Question 1 :

IP address: **192.168.1.102**

TCP port number: **1161**

No.	Time	Source	Destination
3	0.023265	192.168.1.102	128.119.245.12
4	0.026477	192.168.1.102	128.119.245.12

✓ Transmission Control Protocol, Src Port: 1161, Dst Port: 80,

Question 2:

IP address:**128.119.245.12**

TCP port number: **80**

6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK]

Question 3:

The sequence number of TCP SYN segment is **232129012.**

1 0.000000	192.168.1.102	128.119.245.12	TCP	62 1161 → 80 [SYN] Seq=232129012

Value 1 in SYN identifies the segment as a SYN segment. (flags show it is SYN)

```
✓ Flags: 0x002 (SYN)
    000. .... .... = Reserved: Not set
    ...0 .... .... = Nonce: Not set
    .... 0... .... = Congestion Window Reduced
    .... .0.. .... = ECN-Echo: Not set
    .... ..0. .... = Urgent: Not set
    .... ...0 .... = Acknowledgment: Not set
    .... .... 0... = Push: Not set
    .... .... .0.. = Reset: Not set
  > .... .... ..1. = Syn: Set
    .... .... ...0 = Fin: Not set
```

Question 4:

The sequence number of the SYNACK segment is **883061785.** The value of the acknowledgement filed in this ACK segment is **232129013.**

[SYN, ACK] Seq=883061785 Ack=232129013

This value is determined by the value of sequence number which is received from the client computer. **This value = 1+ the value of client computer sequence number.**

The value of 1 in both SYN and Acknowledgment identifies this segment as a SYNACK segment (flags show it is SYN, ACK)

```
.... ...1 .... = Acknowledgment: Set
.... .... 0... = Push: Not set
.... .... .0.. = Reset: Not set
.... .... ..1. = Syn: Set
```

Question 5:

The sequence number of the ACK segment sent by client computer in response to the SYNACK is **232129013.** This segment **does not contain any data.**

```
[ACK] Seq=232129013 Ack=883061786 Win=17520 Len=0
```

The value of Ack is 1 identifies this segment as a ACK segment. (Flags show it is ACK)

```
Flags: 0x010 (ACK)
   000. .... .... = Reserved: Not set
   ...0 .... .... = Nonce: Not set
   .... 0... .... = Congestion Window Redu
   .... .0.. .... = ECN-Echo: Not set
   .... ..0. .... = Urgent: Not set
   .... ...1 .... = Acknowledgment: Set
```

Question 6:

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

```
) [PSH, ACK] Seq=232129013 .

Dp....PO ST /ethe
real-lab s/lab3-1
-reply.h tm HTTP/
1.1..Hos t: gaia.
```

Question 7:

Sender & Receiver: No.4->No.6(①),　No.5->No.9（②）,　No.7->No.12（③）,
No.8->No.14（④）,　No.10->No.15（⑤）,　No.11->No.16（⑥）

	Sent time	ACK receive time	RTT
①	0.026477	0.053937	0.02746
②	0.041737	0.077294	0.035557
③	0.054026	0.124085	0.070059
④	0.054690	0.169118	0.114428
⑤	0.077405	0.217299	0.139894
⑥	0.078157	0.267802	0.189645

alpha = 0.125

① EstimatedRTT = measured RTT =0.02746

② EstimatedRTT = 0.875 * 0.02746 + 0.125 * 0.03557= 0.02847375
③ EstimatedRTT = 0.875 * 0.02847375 + 0.125 * 0.070059= 0.0336719063≈0.03367191
④ EstimatedRTT = 0.875 * 0.0336719063 + 0.125 * 0.114428 =0.0437664180125
⑤ EstimatedRTT = 0.875 * 0.0437664180125 + 0.125 * 0.139894 = 0.0557823657609
⑥ EstimatedRTT = 0.875 * 0.0557823657609 + 0.125 * 0.189645 = 0.0725151950408

Question 8:

The length of **No.4**(the first one in first six TCP segments) is **565bytes**. Other five TCP segments are all 1460 bytes.

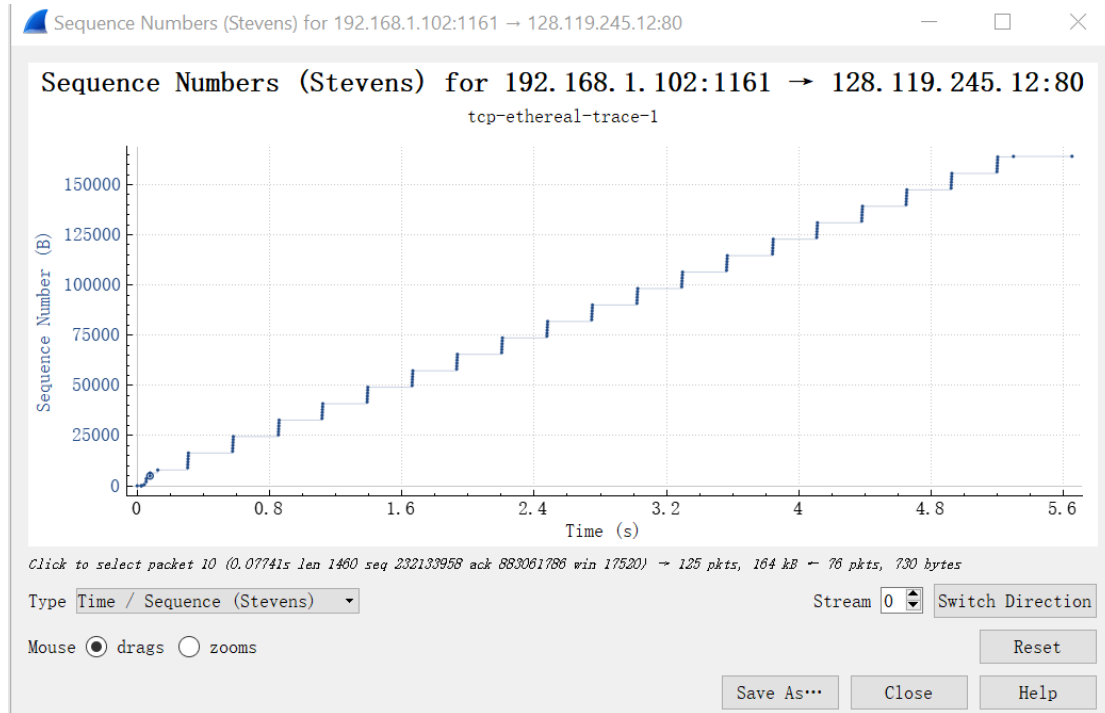| 4 0.026477 | 192.168.1.102 | 128.119.245.12 | TCP | 619 1161 → 80 [PSH, ACK] Seq=232129013 Ack=883061786 Win=17520 Len=565 [|
| 5 0.041737 | 192.168.1.102 | 128.119.245.12 | TCP | 1514 1161 → 80 [PSH, ACK] Seq=232129578 Ack=883061786 Win=17520 Len=1460 |

Question 9:

The minimum amount of available buffer space advertised at the receiver for the entire trace is 5840 bytes. (it is equal to window size value in No.2) The maximum of buffer space advertised at the receiver is 62780 bytes and always larger than sender size. So it will not cause the throttle of the sender.

2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80 → 1161 [SYN, ACK] Seq=883061785 Ack=232129013 Win=5840
50 0.994715	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232158789 Win=61320
51 1.039820	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=883061786 Ack=232160249 Win=62780

Question 10:

As the graph shows, **there is no retransmitted segments in the trace file.** Because if there are any retransmitted segments, sequence number in sometime will smaller than the next time.

Sequence Numbers (Stevens) for 192.168.1.102:1161 → 128.119.245.12:80

Sequence Numbers (Stevens) for 192.168.1.102:1161 → 128.119.245.12:80
tcp-ethereal-trace-1

Click to select packet 10 (0.07741s len 1460 seq 232133958 ack 883061786 win 17520) → 125 pkts, 164 kB ← 76 pkts, 730 bytes

Question 11:

The data of receiver typically acknowledge in an ACK are **565 bytes(No.4), 1460 bytes, 1147 bytes(No.13), 892 bytes.**

	sequence number	data	description
No.4	232129013	566	23219578-566=23219013
No.5	232129578	1460	232131038-1460=232129578
No.7	232131038	1460	232132498-1460=232131038
No.8	232132498	1460	232133958-1460=232132498
No.10	232133958	1460	
...	...	...	

It shows the data is between these two ACKs.

Question 12:

This transmission is from No.4 to No.202. (No.203 shows OK)

The total amount data is between the difference from acknowledged sequence number in No.202 and sequence number in No.4 (First TCP segment). It is equal to **232293103-232129013 =164090 bytes.**

The total time is 5.455830(No.202 time)-0.026477(No.4 time) =5.429353 seconds.

Hence, **the throughput for the TCP connection is computed as 164090/5.429353= 30222.753982 Byte/sec**