq=14 ttl=56 time=28.636 ms
64 bytes from 142.250.192.228: icmp_seq=15 ttl=56 time=28.274 ms
64 bytes from 142.250.192.228: icmp_seq=16 ttl=56 time=28.644 ms
64 bytes from 142.250.192.228: icmp_seq=17 ttl=56 time=28.812 ms
64 bytes from 142.250.192.228: icmp_seq=18 ttl=56 time=28.186 ms
64 bytes from 142.250.192.228: icmp_seq=19 ttl=56 time=28.589 ms
64 bytes from 142.250.192.228: icmp_seq=20 ttl=56 time=28.497 ms
64 bytes from 142.250.192.228: icmp_seq=21 ttl=56 time=31.899 ms
64 bytes from 142.250.192.228: icmp_seq=22 ttl=56 time=28.770 ms
64 bytes from 142.250.192.228: icmp_seq=23 ttl=56 time=28.551 ms
64 bytes from 142.250.192.228: icmp_seq=24 ttl=56 time=28.734 ms
64 bytes from 142.250.192.228: icmp_seq=25 ttl=56 time=28.404 ms
64 bytes from 142.250.192.228: icmp_seq=26 ttl=56 time=28.600 ms
64 bytes from 142.250.192.228: icmp_seq=27 ttl=56 time=28.466 ms
64 bytes from 142.250.192.228: icmp_seq=28 ttl=56 time=28.443 ms
64 bytes from 142.250.192.228: icmp_seq=29 ttl=56 time=28.476 ms
64 bytes from 142.250.192.228: icmp_seq=30 ttl=56 time=28.515 ms
64 bytes from 142.250.192.228: icmp_seq=31 ttl=56 time=28.577 ms
64 bytes from 142.250.192.228: icmp_seq=32 ttl=56 time=28.423 ms
64 bytes from 142.250.192.228: icmp_seq=33 ttl=56 time=28.512 ms
64 bytes from 142.250.192.228: icmp_seq=34 ttl=56 time=28.424 ms
64 bytes from 142.250.192.228: icmp_seq=35 ttl=56 time=28.555 ms
64 bytes from 142.250.192.228: icmp_seq=36 ttl=56 time=28.512 ms
64 bytes from 142.250.192.228: icmp_seq=37 ttl=56 time=28.453 ms
64 bytes from 142.250.192.228: icmp_seq=38 ttl=56 time=28.566 ms
64 bytes from 142.250.192.228: icmp_seq=39 ttl=56 time=28.502 ms
64 bytes from 142.250.192.228: icmp_seq=40 ttl=56 time=28.596 ms
64 bytes from 142.250.192.228: icmp_seq=41 ttl=56 time=28.406 ms
64 bytes from 142.250.192.228: icmp_seq=42 ttl=56 time=28.322 ms
64 bytes from 142.250.192.228: icmp_seq=43 ttl=56 time=28.731 ms
64 bytes from 142.250.192.228: icmp_seq=44 ttl=56 time=28.583 ms
64 bytes from 142.250.192.228: icmp_seq=45 ttl=56 time=28.535 ms
64 bytes from 142.250.192.228: icmp_seq=46 ttl=56 time=28.434 ms
64 bytes from 142.250.192.228: icmp_seq=47 ttl=56 time=28.586 ms
64 bytes from 142.250.192.228: icmp_seq=48 ttl=56 time=28.944 ms
64 bytes from 142.250.192.228: icmp_seq=49 ttl=56 time=28.624 ms

--- google.in ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 28.049/28.602/31.899/0.500 ms
```

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

c) sum of the latencies (a) 157.810 ms
Average of the pings (b) 028.602 ms
In general, latency of ‘ping’ is lower than ‘traceroute’ as ‘ping’ only measures the time from destination and back. Whereas ‘traceroute’ measures latency to each hop separately. Each hop involves different routers which adds additional latency which is not in ‘ping’ command.

d) Maximum Ping Latency in the intermediate hosts: 40.801 ms
Average Ping Latency in the pings: 028.602 ms
Reason: Intermediate hosts has higher ping latency because of congestion on a particular intermediate host whereas the average latency of ping command is calculated over multiple packets and less affected by impact of a slow hop.

e) Reason for Multiple Entries: There are multiple paths to reach the destination host. These multiple entries tell us that packets can take different routes through the network to reach the take the same hop.

f) Average Latency: 282.397 ms (stanford.edu)
Screenshot Attached Below (Next page)

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
udaysangwan@MacBook-Pro-5 ~ % ping -c 50 stanford.edu
PING stanford.edu (171.67.215.200): 56 data bytes
64 bytes from 171.67.215.200: icmp_seq=0 ttl=242 time=282.811 ms
64 bytes from 171.67.215.200: icmp_seq=1 ttl=242 time=282.574 ms
64 bytes from 171.67.215.200: icmp_seq=2 ttl=242 time=282.224 ms
64 bytes from 171.67.215.200: icmp_seq=3 ttl=242 time=282.212 ms
64 bytes from 171.67.215.200: icmp_seq=4 ttl=242 time=282.566 ms
64 bytes from 171.67.215.200: icmp_seq=5 ttl=242 time=282.083 ms
64 bytes from 171.67.215.200: icmp_seq=6 ttl=242 time=282.468 ms
64 bytes from 171.67.215.200: icmp_seq=7 ttl=242 time=282.695 ms
64 bytes from 171.67.215.200: icmp_seq=8 ttl=242 time=282.177 ms
64 bytes from 171.67.215.200: icmp_seq=9 ttl=242 time=282.728 ms
64 bytes from 171.67.215.200: icmp_seq=10 ttl=242 time=283.184 ms
64 bytes from 171.67.215.200: icmp_seq=11 ttl=242 time=281.933 ms
64 bytes from 171.67.215.200: icmp_seq=12 ttl=242 time=282.431 ms
64 bytes from 171.67.215.200: icmp_seq=13 ttl=242 time=282.725 ms
64 bytes from 171.67.215.200: icmp_seq=14 ttl=242 time=282.315 ms
64 bytes from 171.67.215.200: icmp_seq=15 ttl=242 time=281.733 ms
64 bytes from 171.67.215.200: icmp_seq=16 ttl=242 time=282.735 ms
64 bytes from 171.67.215.200: icmp_seq=17 ttl=242 time=282.362 ms
64 bytes from 171.67.215.200: icmp_seq=18 ttl=242 time=282.340 ms
64 bytes from 171.67.215.200: icmp_seq=19 ttl=242 time=282.470 ms
64 bytes from 171.67.215.200: icmp_seq=20 ttl=242 time=281.946 ms
64 bytes from 171.67.215.200: icmp_seq=21 ttl=242 time=282.418 ms
64 bytes from 171.67.215.200: icmp_seq=22 ttl=242 time=282.558 ms
64 bytes from 171.67.215.200: icmp_seq=23 ttl=242 time=282.196 ms
64 bytes from 171.67.215.200: icmp_seq=24 ttl=242 time=282.648 ms
64 bytes from 171.67.215.200: icmp_seq=25 ttl=242 time=282.671 ms
64 bytes from 171.67.215.200: icmp_seq=26 ttl=242 time=282.284 ms
64 bytes from 171.67.215.200: icmp_seq=27 ttl=242 time=282.982 ms
64 bytes from 171.67.215.200: icmp_seq=28 ttl=242 time=282.753 ms
64 bytes from 171.67.215.200: icmp_seq=29 ttl=242 time=281.890 ms
64 bytes from 171.67.215.200: icmp_seq=30 ttl=242 time=281.944 ms
64 bytes from 171.67.215.200: icmp_seq=31 ttl=242 time=282.017 ms
64 bytes from 171.67.215.200: icmp_seq=32 ttl=242 time=282.192 ms
64 bytes from 171.67.215.200: icmp_seq=33 ttl=242 time=282.278 ms
64 bytes from 171.67.215.200: icmp_seq=34 ttl=242 time=282.167 ms
64 bytes from 171.67.215.200: icmp_seq=35 ttl=242 time=282.546 ms
64 bytes from 171.67.215.200: icmp_seq=36 ttl=242 time=282.475 ms
64 bytes from 171.67.215.200: icmp_seq=37 ttl=242 time=282.533 ms
64 bytes from 171.67.215.200: icmp_seq=38 ttl=242 time=282.306 ms
64 bytes from 171.67.215.200: icmp_seq=39 ttl=242 time=282.005 ms
64 bytes from 171.67.215.200: icmp_seq=40 ttl=242 time=282.241 ms
64 bytes from 171.67.215.200: icmp_seq=41 ttl=242 time=282.144 ms
64 bytes from 171.67.215.200: icmp_seq=42 ttl=242 time=282.596 ms
64 bytes from 171.67.215.200: icmp_seq=43 ttl=242 time=282.217 ms
64 bytes from 171.67.215.200: icmp_seq=44 ttl=242 time=282.509 ms
64 bytes from 171.67.215.200: icmp_seq=45 ttl=242 time=282.729 ms
64 bytes from 171.67.215.200: icmp_seq=46 ttl=242 time=282.573 ms
64 bytes from 171.67.215.200: icmp_seq=47 ttl=242 time=282.661 ms
64 bytes from 171.67.215.200: icmp_seq=48 ttl=242 time=281.999 ms
64 bytes from 171.67.215.200: icmp_seq=49 ttl=242 time=282.618 ms

--- stanford.edu ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 281.733/282.397/283.184/0.302 ms
```

g) Number of Hops (google.in): 8 hops. (includes final hop) (1 ignored)
Number of Hops (stanford.edu): 10 hops. (includes final hop) (15 ignored)

Name: Uday Kumar Sangwan
Roll No.: 2022547
Section: A
Assignment: 1

```
udaysangwan@MacBook-Pro-5 ~ % traceroute stanford.edu
traceroute to stanford.edu (171.67.215.200), 64 hops max, 52 byte packets
 1  192.168.224.254 (192.168.224.254)  24.812 ms  14.264 ms  3.292 ms
 2  vpn.iiitd.edu.in (192.168.1.99)  0.451 ms  0.848 ms  0.451 ms
 3  103.25.231.1 (103.25.231.1)  0.991 ms  0.781 ms  0.620 ms
 4  10.1.209.201 (10.1.209.201)  31.850 ms  32.081 ms  31.875 ms
 5  10.1.200.137 (10.1.200.137)  28.062 ms  28.726 ms  27.946 ms
 6  10.255.238.122 (10.255.238.122)  24.320 ms
    10.255.238.254 (10.255.238.254)  27.720 ms  30.103 ms
 7  180.149.48.18 (180.149.48.18)  25.005 ms  24.329 ms  24.318 ms
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * campus-east-rtr-vl1120.sunet (171.66.255.232)  285.583 ms
24  * campus-ial-nets-a-vl1020.sunet (171.64.255.232)  280.084 ms *
25  * * web.stanford.edu (171.67.215.200)  282.990 ms
```

h) Reason for latency difference: Physical distance between us and google servers is lesser than physical distance between us and Stanford servers present in USA.

Question 6:

Description: Downing the lo0 interface, hence cannot send packets giving 100% packet loss.

```
udaysangwan@MacBook-Pro-5 ~ % sudo ifconfig lo0 down
Password:
udaysangwan@MacBook-Pro-5 ~ % ping -c 5 127.0.0.1
PING 127.0.0.1 (127.0.0.1): 56 data bytes
ping: sendto: Can't assign requested address
ping: sendto: Can't assign requested address
Request timeout for icmp_seq 0
ping: sendto: Can't assign requested address
Request timeout for icmp_seq 1
ping: sendto: Can't assign requested address
Request timeout for icmp_seq 2
ping: sendto: Can't assign requested address
Request timeout for icmp_seq 3

--- 127.0.0.1 ping statistics ---
5 packets transmitted, 0 packets received, 100.0% packet loss
udaysangwan@MacBook-Pro-5 ~ % sudo ifconfig lo0 up
```