Exercise 1

Question 1

Server (gaia.cs.umass.edu): 128.119.245.12, port 1161 Client: 192.18.1.102, port 80

Question 2

Sequence number of TCP segment containing HTTP POST command: 232129013

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..%..s. ..p...E. 0010 02 5d 1e 21 40 00 80 06 a2 e7 c0 a8 01 66 80 77 .].!@........f.w 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....POST /ethe 0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-labs/lab3-1 0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f -reply.htm HTTP/ 0060 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 1.1..Host: 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 0090 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 a/5.0 (Windows; 00a0 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e U; Windows NT 5. 00b0 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 1; en-US; rv:1.0 00c0 2e 32 29 20 47 65 63 6b 6f 2f 32 30 30 33 30 32 .2) Gecko/200302 00d0 30 38 20 4e 65 74 73 63 61 70 65 2f 37 2e 30 32 08 Netscape/7.02 00e0 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 78 ..Accept: text/x 00f0 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 ml,application/x 0100 6d 6c 2c 61 70 70 6c 69 63 61 74 69 6f 6e 2f 78 ml,application/x 0110 68 74 6d 6c 2b 78 6d 6c 2c 74 65 78 74 2f 68 74 html+xml,text/ht 0120 6d 6c 3b 71 3d 30 2e 39 2c 74 65 78 74 2f 70 6c ml;q=0.9,text/pl 0130 61 69 6e 3b 71 3d 30 2e 38 2c 76 69 64 65 6f 2f ain;q=0.8,video/ 0140 78 2d 6d 6e 67 2c 69 6d 61 67 65 2f 70 6e 67 2c x-mng,image/png, 0150 69 6d 61 67 65 2f 6a 70 65 67 2c 69 6d 61 67 65 image/jpeg,image 0160 2f 67 69 66 3b 71 3d 30 2e 32 2c 74 65 78 74 2f /gif;q=0.2,text/ 0170 63 73 73 2c 2a 2f 2a 3b 71 3d 30 2e 31 0d 0a 41 css,*/*;q=0.1..A 0180 63 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a 20 ccept-Language: 0190 65 6e 2d 75 73 2c 20 65 6e 3b 71 3d 30 2e 35 30 en-us, en;q=0.50 01a0 0d 0a 41 63 63 65 70 74 2d 45 6e 63 6f 64 69 6e ..Accept-Encodin 01b0 67 3a 20 67 7a 69 70 2c 20 64 65 66 6c 61 74 65 g: gzip, deflate 01c0 2c 20 63 6f 6d 70 72 65 73 73 3b 71 3d 30 2e 39 , compress;q=0.9 01d0 0d 0a 41 63 63 65 70 74 2d 43 68 61 72 73 65 74 ..Accept-Charset 01e0 3a 20 49 53 4f 2d 38 38 35 39 2d 31 2c 20 75 74 : ISO-8859-1, ut 01f0 66 2d 38 3b 71 3d 30 2e 36 36 2c 20 2a 3b 71 3d f-8;q=0.66, *;q= 0200 30 2e 36 36 0d 0a 4b 65 65 70 2d 41 6c 69 76 65 0.66..Keep-Alive 0210 3a 20 33 30 30 0d 0a 43 6f 6e 6e 65 63 74 69 6f : 300..Connectio 0220 6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0a 52 n: keep-alive..R 0230 65 66 65 72 65 72 3a 20 68 74 74 70 3a 2f 2f 67 eferer: http://g 0240 61 69 61 2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 aia.cs.umass.edu 0250 2f 65 74 68 65 72 65 61 6c 2d 6c 61 62 73 2f 6c /ethereal-labs/l 0260 61 62 33 2d 31 2e 68 74 6d 0d 0a ab3-1.htm..

Question 3

First 6 segments in TCP connnection (POST command as the first)

Segment number	Sequence numbers	Time (sec)	ACK receieved (sec)	RTT (sec)	Estimated RTT
1	232129013	0.026477	0.026477	0.02746	0.02746
2	232129578	0.041737	0.041737	0.035557	0.02847
3	232131038	0.054026	0.054026	0.070059	0.03367
4	232132498	0.054690	0.054690	0.114428	0.04376
5	232133958	0.077405	0.077405	0.139894	0.05578
6	232135418	0.078157	0.078157	0.189645	0.07251

Estimated RTT formula: (1-0.125) * RTT + 0.125 * RTT where alpha is 0.125

Question 4

Segment number	Segment length
1	565
2	1460
3	1460
4	1460
5	1460
6	1460

Question 5

The minimum amount of available buffer for the entire trace is 5840 bytes based off the win parameter in the first ACK from the server. The lack of receiver buffer space never throttles the sender.

Question 6

There are no retransmitteed segments in the trace file. To find this, one can search tcp.analysis.retransmission or by sorting the source in ascending order and checking the sequence number.

Question 7

1460 bytes are typically acknowledged by the receiver in an ACK. No.

Question 8

Throughput = Total amount of data / Total transmission time

Total amount of data = Sequence number of last ACK - sequence number of first segment. 232293103 - 232129013 = 164090 bytes

Total transmission time = Time of last ACK - Time of first segment 5.455830 - 0.026477 = 5.429353 seconds

Thus, throughput = 164090 / 5.429353 = 30222.7539819 bytes/sec.

Exercise 2

Question 1

Sequence number of TCP SYN segment used to initiate TCP connection: 2818463618

Question 2

SYNACK segment sent by server to reply to SYN: seq=1247095790, ack=2818463619 where ack = seq num + data. In this case, there is no data and only the SYNACK so it is seq num + 1.

Question 3

ACK segment sent by client in response to SYNACK: seq=2818463519, ack=1247095791. The segment does not contain data because the ack number increased by 1 which is the size of the ACK.

Question 4

The active close was done by both client and server since they sent the FINACK almost simulatneously. Thus, a simultaneous close has been performed.

Question 5

Client to server: 2818463653 - 2818463618 - 2(SYN + FIN) = 33 bytes Server to client: 1247095832 - 1247095790 - 2(SYN + FIN) = 40 bytes

The number of bytes sent between a client and server/server and client is the difference between the Initial Sequence Number and the final ACK sent from the other side.