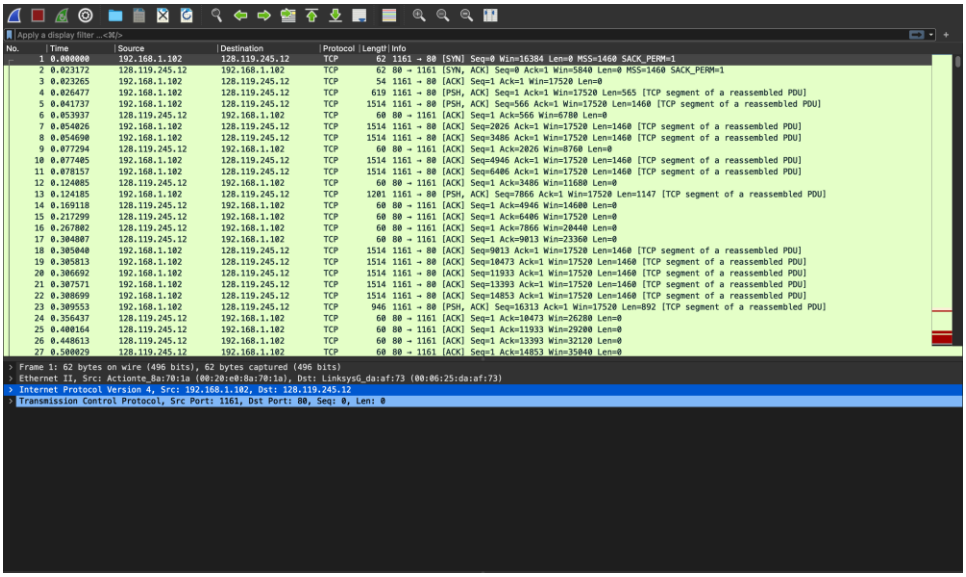
Exercise 1

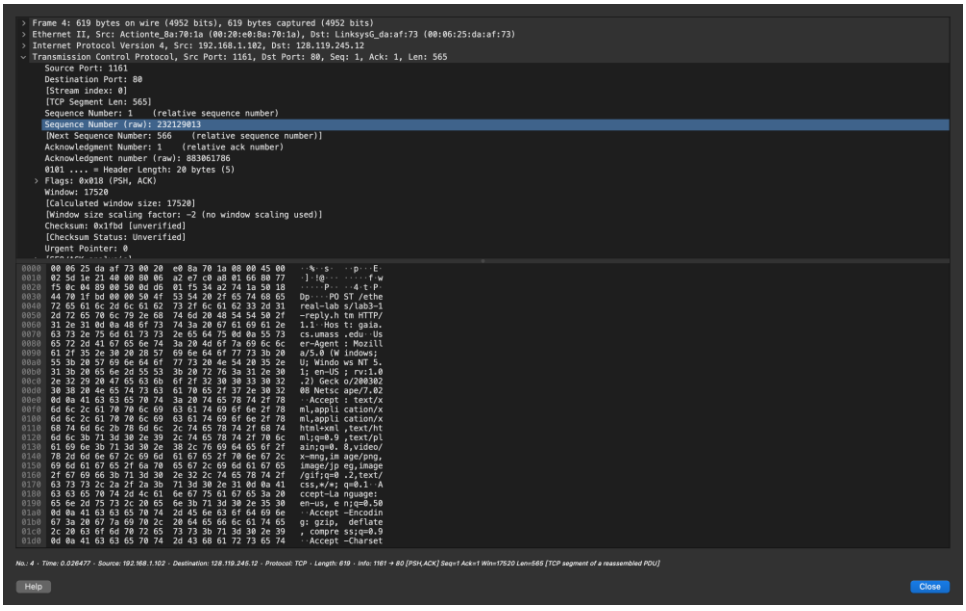
Question 1

- IP address for gaia.cs.umass.edu is 128.119.245.12, port is 80
- Client IP address is 192.168.1.102, port is 1161



Question 2

- 232129013



Question 3

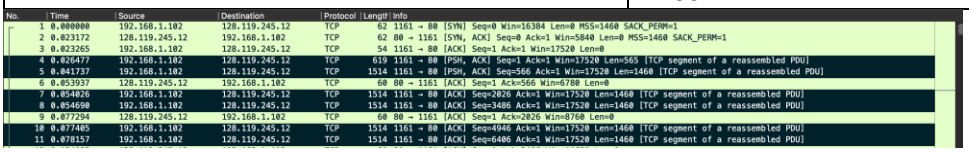
No.	seqNo	Time sent	RTT	ACK receive	EstimatedRTT
4	232129013	0.026477	0.053937	0.02746	0.02746

5	232129578	0.041737	0.077294	0.035557	0.028472
7	232131038	0.054026	0.124085	0.070059	0.03367
8	232132498	0.054690	0.169118	0.114428	0.043765
10	232133958	0.077405	0.217299	0.139894	0.055781
11	232133958	0.078157	0.267802	0.189645	0.072514

$Estimated\ RTT$ = (1 − $alpha$) ∗ $Estimated\ RTT$ + $alpha$ ∗ $Sample\ RTT$, alpha = 0.125

Question 4

No.	Length
4	565
5	1460
7	1460
8	1460
10	1460
11	1460

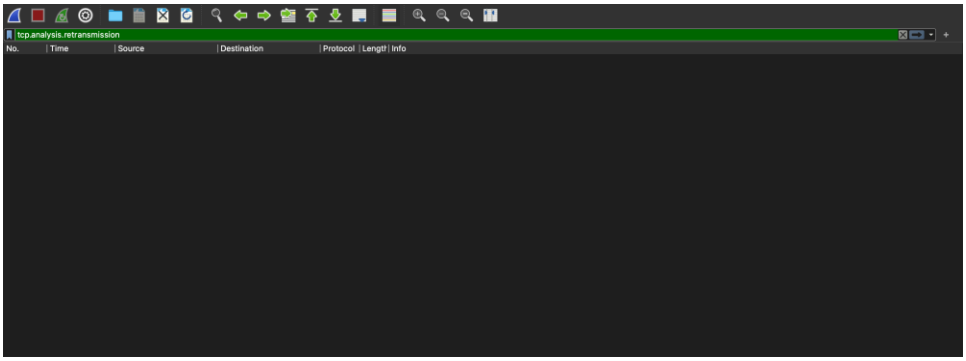


Question 5

The minimum amount is 5480, which is advertised by the [SYN, ACK] packet sent by receiver. This does not throttle the sender because the window size quickly grows to a reasonable size, most of the time in range 17000 ~ 62780. The window size is always set to a small value at the start of the connection, and the less error occurs in the transmission, the larger the window size will be advertised.

Question 6

No retransmission, by applying tcp.analysis.retransmission filter. Also, all the ACK number in the ACK from receiver is monotonically increasing, which means all the packets are received correctly.



Question 7

In the early part of the trace file, each packet is individually being ACKed by the receiver. However, at segment #60, the ACK with the acknowledgement field as 232166981is acknowledging two segments with sequence #232164061 and #232165521. After #60, there are several instances when the receiver sends an ACK for every other received segment. This is due to the TCP uses Delayed ACKs where the receiver

waits for up to 500 msec for the arrival of another in-order segment and then sends a cumulative ACK for both of the received segments.

Question 8

- Total amount of data = last ACK number of ACK from receiver – first sequence number of the data segment packet send by sender = 232293103 - 232129013 = 164090 bytes.
- Total time used = time of last packet received – time of first packet send = 5.455830 - 0.026477 = 5.429353 seconds
- Throughput = total amount of data / total time = 164090/5.429353 = 30222.75bytes/s = 3.02Kbps

Exercise 2

Question 1

Initial sequence number is 2818463618

Question 2

The sequence number of the SYNACK segment sent by the server is 1247095790. The ACK in the SYNACK segment is 2818463619. Since SYN has 1 byte, The server has added 1 in the ISN from the client to arrive at the ACK number,

Question 3

Sequence number is 2818463619 and ack number is 1247095791. This segment does not contians any data.

Question 4

The connection is close by a simultaneous close, which means both client and server have sent the FIN at the same time, without receiving FIN from the other side (FINs No 304 and 305). ACK is not increasing by 1 in the FINs No 304 and 305 proved this.

Question 5

- Client to Server: $final\ ACK - ISN - 2(SYN, FIN)$ = 2818463653 − 2818463618 − 2 = 33 Bytes
- Server to. Client: $final\ ACK - ISN - 2(SYN, FIN)$ = 1247095832 − 1247095790 − 2 = 40 Bytes