COMP9331 Lab4

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Exercise 1:

Question 1:

The IP address of gaia.cs.umass.edu is 128.119.245.12 and port number is 80.

The IP address used by the client computer (source) that is transferring the file to gaia.cs.umass.edu is 192.168.1.102 and the port number is 1161.

Question 2:

```
No.   Time       Source          Destination     Protocc Lengt Info
   1 0.000000   192.168.1.102   128.119.245.12  TCP      62 1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
   2 0.023172   128.119.245.12  192.168.1.102   TCP      62 80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
   3 0.023265   192.168.1.102   128.119.245.12  TCP      54 1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
   4 0.026477   192.168.1.102   128.119.245.12  TCP     619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
   5 0.041737   192.168.1.102   128.119.245.12  TCP    1514 1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
   6 0.053937   128.119.245.12  192.168.1.102   TCP      60 80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
   7 0.054026   192.168.1.102   128.119.245.12  TCP    1514 1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
   8 0.054690   192.168.1.102   128.119.245.12  TCP    1514 1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
˅ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
     Source Port: 1161
     Destination Port: 80
     [Stream index: 0]
     [TCP Segment Len: 565]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 232129013
     [Next Sequence Number: 566    (relative sequence number)]
     Acknowledgment Number: 1    (relative ack number)
     Acknowledgment number (raw): 883061786
     0101 .... = Header Length: 20 bytes (5)
   ˅ Flags: 0x018 (PSH, ACK)
       000. .... .... = Reserved: Not set
       ...0 .... .... = Nonce: Not set
       .... 0... .... = Congestion Window Reduced (CWR): Not set
0020  f5 0c 04 89 00 50 0d d6  01 f5 34 a2 74 1a 50 18    ·····P·· ··4·t·P·
0030  44 70 1f bd 00 00 50 4f  53 54 20 2f 65 74 68 65    Dp····PO ST /ethe
```

The sequence number of the TCP segment containing the HTTP POST command is 232129013.

Question 3:

EstimatedRTT = 0.875 * EstimatedRTT + 0.125 * Sample RTT

| No.	Seq#Length	Time	sentTime	ACK	Sample RTT	Estimated RTT
1	232129013	565	0.026477	0.053937	0.02746	0.02746
2	232129578	1460	0.041737	0.077294	0.035557	0.028472
3	232131038	1460	0.054026	0.124085	0.070059	0.03367
4	232132498	1460	0.054690	0.169118	0.114428	0.043765
5	232133958	1460	0.077405	0.217299	0.139894	0.055781
6	232135418	1460	0.078157	0.267802	0.189645	0.072514

Question 4:

See the table

Question 5:

The minimum amount of available buffer space advertised at the receiver for the entire trace is 5840 bytes and finally grows to 62780 bytes. Therefore, the lack of receiver buffer space doesn't ever throttle the sender

Question 6:
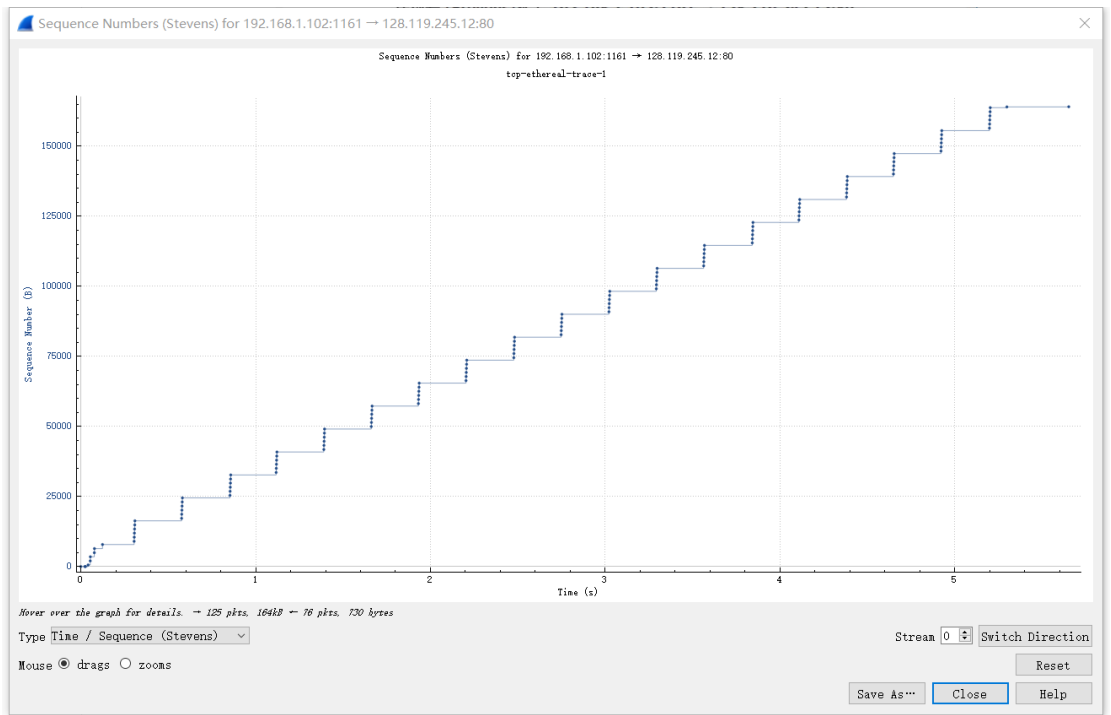
There are no retransmitted segments in the trace file.

I used Steven graph to check for this question.

Question 7:

Time	Source	Destination	Protoco	Lengt	Info
181 4.921025	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=149737 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
182 4.921916	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=151197 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
183 4.922820	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=152657 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
184 4.923863	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=154117 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
185 4.924667	192.168.1.102	128.119.245.12	TCP	946	1161 → 80 [PSH, ACK] Seq=155577 Ack=1 Win=17520 Len=892 [TCP segment of a reassembled PDU]
186 5.019189	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=151197 Win=62780 Len=0
190 5.125019	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=154117 Win=62780 Len=0
191 5.197286	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=156469 Win=62780 Len=0
192 5.197508	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=156469 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
193 5.198388	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=157929 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
194 5.199275	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=159389 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
195 5.200252	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
196 5.201150	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]

The receiver typically acknowledges 1470 bytes of data in an ACK.

The receiver acknowledged 181,183 and 185 segment.

Question 8:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565 [TCP segment of a reassembled PDU]
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	0.124185	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP segment of a reassembled PDU]

Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
    Source Port: 1161
    Destination Port: 80
    [Stream index: 0]
    [TCP Segment Len: 565]
    Sequence Number: 1   (relative sequence number)
    Sequence Number (raw): 232129013
    [Next Sequence Number: 566   (relative sequence number)]
    Acknowledgment Number: 1   (relative ack number)
    Acknowledgment number (raw): 883061786
    0101 .... = Header Length: 20 bytes (5)
> Flags: 0x018 (PSH, ACK)
    Window: 17520

No.	Time	Source	Destination	Protocol	Length	Info
193	5.198388	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=157929 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
194	5.199275	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=159389 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
195	5.200252	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
196	5.201150	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
197	5.202024	192.168.1.102	128.119.245.12	TCP	326	1161 → 80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 Len=272 [TCP segment of a reassembled P
198	5.297257	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
199	5.297341	192.168.1.102	128.119.245.12	HTTP	104	POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
200	5.389471	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201	5.447887	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202	5.455830	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203	5.461175	128.119.245.12	192.168.1.102	HTTP	784	HTTP/1.1 200 OK (text/html)
206	5.651141	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=164091 Ack=731 Win=16790 Len=0
213	7.595557	192.168.1.102	199.2.53.206	TCP	62	1162 → 631 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1

> Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 164091, Len: 0
    Source Port: 80
    Destination Port: 1161
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence Number: 1   (relative sequence number)
    Sequence Number (raw): 883061786
    [Next Sequence Number: 1   (relative sequence number)]
    Acknowledgment Number: 164091   (relative ack number)
    Acknowledgment number (raw): 232293103
    0101 .... = Header Length: 20 bytes (5)
> Flags: 0x010 (ACK)
    Window: 62780

The total data are 164091 - 1 = 164090 bytes and the total transmission time is 5.455830 - 0.026477 = 5.4294 seconds. Hence, the throughput for the TCP connection is computed as 164090/5.4294 = 30.222 KB/sec.

Exercise 2:

Question 1:

The sequence number of the TCP SYN segment is 2818463618.

Question 2:

The sequence number of the SYNACK segment is 1247095790.

The value of the Acknowledgement field in the SYNACK segment is 2818463619.

Yes, the server has added 1 in the ISN from the client to arrive at the ACK number.

Question 3:

The sequence number of the ACK segment is 2818463619.

The value of the Acknowledgment field in this ACK segment is 1247095791. This segment contains no data because the later segment 298 as it is using the same Seq number.

Question 4:

Both the client and server did the active close, because according to segment 304 and 305, both client and server have sent a FIN ACK segment to the other side as their last sending-segment.

Question 5:

Client: ISN = 2818463618, last ACK = 2818463653

Data sent = 2818463653 - 2818463618 – 2 (1 SYN 1 FIN) = 33 Bytes

Server: ISN = 1247095790, last ACK = 1247095832

Data sent = 1247095832 - 1247095790 - 2 = 40 Bytes

Data sent = final ACK received - ISN - 2 (1 for SYN and 1 for FIN)