

# COMP3331 Lab 4

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## Exercise 1

1. IP address of gaia.cs.umass.edu is 128.119.245.12. It is sending and receiving TCP segments on port 80. The IP address of the client computer is 192.168.1.102 and it uses port 1161.
2. The sequence number of the TCP segment containing the HTTP POST command is 232129013
3. The sequence numbers of the first six segments in the TCP connection are 232129013, 232129578, 232131038, 232132498, 232133958 and 232135418.

	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
Sequence number	232129013	232129578	232131038	232132498	232133958	232135418
Time sent (s)	0.026477	0.041737	0.054026	0.054690	0.077405	0.078157
Time when ACK received (s)	0.053937	0.077294	0.124085	0.169118	0.217299	0.267802
RTT (ACK received – time sent)	0.02746	0.035557	0.070059	0.11443	0.13989	0.18964
EstimatedRTT	0.02746	0.028472	0.033695	0.04379	0.05580	0.07253

$$\text{EstimatedRTT} = (1-0.125)*\text{EstimatedRTT} + 0.125*\text{SampleRTT}$$

4.

	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
Length (bytes)	565	1460	1460	1460	1460	1460

5. The minimum amount of buffer space advertised is 5840 bytes. The lack of receiver buffer space does not ever throttle the sender; the buffer space is dynamically allocated and is constantly increasing in the trace file.
6. There are no retransmitted segments in the trace file. I checked the sequence numbers of all the TCP segments and found that there were no duplicate sequence numbers.
7. The receiver typically acknowledges 1460 bytes in an ACK, with the exception of the first ACK which acknowledges 565 bytes. There is a special case where the receiver sometimes ACKs two packets instead of just one.
8. Throughput = total data length/total time

$$\text{Total data length} = \text{ACK no. of last segment} - \text{seq. no. of first segment}$$

$$= 232,292,103 - 232,129,012 \text{ bytes}$$

$$= 164,091 \text{ bytes}$$

Total time =  $5.455830 - 0.026477 = 5.42494$  s

Throughput =  $164,091 \text{ bytes} / 5.42494 \text{ s}$

= 30223 bps

## Exercise 2

1. The sequence number of the TCP SYN segment that is used to initiate the TCP connection is 2818463618
2. The sequence number of the SYNACK segment sent by the server to the client computer in reply to the SYN is 1247095790. The value of the Acknowledgement field in the SYNACK segment is 2818463619. The server determined that value by adding the size of the data to the sequence number of the SYN segment. In this case, the size of the data would be  $2818463619 - 2818463618 = 1$  byte.
3. The sequence number of the ACK segment sent by the client computer in response to the SYNACK is 2818463619. The value of the Acknowledgment field in this ACK segment is 1247095791. This segment doesn't contain any data.
4. Both the client and the server have simultaneously done the active close since they have sent FIN packets at the same time. A simultaneous close has been performed.
5. The number of data bytes transferred during the connection is equals to the final ACK number – the initial sequence number.  $2818463653 - 2818463618 = 35$  bytes.