

Assignment 2

Part 1

No.	Time	192.168.0.16	185.164.136.79	
1	0.000000	SYN (61450)	-----> (4001)	Seq = 0
2	0.037141	SYN, ACK (61450)	<----- (4001)	Seq = 0 Ack = 1
3	0.037206	ACK (61450)	-----> (4001)	Seq = 1 Ack = 1
4	0.066290	ACK - Len: 1448 (61450)	<----- (4001)	Seq = 1 Ack = 1
5	0.068121	ACK - Len: 1448 (61450)	<----- (4001)	Seq = 1449 Ack = 1
6	0.068125	PSH, ACK - Len: 1200 (61450)	<----- (4001)	Seq = 2897 Ack = 1
7	0.068189	ACK (61450)	-----> (4001)	Seq = 1 Ack = 2897
8	0.068190	ACK (61450)	-----> (4001)	Seq = 1 Ack = 4097
9	0.068291	FIN, ACK (61450)	<----- (4001)	Seq = 4097 Ack = 1
10	0.068328	ACK (61450)	-----> (4001)	Seq = 1 Ack = 4098
11	0.068338	FIN, ACK (61450)	-----> (4001)	Seq = 1 Ack = 4098
12	0.096127	ACK (61450)	<----- (4001)	Seq = 4098 Ack = 2

1. SYN sent by client to server to initiate TCP connection. Client SEQ number is initialised at 0.
2. Server ACKs client's SYN to begin TCP connection. SYN sent by server to client to initiate TCP connection in the opposite direction. Server SEQ number is 0, server ACK number is 1 since it has received 1 byte of data – the SYN from the client.
3. ACK sent by client to server to ACK TCP connection. Client SEQ number is increased to 1 for previous SYN sent. Client ACK number also increments to 1.
4. First part of message sent from the server to the client. Server SEQ number is still 1.
5. Second part sent to the client. Server SEQ number increased to 1449 since 1448 bytes have already been sent.
6. Sending final 1200 bytes, server SEQ incremented to 2897 (1449+1448)
7. Client ACKs first two messages; client ACK number increases to 2897 (1+1448+1448).
8. Client ACKs final message; client ACK number increases to 4097.
9. Server sends FIN to indicate it has completed sending messages.
10. Client ACKs the FIN; client ACK number increases to 4098.
11. Client sends FIN to indicate it has completed sending messages.
12. Server ACKs the FIN; server ACK number increases to 2. This completes the transmission.

Part 2

No.	Time	192.168.0.16	185.164.136.79
1	0.845038	SYN	Seq = 0
2	0.876866	(61453) -----> (4002)	Seq = 0 Ack = 1
3	0.876940	(61453) SYN, ACK <----- (4002)	Seq = 1 Ack = 1
4	0.908654	(61453) ACK	Seq = 1 Ack = 1
5	0.912004	(61453) ACK - Len: 1448 -----> (4002)	Seq = 1449 Ack = 1
6	0.912008	(61453) ACK - Len: 1448 <----- (4002)	Seq = 2897 Ack = 1
7	0.912076	(61453) ACK	Seq = 1 Ack = 2897
8	0.912231	(61453) ACK -----> (4002)	Seq = 1 Ack = 4345
9	0.912578	(61453) ACK - Len: 1448 -----> (4002)	Seq = 4345 Ack = 1
10	0.913778	(61453) ACK - Len: 1448 <----- (4002)	Seq = 5793 Ack = 1
11	0.913781	(61453) ACK - Len: 1448 <----- (4002)	Seq = 7241 Ack = 1
12	0.913828	(61453) ACK -----> (4002)	Seq = 1 Ack = 7241
13	0.913900	(61453) ACK -----> (4002)	Seq = 1 Ack = 8689
14	0.913971	(61453) ACK - Len: 1448 <----- (4002)	Seq = 8689 Ack = 1
15	0.913973	(61453) ACK - Len: 1448 <----- (4002)	Seq = 10137 Ack = 1
16	0.914013	(61453) ACK -----> (4002)	Seq = 1 Ack = 11585
17	0.914226	(61453) ACK -----> (4002)	Seq = 1 Ack = 11585
18	0.914888	(61453) ACK - Len: 1448 <----- (4002)	Seq = 11585 Ack = 1
19	0.914890	(61453) ACK - Len: 1448 <----- (4002)	Seq = 13033 Ack = 1
20	0.914931	(61453) ACK -----> (4002)	Seq = 1 Ack = 14481
21	0.914988	(61453) ACK -----> (4002)	Seq = 1 Ack = 14481
22	0.937854	(61453) ACK - Len: 1448 <----- (4002)	Seq = 14481 Ack = 1
23	0.937858	(61453) ACK - Len: 1448 <----- (4002)	Seq = 15929 Ack = 1
24	0.937859	(61453) ACK - Len: 1448 <----- (4002)	Seq = 17377 Ack = 1
25	0.937860	(61453) ACK - Len: 1448 <----- (4002)	Seq = 18825 Ack = 1
26	0.937861	(61453) ACK - Len: 1448 <----- (4002)	Seq = 20273 Ack = 1
27	0.937864	(61453) ACK - Len: 1448 <----- (4002)	Seq = 21721 Ack = 1
28	0.937865	(61453) ACK - Len: 1448 <----- (4002)	Seq = 23169 Ack = 1
29	0.937866	(61453) ACK - Len: 1448 <----- (4002)	Seq = 24617 Ack = 1
30	0.937867	(61453) ACK - Len: 1448 <----- (4002)	Seq = 26065 Ack = 1
31	0.937868	(61453) ACK - Len: 1448 <----- (4002)	Seq = 27513 Ack = 1

32	0.937869		ACK - Len: 1448		Seq = 28961 Ack = 1
		(61453)	<-----	(4002)	
33	0.937870		ACK - Len: 1448		Seq = 30409 Ack = 1
		(61453)	<-----	(4002)	
34	0.937870		ACK - Len: 1448		Seq = 31857 Ack = 1
		(61453)	<-----	(4002)	
35	0.937937		ACK		Seq = 1 Ack = 17377
		(61453)	----->	(4002)	
36	0.937937		ACK		Seq = 1 Ack = 20273
		(61453)	----->	(4002)	
37	0.937937		ACK		Seq = 1 Ack = 23169
		(61453)	----->	(4002)	
38	0.937937		ACK		Seq = 1 Ack = 26065
		(61453)	----->	(4002)	
39	0.937991		ACK		Seq = 1 Ack = 28961
		(61453)	----->	(4002)	
40	0.937991		ACK		Seq = 1 Ack = 31857
		(61453)	----->	(4002)	
41	0.938111		ACK		Seq = 1 Ack = 33305
		(61453)	----->	(4002)	
42	0.938608		ACK		Seq = 1 Ack = 33305
		(61453)	----->	(4002)	
43	0.938959		ACK		Seq = 1 Ack = 33305
		(61453)	----->	(4002)	
44	0.939157		ACK		Seq = 1 Ack = 33305
		(61453)	----->	(4002)	
45	0.939333		ACK		Seq = 1 Ack = 33305
		(61453)	----->	(4002)	
46	0.966054		ACK - Len: 1448		Seq = 33305 Ack = 1
		(61453)	<-----	(4002)	
47	0.966067		ACK - Len: 1448		Seq = 34753 Ack = 1
		(61453)	<-----	(4002)	
48	0.966217		ACK - Len: 1448		Seq = 36201 Ack = 1
		(61453)	<-----	(4002)	
49	0.966222		ACK - Len: 1448		Seq = 37649 Ack = 1
		(61453)	<-----	(4002)	
50	0.966226		ACK - Len: 1448		Seq = 39097 Ack = 1
		(61453)	<-----	(4002)	
51	0.966229		ACK - Len: 1448		Seq = 40545 Ack = 1
		(61453)	<-----	(4002)	
52	0.966347		ACK - Len: 1448		Seq = 41993 Ack = 1
		(61453)	<-----	(4002)	
53	0.966357		ACK - Len: 1448		Seq = 43441 Ack = 1
		(61453)	<-----	(4002)	
54	0.966362		ACK - Len: 1448		Seq = 44889 Ack = 1
		(61453)	<-----	(4002)	
55	0.966365		ACK - Len: 1448		Seq = 46337 Ack = 1
		(61453)	<-----	(4002)	
56	0.966368		ACK - Len: 1448		Seq = 47785 Ack = 1
		(61453)	<-----	(4002)	
57	0.966380		ACK - Len: 1448		Seq = 49233 Ack = 1
		(61453)	<-----	(4002)	
58	0.966515		ACK - Len: 1448		Seq = 50681 Ack = 1
		(61453)	<-----	(4002)	
59	0.966521		ACK - Len: 1448		Seq = 52129 Ack = 1
		(61453)	<-----	(4002)	
60	0.966597		ACK		Seq = 1 Ack = 36201
		(61453)	----->	(4002)	
61	0.966599		ACK		Seq = 1 Ack = 39097
		(61453)	----->	(4002)	
62	0.966599		ACK		Seq = 1 Ack = 41993
		(61453)	----->	(4002)	
63	0.966600		ACK		Seq = 1 Ack = 44889
		(61453)	----->	(4002)	
64	0.966600		ACK		Seq = 1 Ack = 47785
		(61453)	----->	(4002)	
65	0.966601		ACK		Seq = 1 Ack = 50681
		(61453)	----->	(4002)	

66	0.966763		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
67	0.967634		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
68	0.967858		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
69	0.968079		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
70	0.968308		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
71	0.968661		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
72	0.968756		ACK		Seq = 1 Ack = 53577
		(61453)	----->	(4002)	
73	0.983192		ACK - Len: 1448		Seq = 53577 Ack = 1
		(61453)	<-----	(4002)	
74	0.983205		ACK - Len: 1448		Seq = 55025 Ack = 1
		(61453)	<-----	(4002)	
75	0.983524		ACK - Len: 1448		Seq = 56473 Ack = 1
		(61453)	<-----	(4002)	
76	0.983533		ACK - Len: 1448		Seq = 57921 Ack = 1
		(61453)	<-----	(4002)	
77	0.983537		ACK - Len: 1448		Seq = 59369 Ack = 1
		(61453)	<-----	(4002)	
78	0.983540		ACK - Len: 1448		Seq = 60817 Ack = 1
		(61453)	<-----	(4002)	
79	0.983543		ACK - Len: 1448		Seq = 62265 Ack = 1
		(61453)	<-----	(4002)	
80	0.983547		ACK - Len: 1448		Seq = 63713 Ack = 1
		(61453)	<-----	(4002)	
81	0.983628		ACK		Seq = 1 Ack = 56473
		(61453)	----->	(4002)	
82	0.983629		ACK		Seq = 1 Ack = 59369
		(61453)	----->	(4002)	
83	0.983744		ACK		Seq = 1 Ack = 62265
		(61453)	----->	(4002)	
84	0.983744		ACK		Seq = 1 Ack = 65161
		(61453)	----->	(4002)	
85	0.984876		ACK		Seq = 1 Ack = 65161
		(61453)	----->	(4002)	
86	0.985642		ACK		Seq = 1 Ack = 65161
		(61453)	----->	(4002)	
87	0.985892		ACK		Seq = 1 Ack = 65161
		(61453)	----->	(4002)	
88	0.986095		FIN, PSH, ACK - Len:		Seq = 65161 Ack = 1
		(61453)	<-----	(4002)	
89	0.986137		ACK		Seq = 1 Ack = 65538
		(61453)	----->	(4002)	
90	0.986193		FIN, ACK		Seq = 1 Ack = 65538
		(61453)	----->	(4002)	
91	1.006935		ACK		Seq = 65538 Ack = 2
		(61453)	<-----	(4002)	

1. SYN sent by client to server to initiate TCP connection. Client SEQ number is initialised at 0.
2. Server ACKs client's SYN to begin TCP connection. SYN sent by server to client to initiate TCP connection in the opposite direction. Server SEQ number is 0, server ACK number is 1 since it has received 1 byte of data – the SYN from the client.
3. ACK sent by client to server to ACK TCP connection. Client SEQ number is increased to 1 for previous SYN sent. Client ACK number also increments to 1.
4. From this packet until packet 87, the server sends data, each time incrementing its SEQ and the client responding, each time incrementing its ACK. Server ACK and client SEQ remain at 1 throughout this section.
- ...
88. Server sends final packet with FIN flag to indicate it has completed sending data.
89. Client ACKs final packet, incrementing client ACK to 65538.
90. Client sends packet with FIN flag to indicate it has completed sending data.
91. Server ACKs the client FIN packet, incrementing server ACK to 2, with server SEQ reaching 65538; this completes the transmission.