CS3205 Assignment 1

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1 Problem 1 - Ping

1.1 Problem a. Getting the distances

For obtaining the latitudes and longitudes, the geolocation API provided by ipapi.com is used. The script used to get the locations using the API is provided (**getlocations.py**). All locations are stored in latitude, longitude format in **locations.txt** file.

The haversine distance is then computed between the target server's location coordinates and the coordinates corresponding to IITM campus (my location). The distances are computed using the **getdistance.py** file which reads from the **locations.txt** file, and writes the distances down into the **distances.txt** file.

1.2 Problem b. Logging RTT and Location

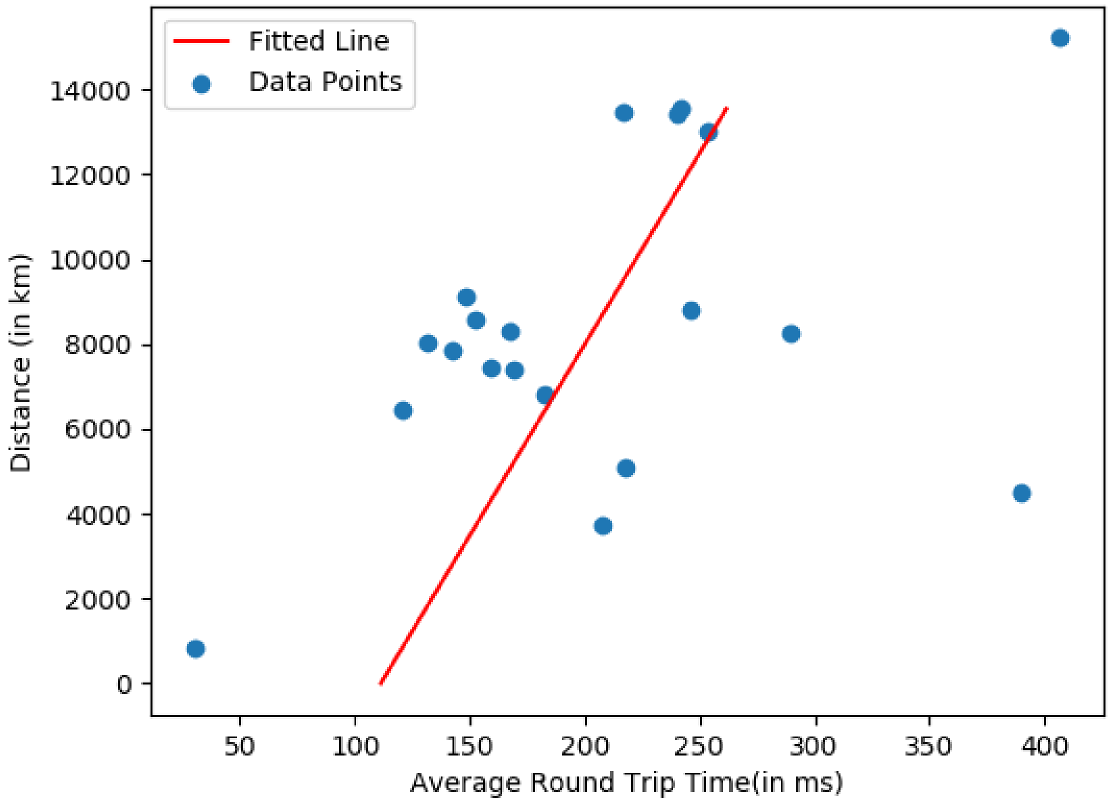
This task is done by the **genlogs.py** script. To automate the process of getting RTTs of the IP Addresses, Python's subprocess module is used which spawns the ping command process for each IP addresses one by one, reads the Standard Output and parses it to get the RTTs. Once the RTTs are obtained, the script logs the RTTs and the locations as per the format mentioned in the problem statement.

The logs are stored in the **logs.txt** file

1.3 Problem c. Trend between RTTs and Distances

The trend between the round trip times (average of the 10 RTTs) and distances are plotted below. A straight line has been fitted to the points to estimate the average speed of transmission (given by twice the slope of the line).

Figure 1: RTT v/s Distance trend



A speed of **45086.75 Km/s** was obtained which is roughly **6** times slower than the speed of light.

1.4 Problem d. Traceroute

The last IP address in the ping-servers.txt file is **139.130.4.5**. The traceroute output is stored in the **traceroute_output.txt** file.

Q1. A total of **22** hops were observed.

Q2. We need to look at hops 9,10,11,12 as things are interesting here. At hop number 9 the packet arrives at the IP address

115.247.85.129. I used **check-host.net** to get the geolocation information for this IP address. This IP address belongs to Reliance Jio Infocomm Limited, and is located in **India**.

At hop number 10, the IP address is **172.31.3.25**. This is a private(internal) IP address. Hence nothing can be determined about its location.

Though at hop number 11, the IP address is **103.198.140.170**, which belongs to Reliance Jio **Singapore**. At least as per the geolocation tool this packet could be in Singapore. But something worth noticing is the round trip time. The round trip time is **3.5 ms**. That is it takes 3.5 ms for the ICMP request to go and arrive back at my computer. That is if the packets were to travel at the speed of light, the distance would be $3 \cdot 10^5 \cdot 0.5 \cdot 3.5 \cdot 10^{-3} Km = 525 Km$.

Singapore is certainly not just 525 KM away from the IITM campus.

Thus it means that even though the geolocation tool claims that this IP address is in Singapore, it is actually a router in India.

What happens next is interesting. At hop 12, the IP address is **103.198.140.209**. This is in Singapore as per the geolocation tool. If we observe the RTT, there is a 10 times jump in the round trip time compared to the previous round trip times. The round trip time is **43.6 ms**. The distance for this comes out to be 6540 KM. Given that the distance between Singapore and India is roughly 3600 KM, this is a believable result. And hence at the 12th hop the packet has actually arrived at Singapore.

Hence the IP address of the last router along the path in India is **103.198.140.170** (11th hop).

Q3. As highlighted earlier, the packet visits **Singapore**.

2 Problem 2 - tcpdump

The command executed to do **tcpdump** was:
sudo tcpdump -i eth0 -s 65535 -w output_file
Here, 65535 is the max packet size, and **eth0** is the interface.

2.1 Problem a) tcpdump for ping

A total of 8 packets were exchanged as shown in the wireshark screenshot below. The pcap file is **assign2a.pcap**

Figure 2: Ping tcpdump

59	40.234250	172.19.113.1	139.130.4.5	ICMP	98 Echo (ping) request	id=0x4e6a, seq=1/256, ttl=64 (reply in 60)
60	40.476501	139.130.4.5	172.19.113.1	ICMP	98 Echo (ping) reply	id=0x4e6a, seq=1/256, ttl=229 (request in 59)
61	41.233913	172.19.113.1	139.130.4.5	ICMP	98 Echo (ping) request	id=0x4e6a, seq=2/512, ttl=64 (reply in 62)
62	41.475880	139.130.4.5	172.19.113.1	ICMP	98 Echo (ping) reply	id=0x4e6a, seq=2/512, ttl=229 (request in 61)
63	42.234181	172.19.113.1	139.130.4.5	ICMP	98 Echo (ping) request	id=0x4e6a, seq=3/768, ttl=64 (reply in 64)
64	42.476229	139.130.4.5	172.19.113.1	ICMP	98 Echo (ping) reply	id=0x4e6a, seq=3/768, ttl=229 (request in 63)
65	43.234662	172.19.113.1	139.130.4.5	ICMP	98 Echo (ping) request	id=0x4e6a, seq=4/1024, ttl=64 (reply in 66)
66	43.489317	139.130.4.5	172.19.113.1	ICMP	98 Echo (ping) reply	id=0x4e6a, seq=4/1024, ttl=229 (request in 65)

The RTTs were 242ms,242ms,242ms,255ms which agrees with the packet arrival and departure times shown in the wire shark screen shot.

2.2 Problem b) Loading a URL

pcap file: assign2b.pcap

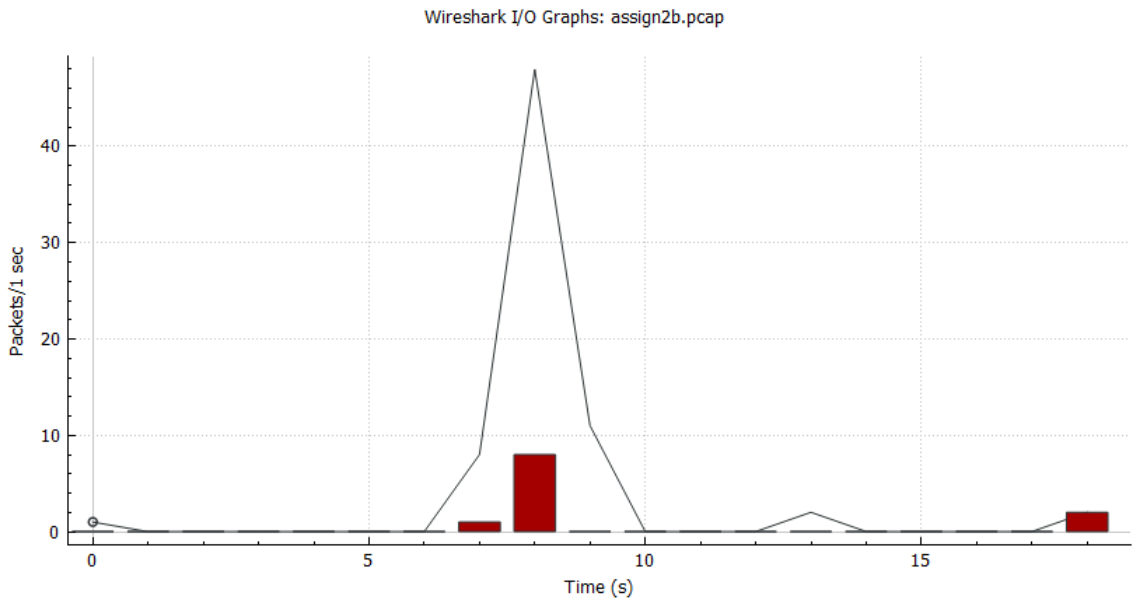
i. **0** (Zero) packets were exchanged for the 1st 5 seconds(since the start of tcpdump) **8** packets were exchanged between 6th and 7th second.

ii. **34** packets outgoing and **26** packets incoming

iii. **4326** bytes were sent from the client to the server. **22063** bytes were recieved.

The I/O graph is plotted below:

Figure 3: I/O Graph for part b

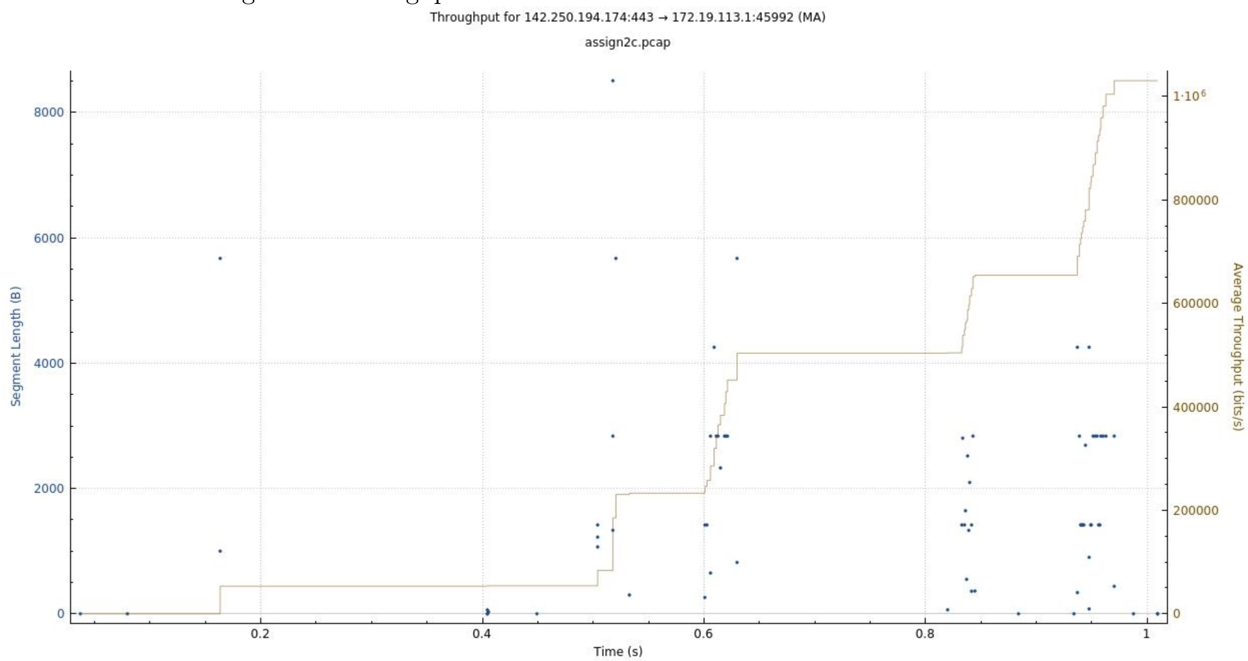


2.3 Problem c) YouTube Video

pcap file: assign2c.pcap

The throughput is plotted below:

Figure 4: Throughput for YouTube Video



3 Problem 3 - Hamming Code

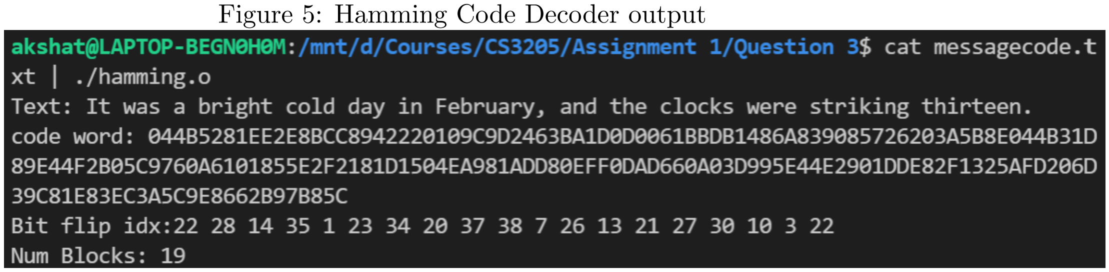
The logic of the Hamming Code decoder is based on the fact that the error position is the XOR of the positions of set (1) bits.

A C++ code (**hamming.cpp**) is written to decode the coded message provided.

The following text is obtained as output: **It was a bright cold day in February, and the clocks were striking thirteen.**

The screenshot of the output is attached which also shows additional information such as bit flips:

Figure 5: Hamming Code Decoder output



```
akshat@LAPTOP-BEGN0H0M:/mnt/d/Courses/CS3205/Assignment 1/Question 3$ cat messagecode.t
xt | ./hamming.o
Text: It was a bright cold day in February, and the clocks were striking thirteen.
code word: 044B5281EE2E8BCC8942220109C9D2463BA1D0D0061BBDB1486A839085726203A5B8E044B31D
89E44F2B05C9760A6101855E2F2181D1504EA981ADD80EFF0DAD660A03D995E44E2901DDE82F1325AFD206D
39C81E83EC3A5C9E8662B97B85C
Bit flip idx:22 28 14 35 1 23 34 20 37 38 7 26 13 21 27 30 10 3 22
Num Blocks: 19
```