

Exercise 1

Question 1:

- 1) the IP address of gaia.cs.umass.edu is : 128.119.245.12
port number: 80
- 2) the IP address of client computer is: 192.168.1.102
port number: 1161

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]

> Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
 > Ethernet II, Src: Actionte_Ba: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: 0, Len: 0

Question 2:

the sequence number of the TCP segment is: 232129013

1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=232129013 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=883061785 Ack=232129013 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=232129013 Ack=883061786 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=232129013 Ack=883061786 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=232129578 Ack=883061786 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=883061786 Ack=232129578 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232131038 Ack=883061786 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=232132498 Ack=883061786 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=883061786 Ack=232131038 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232133958 Ack=883061786 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_Ba: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: 232129013, Ack: 883061786, Len: 565
 Source Port: 1161
 Destination Port: 80
 [Stream index: 0]
 [TCP Segment Len: 565]
 Sequence number: 232129013
 [next sequence number: 232129578]
 Acknowledgment number: 883061786

0000 44 70 1f bd 00 00 00 4f 51 54 20 2f 65 74 66 05 Dp: 80.80.80.80
 0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 55 2d 51 real-kim-trainbi-2
 0080 2d 72 65 70 6c 79 2d 60 74 62 60 40 54 54 50 2f reply-hy-tr-nitro
 00c0 11 20 11 8d 9c 4d 0f 71 74 3e 20 67 01 69 63 2d 11-104-11-gaia
 0100 63 73 20 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass.edu-80
 0140 65 72 2d 41 62 65 66 74 3a 20 4d 67 72 69 6c 65 net-agent-102112
 0180 63 2f 25 20 20 20 20 52 60 6e 6d 67 71 38 20 20 175.0.0.102
 01c0 55 3b 20 57 69 6a 64 6f 77 73 20 4a 54 20 35 20 31 mindo-us-ht-5
 0200 81 30 20 65 6e 2d 55 53 30 60 72 76 3a 11 2e 10 81-08-06-17v11-0

Question 3:

NO.	Seg1	Seg2	Seg3	Seg4	Seg5	Seg6
Sequence Number	232129013	232129578	232131038	232132498	232133958	232135418
Time sent	0.026477 sec	0.041737 sec	0.054026 sec	0.054690 sec	0.077405 sec	0.078157 sec
Time ACK received	0.053937 sec	0.077294 sec	0.124085 sec	0.169118 sec	0.217299 sec	0.267802 sec
Sample RTT	0.02746 sec	0.035557 sec	0.070059 sec	0.11443 sec	0.13989 sec	0.18964 sec
Estimated RTT	0.02746 sec	0.028472 sec	0.03367 sec	0.043765 sec	0.055781 sec	0.072514 sec

Question 4:

Seg 1 = 565 bytes
 Seg 2 = 1460 bytes
 Seg 3 = 1460 bytes
 Seg 4 = 1460 bytes
 Seg 5 = 1460 bytes
 Seg 6 = 1460 bytes

Question 5:

- 1) Min buffer: 5840 bytes
- 2) No, it doesn't throttle the sender.

Question 6:

There is no retransmitted segment in the trace file.

As all sequence numbers of the TCP segments are increasing with the time. If there is a retransmitted segment, the sequence number will be smaller than previous segments sequence number.

Question 7:

the receiver typically acknowledges 565, 1460, 892 bytes of data in an ACK

30	0.576671	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232146217 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
31	0.577385	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232147677 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
32	0.578329	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232149137 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
33	0.579195	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232150597 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
34	0.580149	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232152057 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
0	0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK] Seq=232129013 Ack=883061786 Win=17520 Len=565 [TCP segment of a reassembled PDU]
0	0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK] Seq=232129578 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
55	0.579195	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232150597 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
34	0.580149	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=232152057 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
35	0.581074	192.168.1.102	128.119.245.12	TCP	946 1161 → 80 [PSH, ACK] Seq=232153517 Ack=883061786 Win=17520 Len=892 [TCP segment of a reassembled PDU]
36	0.626496	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232147677 Win=40880 Len=0

Question 8:

Total data transmitted

= acknowledgement seq number of last seg – seq number of first segment
 = 232,293,103 – 232,129,013 bytes
 = 164,090 bytes

Transmission time = 5.455830 – 0.026477 = 5.429353 sec

Throughput = 164,090 bytes / 5.429353 sec = 30223 bps

Exercise 2

Question 1:

The sequence number of the TCP SYN segment is: 2818463618.

Question 2:

- 1) the sequence Number of SYNACK Segment: 1247095790.
- 2) The value is : 2818463619.
- 3) The server adds 1 on the initial serial number sent by the client.

Question 3:

- 1) The sequence number is: 2818463619.
- 2) The value is: 1247095791.
- 3) This segment contains $2818463652 - 2818463619 = 33$ bytes data.

Question 4:

It is the simultaneous close. Both client and server did the active close. From no. 304 & 305 the seq and ack did not increase.

Question 5:

Client to server:

Data = 2818463653 (ISN) - 2818463618 (Final ACK) - 1(SYN) - 1(FIN) = 33 Bytes

Server to client:

Data = 1247095832 (ISN) - 1247095790 (Final ACK) - 1(SYN) - 1(FIN) = 40 Bytes