Assignment 5
210010033
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Part 2:

1. IP of the source is 10.200.179.176
   The TCP port number is 80

2. IP of gaia.cs.umass.edu is 128.119.245.12
   The source port is 80 and destination port is 59128

Part 3:

1.

The raw sequence number of the TCP SYN packet that is 869092609 and the relative sequence number is 0. The flags in the TCP packet represent that it is an SYN segment.

2.

```
✓ Transmission Control Protocol, Src Port: 80, Dst Port: 59128, Seq: 0, Ack: 1, Len: 0
    Source Port: 80
    Destination Port: 59128
    [Stream index: 7]
  > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 0]
    Sequence Number: 0     (relative sequence number)
    Sequence Number (raw): 365568124
    [Next Sequence Number: 1     (relative sequence number)]
    Acknowledgment Number: 1     (relative ack number)
    Acknowledgment number (raw): 869092610
    1000 .... = Header Length: 32 bytes (8)
  > Flags: 0x012 (SYN, ACK)
    Window: 29200
    [Calculated window size: 29200]
    Checksum: 0x2b68 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
```

The raw sequence number of the TCP SYNACK packet that is 365568124and the relative sequence number is 0. The flags in the TCP packet represent that it is an SYNACK segment. The relative acknowledgment is 1 and the acknowledgment number (raw) is 869092610. The value of the acknowledgment number is (sequence number + 1).

3.
The raw sequence number of the TCP segment

```
✓ Transmission Control Protocol, Src Port: 59128, Dst Port: 80, Seq: 148751, Ack: 1, Len: 558
    Source Port: 59128
    Destination Port: 80
    [Stream index: 7]
  > [Conversation completeness: Complete, WITH_DATA (31)]
    [TCP Segment Len: 558]
    Sequence Number: 148751     (relative sequence number)
    Sequence Number (raw): 869241360
    [Next Sequence Number: 149309     (relative sequence number)]
    Acknowledgment Number: 1     (relative ack number)
    Acknowledgment number (raw): 365568125
    0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x018 (PSH, ACK)
    Window: 4096
    [Calculated window size: 262144]
    [Window size scaling factor: 64]
    Checksum: 0xb2d9 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
  > [Timestamps]
  > [SEQ/ACK analysis]
    TCP payload (558 bytes)
    TCP segment data (558 bytes)
```

containing the header of the HTTP POST command packet that is 869241360 and the relative sequence number is 0148751. Size is 558 bytes in the payload. No, not all of the data of the alice.txt file was transferred in this single TCP segment.

4.
   i. 9:05:05.616466 am 7th Feb 2024
   ii. 9:05:05.878832 am 7th Feb 2024
   iii. rtt of the first package is 0.26212400 seconds.
   iv. rtt of the second package is 0.000258000 seconds.

5. The following are the first four data carrying TCP segments:

   The length (header plus payload) of each of the first four data-carrying TCP is $1250 + 20 = 1270$ bytes.

6. Buffer size is 262144 bytes as advertised. Since it does not change among the first 4 packets, the buffer space never throttles the sender.

7. No, there aren't any retransmitted segments in the trace file. I checked this using **tcp.analysis.retransmission** in the filter.

8.

```
51 09:05:05.880111  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=1 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
52 09:05:05.880115  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=1251 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
53 09:05:05.880117  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=2501 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
54 09:05:05.880120  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=3751 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
55 09:05:05.880122  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=5001 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
56 09:05:05.880125  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=6251 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
57 09:05:05.880129  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=7501 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
58 09:05:05.880131  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=8751 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
59 09:05:05.880135  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=10001 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
60 09:05:05.880145  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=11251 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
```
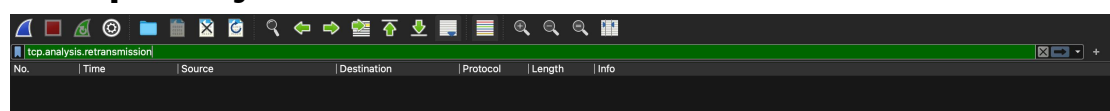
The receiver acknowledges 1 byte in the first packet
and 1250 byte each in the last 9 packets.

```
62 09:05:06.178274  128.119.245.12        10.200.179.176       TCP        54 80 → 59128 [ACK] Seq=1 Ack=6251 Win=41728 Len=0
63 09:05:06.178275  128.119.245.12        10.200.179.176       TCP        54 80 → 59128 [ACK] Seq=1 Ack=12501 Win=54272 Len=0
```

The packet number 62 ACKS packet 55
The packet numerb 63 ACKS packte 60
Hence, I can find cases where the receiver is ACKing
every other received segment among these first ten
data-carrying segments

9. The first package aknowledged 1 byte.

```
51 09:05:05.880111  10.200.179.176        128.119.245.12       TCP        1304 59128 → 80 [ACK] Seq=1 Ack=1 Win=262144 Len=1250 [TCP segment of a reassembled PDU]
```
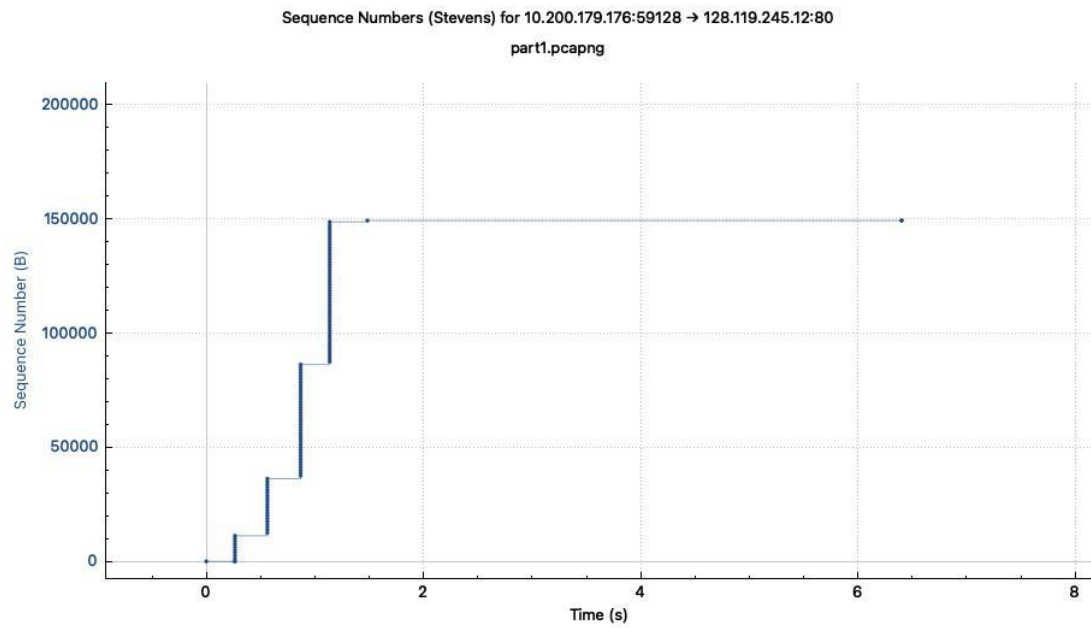
The last package aknowledged 149309 bytes.

```
287 09:05:12.018861  10.200.179.176        128.119.245.12       TCP        54 59128 → 80 [FIN, ACK] Seq=149309 Ack=779 Win=262144 Len=0
```
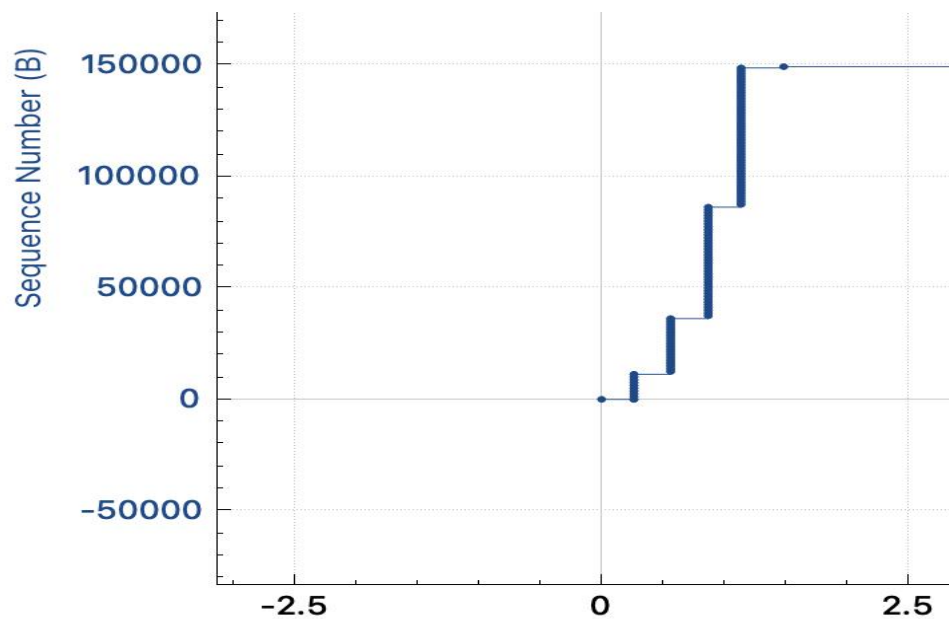
Time between the first and last package is 12.018861-
5.880111 = 6.13875 seconds
Throughput = 149308/6.13875
= 24322.3783 bytes/second

Part 4:

Sequence Numbers (Stevens) for 10.200.179.176:59128 → 128.119.245.12:80

part1.pcapng

The following figure shows slow start till 0.85 seconds since each vertical grows exponentially is size:

The following figure shows congestion avoidance at about 1.2 second since the difference in successive verticals(no. of bytes sent) at 0.85 and 1.2 seconds is not that much large as the start. :

Sequence Numbers (Stevens) for 10.200.179.176:59128 → 128.119.245.12:80

part1.pcapng