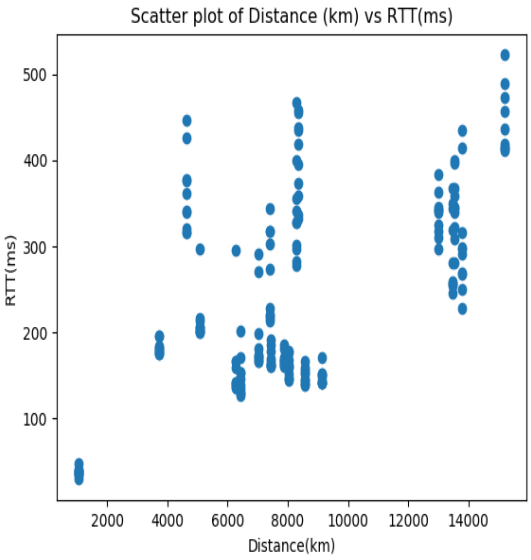
CS3205: ASSIGNMENT REPORT

JEFFIN BIJU (EE19B085)

March 2022

1 Q1

Parts (a), (b), (c): Code in `Q1.py` file in folder Q1. Distances stored in distances.txt file and RTT stored in rtt_log.csv file in folder Q1.
Scatter plot: Average speed is 8.02 times slower than speed of light



Part (d):

```
Jeffins-MacBook-Air:~ jeffinbiju$ traceroute 139.130.4.5
traceroute to 139.130.4.5 (139.130.4.5), 64 hops max, 52 byte packets
 1  192.168.1.1 (192.168.1.1)  4.201 ms  14.341 ms  1.102 ms
 2  abts-kk-dynamic-001.64.172.122.airtelbroadband.in (122.172.64.1)  18.864 ms  11.849 ms  8.415 ms
 3  182.79.20.201 (182.79.20.201)  9.425 ms
    125.18.238.133 (125.18.238.133)  28.656 ms  18.724 ms
 4  116.119.57.158 (116.119.57.158)  68.796 ms
    116.119.68.223 (116.119.68.223)  54.008 ms
    182.79.135.24 (182.79.135.24)  77.492 ms
 5  unknown.telstraglobal.net (202.127.73.101)  45.752 ms  43.797 ms  53.759 ms
 6  * i-91.sgcn-core01.telstraglobal.net (202.84.224.198)  47.230 ms *
 7  i-15350.pthp-core02.telstraglobal.net (202.84.140.37)  95.429 ms
    i-91.sgcn-core01.telstraglobal.net (202.84.224.198)  109.599 ms  117.876 ms
 8  bundle-ether5.pie-core10.perth.telstra.net (203.50.9.1)  122.643 ms  97.742 ms
    i-25451.pthw-core02.telstraglobal.net (202.84.141.238)  113.711 ms
 9  bundle-ether5.wel-core10.perth.telstra.net (203.50.9.5)  102.268 ms
    bundle-ether3.way-core10.adelaide.telstra.net (203.50.6.234)  132.189 ms
    bundle-ether5.wel-core10.perth.telstra.net (203.50.9.5)  95.851 ms
10  bundle-ether16.exi-core10.melbourne.telstra.net (203.50.6.231)  139.145 ms
    bundle-ether3.fli-core10.adelaide.telstra.net (203.50.6.232)  122.255 ms
    bundle-ether16.exi-core10.melbourne.telstra.net (203.50.6.231)  144.471 ms
11  bundle-ether16.win-core10.melbourne.telstra.net (203.50.6.229)  152.568 ms
    bundle-ether12.chw-core10.sydney.telstra.net (203.50.11.124)  175.723 ms
    bundle-ether16.win-core10.melbourne.telstra.net (203.50.6.229)  132.473 ms
12  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  148.613 ms  138.743 ms
    bundle-ether4-3.ken-core10.sydney.telstra.net (203.50.6.226)  145.331 ms
13  203.50.11.221 (203.50.11.221)  161.593 ms  140.991 ms  141.578 ms
14  139.130.4.5 (139.130.4.5)  156.865 ms  163.441 ms  143.650 ms
Jeffins-MacBook-Air:~ jeffinbiju$
```

1) Number of hops = 14
2) Using ip-api.com, we can find that the IP address of router that forwards packet to foreign router is 116.119.57.158, the foreign router that receives this packet has ip address 202.127.73.101 which is located in Hong Kong.
3) Hong Kong

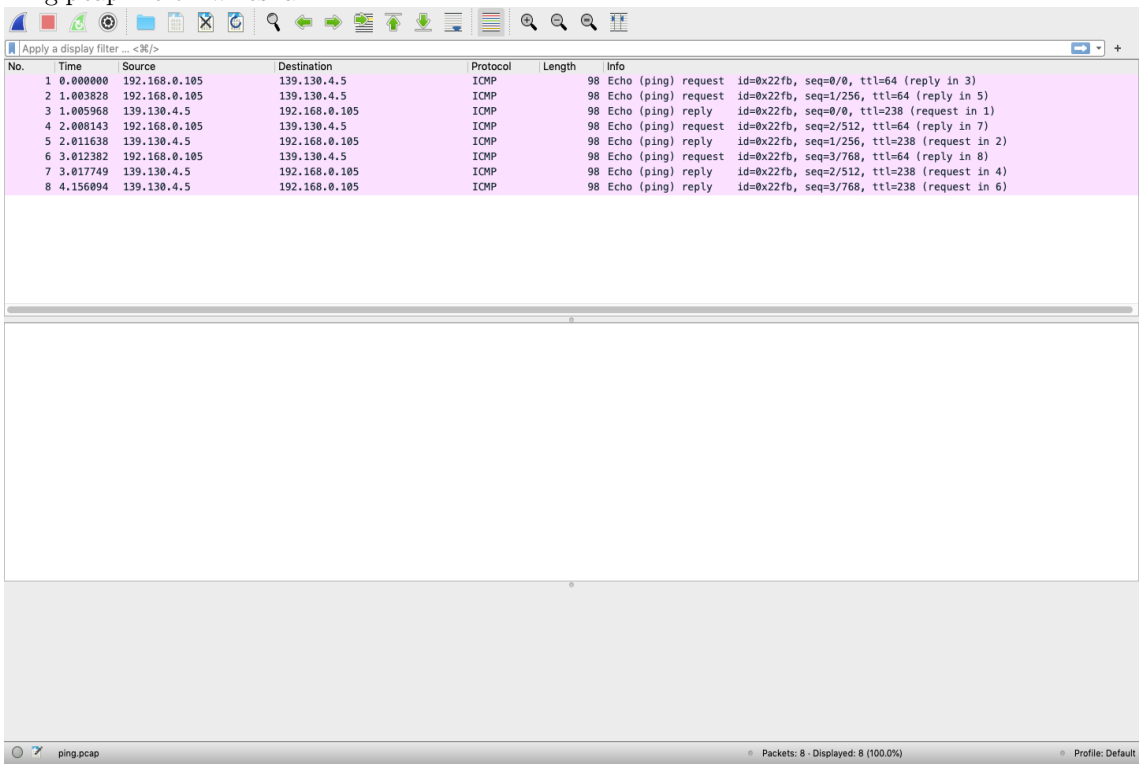
2 Q2

Part (a)
Ping -c4 output on terminal:

```
Jeffins-MacBook-Air:~ jeffinbiju$ ping -c4 139.130.4.5
PING 139.130.4.5 (139.130.4.5): 56 data bytes
Request timeout for icmp_seq 0
64 bytes from 139.130.4.5: icmp_seq=0 ttl=238 time=1006.033 ms
64 bytes from 139.130.4.5: icmp_seq=1 ttl=238 time=1007.889 ms
64 bytes from 139.130.4.5: icmp_seq=2 ttl=238 time=1009.672 ms
64 bytes from 139.130.4.5: icmp_seq=3 ttl=238 time=1143.788 ms

--- 139.130.4.5 ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 1006.033/1041.845/1143.788/58.871 ms
```

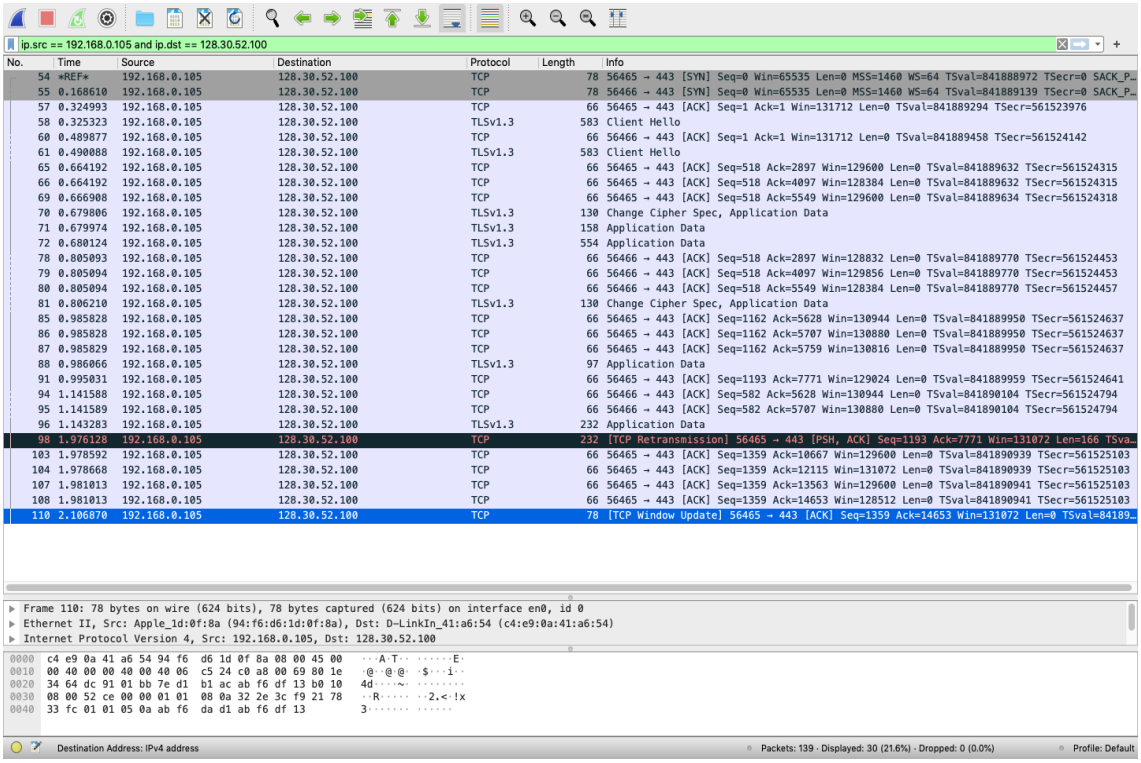
Ping.pcap file on wireshark

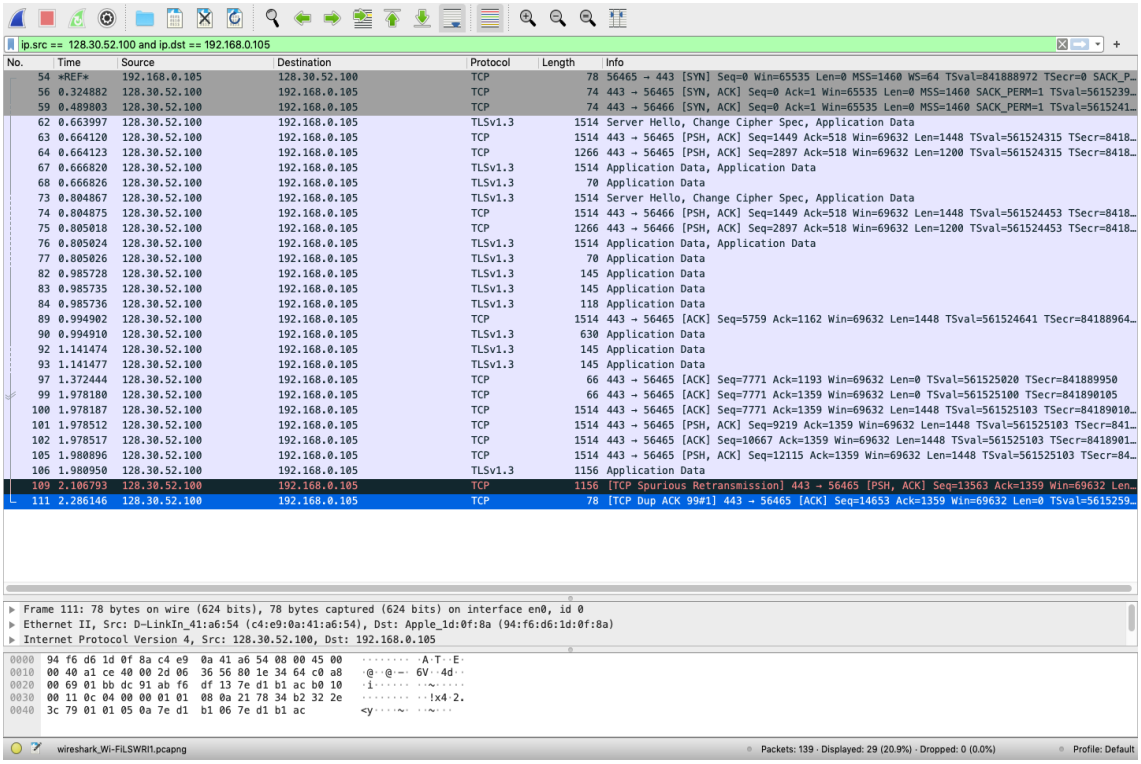


We can see that 8 packets were exchanged. We can also see that the RTT we get from ping is almost equal to the RTT observed by opening the pcap file in wireshark as shown in the above images. For example, the second ping gives an RTT=1007.889 ms as shown in the terminal output. As seen in wireshark, it's RTT=2.008143-1.005968=1.002175 which is approximately equal to 1007.889.

Part (b)

We can see that the server ip address is 128.30.52.100 and my ip address is 192.168.0.105.


ip.src == 192.168.0.105 and ip.dst == 128.30.52.100
No. Time Source Destination Protocol Length Info
54 *REF* 192.168.0.105 128.30.52.100 TCP 78 56465 → 443 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=64 TSval=841888972 TSecr=0 SACK_P…
55 0.168610 192.168.0.105 128.30.52.100 TCP 78 56466 → 443 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=64 TSval=841889139 TSecr=0 SACK_P…
57 0.324993 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1 Ack=1 Win=131712 Len=0 TSval=841889294 TSecr=561523976
58 0.325323 192.168.0.105 128.30.52.100 TLSv1.3 583 Client Hello
60 0.489877 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=1 Ack=1 Win=131712 Len=0 TSval=841889458 TSecr=561524142
61 0.490088 192.168.0.105 128.30.52.100 TLSv1.3 583 Client Hello
65 0.664192 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=518 Ack=2897 Win=129600 Len=0 TSval=841889632 TSecr=561524315
66 0.664192 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=518 Ack=4097 Win=128384 Len=0 TSval=841889632 TSecr=561524315
69 0.666908 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=518 Ack=5549 Win=129600 Len=0 TSval=841889634 TSecr=561524318
70 0.679806 192.168.0.105 128.30.52.100 TLSv1.3 130 Change Cipher Spec, Application Data
71 0.679974 192.168.0.105 128.30.52.100 TLSv1.3 158 Application Data
72 0.680124 192.168.0.105 128.30.52.100 TLSv1.3 554 Application Data
78 0.805093 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=518 Ack=2897 Win=128832 Len=0 TSval=841889770 TSecr=561524453
79 0.805094 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=518 Ack=4097 Win=129856 Len=0 TSval=841889770 TSecr=561524453
80 0.805094 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=518 Ack=5549 Win=128384 Len=0 TSval=841889770 TSecr=561524457
81 0.806210 192.168.0.105 128.30.52.100 TLSv1.3 130 Change Cipher Spec, Application Data
85 0.985828 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1162 Ack=5628 Win=130944 Len=0 TSval=841889950 TSecr=561524637
86 0.985828 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1162 Ack=5707 Win=130880 Len=0 TSval=841889950 TSecr=561524637
87 0.985829 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1162 Ack=5759 Win=130816 Len=0 TSval=841889950 TSecr=561524637
88 0.986066 192.168.0.105 128.30.52.100 TLSv1.3 97 Application Data
91 0.995031 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1193 Ack=7771 Win=129024 Len=0 TSval=841889959 TSecr=561524641
94 1.141588 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=582 Ack=5628 Win=130944 Len=0 TSval=841890104 TSecr=561524794
95 1.141589 192.168.0.105 128.30.52.100 TCP 66 56466 → 443 [ACK] Seq=582 Ack=5707 Win=130880 Len=0 TSval=841890104 TSecr=561524794
96 1.143283 192.168.0.105 128.30.52.100 TLSv1.3 232 Application Data
98 1.976128 192.168.0.105 128.30.52.100 TCP 232 [TCP Retransmission] 56465 → 443 [PSH, ACK] Seq=1193 Ack=7771 Win=131072 Len=166 TSva…
103 1.978592 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1359 Ack=10667 Win=129600 Len=0 TSval=841890939 TSecr=561525103
104 1.978668 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1359 Ack=12115 Win=131072 Len=0 TSval=841890939 TSecr=561525103
107 1.981013 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1359 Ack=13563 Win=129600 Len=0 TSval=841890941 TSecr=561525103
108 1.981013 192.168.0.105 128.30.52.100 TCP 66 56465 → 443 [ACK] Seq=1359 Ack=14653 Win=128512 Len=0 TSval=841890941 TSecr=561525103
110 2.106870 192.168.0.105 128.30.52.100 TCP 78 [TCP Window Update] 56465 → 443 [ACK] Seq=1359 Ack=14653 Win=131072 Len=0 TSval=84189…
Frame 110: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface en0, id 0
Ethernet II, Src: Apple_1d:0f:8a (94:f6:d6:1d:0f:8a), Dst: D-LinkIn_41:a6:54 (c4:e9:0a:41:a6:54)
Internet Protocol Version 4, Src: 192.168.0.105, Dst: 128.30.52.100
0000 c4 e9 0a 41 a6 54 94 f6 d6 1d 0f 8a 08 00 45 00
0010 00 40 00 00 40 00 40 06 c5 24 c0 a8 00 69 80 1e
0020 34 64 dc 91 01 bb 7e d1 b1 ac ab f6 df 13 b0 10
0030 08 00 52 ce 00 00 01 01 08 0a 32 2e 3c f9 21 78
0040 33 fc 01 01 05 0a ab f6 da d1 ab f6 df 13
Destination Address: IPv4 address
Packets: 139 · Displayed: 30 (21.6%) · Dropped: 0 (0.0%)
Profile: Default



Number of outgoing packets = 30, Number of incoming packets = 28.

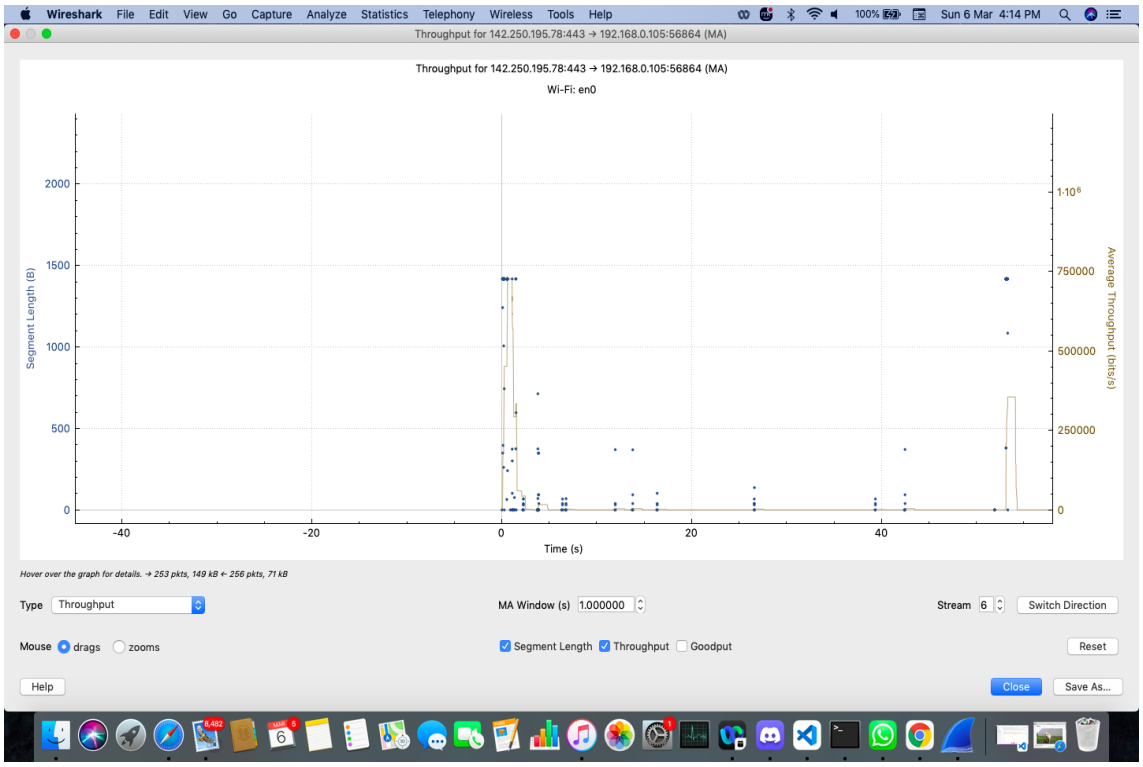
Number of outgoing packets in 1st second = 21, 2nd second = 8, 3rd second = 1.

Number of incoming packets in 1st second = 17, 2ns second = 9, 3rd second = 2.

Size of outgoing data = sum of lengths of outgoing packets as seen in wireshark length column = 78+78+66+583.....=4121 bytes

Similarly size of incoming data = sum of lengths of incoming packets as seen in wireshark length column = 74+74+1514+1514+.....=23324 bytes

Part (c) Plot of throughput in TCP stream:
We can see that the throughput is high initially since youtube prefetches most of the content before starting to play the video so as to prevent buffering during the video.



3 Q3

See code in Q3.py file in folder Q3.
Answer:It was a bright cold day in February, and the clocks were striking thirteen.