Exercise 1:

Q1:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=232129012 Win=16384 Len=0 MSS=1460 SACK_PERM=1

The IP address of gaia.cs.umass.edu is 128.119.245.12 ,and it useing port number is 80 to sending and receiving TCP segments. The IP address and TCP port number used by the client is 192.168.1.102 and 1162.

Q2:

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]
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232135418 Ack=883061786 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=883061786 Ack=232132498 Win=11680 Len=0
13 0.124185	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=232136878 Ack=883061786 Win=17520 Len=1147 [TCP segment of a reassembled PDU]
14 0.169118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232133958 Win=14600 Len=0
15 0.217299	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232135418 Win=17520 Len=0
16 0.267802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232136878 Win=20440 Len=0
17 0.304807	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232138025 Win=23360 Len=0
18 0.305040	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232138025 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
19 0.305813	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232139485 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
20 0.306692	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232140945 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
21 0.307571	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232142405 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
22 0.308699	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232143865 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_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
v 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
     0101 .... = Header Length: 20 bytes (5)
   > Flags: 0x018 (PSH, ACK)
     Window: 17520
```

```
0030  44 70 1f bd 00 00 50 4f  53 54 20 2f 65 74 68 65   Dp····PO ST /ethe
0040  72 65 61 6c 2d 6c 61 62  73 2f 6c 61 62 33 2d 31   real-lab s/lab3-1
0050  2d 72 65 70 6c 79 2e 68  74 6d 20 48 54 54 50 2f   -reply.h tm HTTP/
0060  31 2e 31 0d 0a 48 6f 73  74 3a 20 67 61 69 61 2e   1.1··Hos t: gaia.
0070  63 73 2e 75 6d 61 73 73  2e 65 64 75 0d 0a 55 73   cs.umass .edu··Us
0080  65 72 2d 41 67 65 6e 74  3a 20 4d 6f 7a 69 6c 6c   er-Agent : Mozill
```

The number 4 packet containing the HTTP POST command and it has sequence number of 232129013

Q3:

4 0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=232129013
5 0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=232129578
6 0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?
7 0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232131038 Ack=?
8 0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232132498 Ack=?
9 0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?
10 0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232133958 Ack=?
11 0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=232135418 Ack=?
12 0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?
13 0.124185	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=232136878
14 0.169118	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?
15 0.217299	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?
16 0.267802	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=?

The first six segments are number 4,5,7,8,10,11 and they have sequence number 232129013, 232129578, 232131038, 232132498, 232133958, 232135418, respectively. And their ACK are packet number 6,9,12,14,15,16.
Packet 4 sent at 0.026477 seconds and it's ACK received at 0.053937 seconds. The RTT value is 0.02746 seconds. The EstimatedRTT value at this point is 0.02746 seconds.
Packet 5 sent at 0.041737 seconds and it's ACK received at 0.077294 seconds. The RTT value is 0.035557 seconds. The EstimatedRTT value at this point is 0.02847 seconds.

Packet 7 sent at 0.054026 seconds and it's ACK received at 0.124085 seconds. The RTT value is 0.070059 seconds. The EstimatedRTT value at this point is 0.03367 seconds.

Packet 8 sent at 0.054690 seconds and it's ACK received at 0.169118 seconds. The RTT value is 0.114428 seconds. The EstimatedRTT value at this point is 0.043765 seconds.

Packet 10 sent at 0.077405 seconds and it's ACK received at 0.217299 seconds. The RTT value is 0.139894 seconds. The EstimatedRTT value at this point is 0.05578 seconds.

Packet 11 sent at 0.078157 seconds and it's ACK received at 0.267802 seconds. The RTT value is 0.189645 seconds. The EstimatedRTT value at this point is 0.072514 seconds.

Q4:

```
 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 [
 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
 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
 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
 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
11 0.078157    192.168.1.102    128.119.245.12    TCP   1514 1161 → 80 [ACK] Seq=232135418 Ack=883061786 Win=17520 Len=1460 [TCP
```

The length of each of the first six TCP segments is 565,1460,1460,1460,1460 and 1460 bytes.

Q5:

```
ip.dst == 192.168.1.102

No.   Time   Source   Destination   Protocol Length Info
  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
  6 0.053937   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232129578 Win=6780 Len=0
  9 0.077294   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232131038 Win=8760 Len=0
 12 0.124085   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232132498 Win=11680 Len=0
 14 0.169118   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232133958 Win=14600 Len=0
 15 0.217299   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232135418 Win=17520 Len=0
 16 0.267802   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232136878 Win=20440 Len=0
 17 0.304807   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232138025 Win=23360 Len=0
 24 0.356437   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232139485 Win=26280 Len=0
 25 0.400164   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232140945 Win=29200 Len=0
 26 0.448613   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232142405 Win=32120 Len=0
 27 0.500029   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232143865 Win=35040 Len=0
 28 0.545052   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232145325 Win=37960 Len=0
 29 0.576417   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232146217 Win=37960 Len=0
 36 0.626496   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232147677 Win=40880 Len=0
 37 0.672796   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232149137 Win=43800 Len=0
 38 0.730684   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232150597 Win=46720 Len=0
 39 0.772990   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232152057 Win=49640 Len=0
 40 0.820622   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232153517 Win=52560 Len=0
 41 0.853186   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232154409 Win=52560 Len=0
 48 0.899423   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232155869 Win=55480 Len=0
 49 0.949545   128.119.245.12   192.168.1.102   TCP   60 80 → 1161 [ACK] Seq=883061786 Ack=232157329 Win=58400 Len=0
```

```
ip.dst == 192.168.1.102

No.   Time        Source            Destination       Protocol  Length  Info
 49 0.949545    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232157329 Win=58400 Len=0
 50 0.994715    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232158789 Win=61320 Len=0
 51 1.039820    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232160249 Win=62780 Len=0
 52 1.117097    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232162601 Win=62780 Len=0
 59 1.200421    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232164061 Win=62780 Len=0
 60 1.265026    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232166981 Win=62780 Len=0
 61 1.362074    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232169901 Win=62780 Len=0
 62 1.389886    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232170793 Win=62780 Len=0
 69 1.488313    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232173713 Win=62780 Len=0
 70 1.584980    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232176633 Win=62780 Len=0
 71 1.661513    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232178985 Win=62780 Len=0
 78 1.758227    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232181905 Win=62780 Len=0
 79 1.860063    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232184825 Win=62780 Len=0
 80 1.930880    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232187177 Win=62780 Len=0
 87 2.029069    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232190097 Win=62780 Len=0
 88 2.126682    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232193017 Win=62780 Len=0
 89 2.203195    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232195369 Win=62780 Len=0
 96 2.311413    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232198289 Win=62780 Len=0
 97 2.404228    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232201209 Win=62780 Len=0
 98 2.476576    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232203561 Win=62780 Len=0
105 2.576633    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232206481 Win=62780 Len=0
106 2.672045    128.119.245.12    192.168.1.102     TCP     60 80 → 1161 [ACK] Seq=883061786 Ack=232209401 Win=62780 Len=0
```

No.	Time	Source	Destination	Protocol	Length	Info
106	2.672045	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232209401 Win=62780 Len=0
107	2.747257	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232211753 Win=62780 Len=0
114	2.847009	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232214673 Win=62780 Len=0
115	2.944420	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232217593 Win=62780 Len=0
116	3.020822	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Steq=883061786 Ack=232219945 Win=62780 Len=0
123	3.117302	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232222865 Win=62780 Len=0
124	3.216127	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232225785 Win=62780 Len=0
125	3.291672	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232228137 Win=62780 Len=0
132	3.388926	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232231057 Win=62780 Len=0
133	3.485275	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232233977 Win=62780 Len=0
134	3.562531	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232236329 Win=62780 Len=0
141	3.660330	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232239249 Win=62780 Len=0
142	3.768417	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232242169 Win=62780 Len=0
143	3.840483	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232244521 Win=62780 Len=0
150	3.936967	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232247441 Win=62780 Len=0
151	4.031145	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232250361 Win=62780 Len=0
152	4.107455	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232252713 Win=62780 Len=0
159	4.205521	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232255633 Win=62780 Len=0
160	4.300300	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232258553 Win=62780 Len=0
161	4.379826	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232260905 Win=62780 Len=0
168	4.476833	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232263825 Win=62780 Len=0
169	4.575928	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232266745 Win=62780 Len=0
170	4.648167	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232269097 Win=62780 Len=0
177	4.747988	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232272017 Win=62780 Len=0
178	4.844598	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232274937 Win=62780 Len=0
179	4.920051	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232277289 Win=62780 Len=0
186	5.019189	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232280209 Win=62780 Len=0
190	5.125019	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232283129 Win=62780 Len=0
191	5.197286	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232285481 Win=62780 Len=0
198	5.297257	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232288401 Win=62780 Len=0
200	5.389471	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232291321 Win=62780 Len=0
201	5.447887	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232293053 Win=62780 Len=0
202	5.455830	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=883061786 Ack=232293103 Win=62780 Len=0

The minimum amount of available buffer space advertised at the receiver is 5840, by looking at packet number 2. And the sender doesn't throttle since the window size that receiver advertised for the entire trace is never decreased.

Q6:
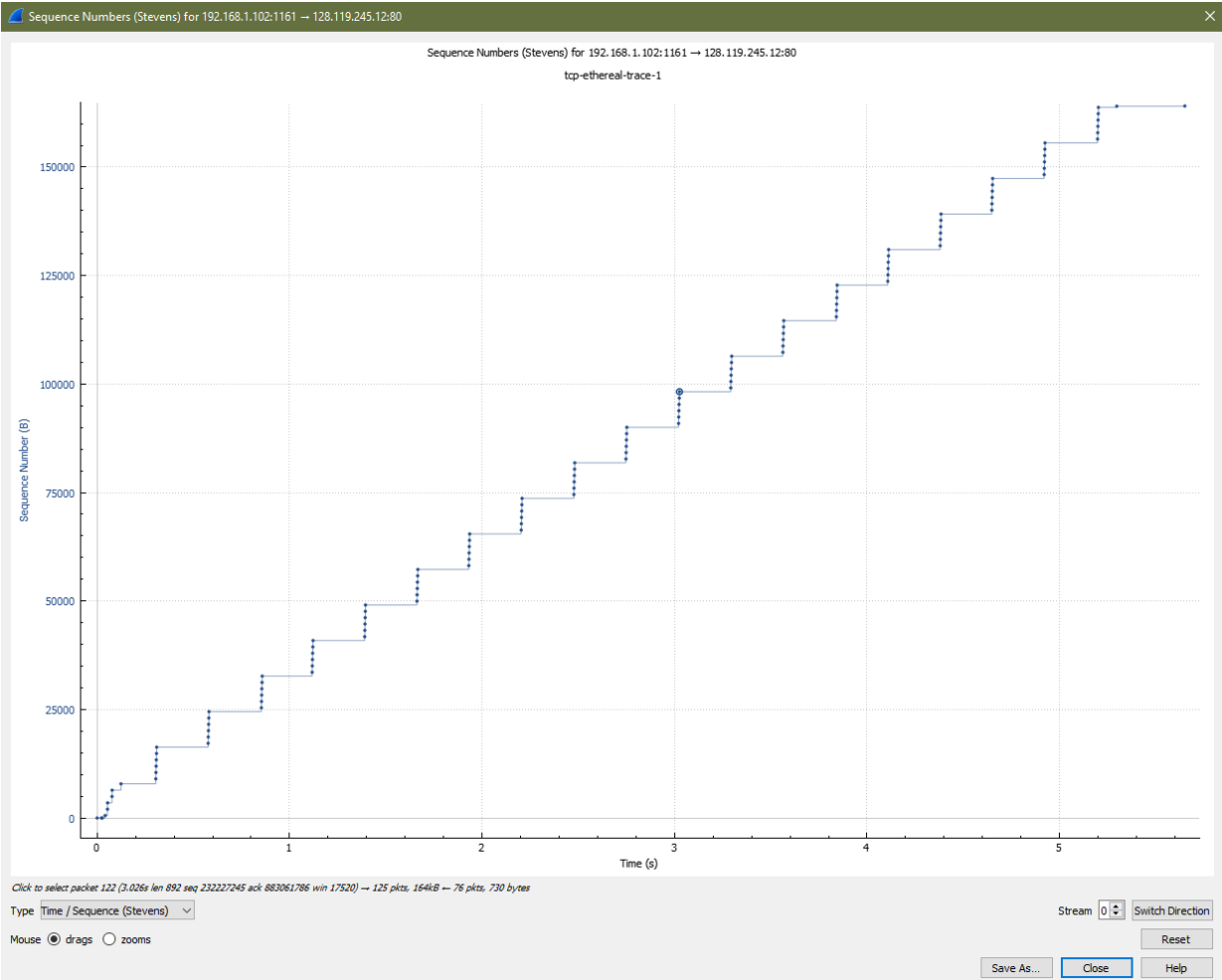
There are not any retransmitted segments in the trace file. Since in the sequence number diagram, there isn't any duplicated sequence number.

Q7:

```
52 1.117097   128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232182601 Win=62780 Len=0
53 1.117333   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232162601 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
54 1.118133   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232164061 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
55 1.119029   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232165521 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
56 1.119858   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232166981 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
57 1.120902   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232168441 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
58 1.121891   192.168.1.102    128.119.245.12   TCP    946 1161 → 80 [PSH, ACK] Seq=232169901 Ack=883061786 Win=17520 Len=892 [TCP segment of a reassembled PDU]
59 1.200421   128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232164061 Win=62780 Len=0
60 1.265026   128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232166981 Win=62780 Len=0
61 1.362074   128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232169901 Win=62780 Len=0
62 1.389886   128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232170793 Win=62780 Len=0
63 1.390110   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232170793 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
64 1.390824   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232172253 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
65 1.391683   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232173713 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
66 1.392594   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232175173 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
67 1.393390   192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232176633 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
68 1.394202   192.168.1.102    128.119.245.12   TCP    946 1161 → 80 [PSH, ACK] Seq=232178093 Ack=883061786 Win=17520 Len=892 [TCP segment of a reassembled PDU]

163 4.380741  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232262365 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
164 4.381618  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232263825 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
165 4.382478  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232265285 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
166 4.383659  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232266745 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
167 4.384548  192.168.1.102    128.119.245.12   TCP    946 1161 → 80 [PSH, ACK] Seq=232268205 Ack=883061786 Win=17520 Len=892 [TCP segment of a reassembled PDU]
168 4.476833  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232263825 Win=62780 Len=0
169 4.575928  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232266745 Win=62780 Len=0
170 4.648167  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232269097 Win=62780 Len=0
171 4.648386  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232269097 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
172 4.649100  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232270557 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
173 4.649993  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232272017 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
174 4.650926  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232273477 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
175 4.651858  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232274937 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
176 4.652735  192.168.1.102    128.119.245.12   TCP    946 1161 → 80 [PSH, ACK] Seq=232276397 Ack=883061786 Win=17520 Len=892 [TCP segment of a reassembled PDU]
177 4.747988  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232272017 Win=62780 Len=0
178 4.844598  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232274937 Win=62780 Len=0
179 4.920051  128.119.245.12   192.168.1.102    TCP    60 80 → 1161 [ACK] Seq=883061786 Ack=232277289 Win=62780 Len=0
180 4.920310  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232277289 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
181 4.921025  192.168.1.102    128.119.245.12   TCP    1514 1161 → 80 [ACK] Seq=232278749 Ack=883061786 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=232280209 Ack=883061786 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=232281669 Ack=883061786 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=232283129 Ack=883061786 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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Since the sender typically send 1460 bytes of data, the receiver typically acknowledges 1460 bytes of data in an ACK. Between packet number 59,60,61, the ACK number increase by 2920 each time which means packet 60 is ACKing 2 received segment of size 1460 bytes.

Q8:
The throughput for the TCP connection is equal to the total amount of data / the total time it used. 232293103-232129012-1 = 164090 bytes of data transferred, and 5.455830 seconds used. Therefore the throughput is 164090 / 5.455830 = 30076.0837489 bytes/seconds.

Exercise 2:

Q1:
The sequence number of the TCP SYN segment is 2818463618.

Q2:
The sequence number of the SYNACK segment is 1247095790. And the Acknowledgement field in the SYNACK segment has value of 2818463619 which is the sender's ISN +1. The server determine this value by adding the sequence number of the TCP SYN segment by one.

Q3:
The sequence number of the ACK segment sent by the client computer in response to the SYNACK is 2818463619. And the value of the Acknowledgment field in this ACK segment is 1247095791. This segment doesn't contain any data, it's part of the TCP three-way handshake.

Q4:
Client and server simultaneously done the active close. Since in the packet number 304, 305, the client and server simultaneously send FIN ACK message to each other.

Q5:

There has been 33 bytes of data transferred which is the final ACK received - the Initial Sequence Number - 2. The minus 2 is because the SYN and FIN message both add the sequence number by one.