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CMSC 481 - Networking
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Lab 4

TCP Problems

1. The IP address and TCP port number of the source are 192.168.1.102 and 1161, respectively.

```
1    0.000000   192.168.1.102    128.119.245.12 TCP   62
1161→80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
```

2. The IP address of gaia.cs.umass.edu is 128.119.245.12. The port that it is sending and receiving TCP segments from is port 80.

```
1    0.000000   192.168.1.102    128.119.245.12 TCP   62
1161→80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
```

3. No trace available.
4. The sequence number is 0.

```
1    0.000000   192.168.1.102    128.119.245.12 TCP   62
1161→80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
```

The SYN flag is set to 1.

```
000. .... .... = Reserved: Not set
...0 .... .... = Nonce: Not set
.... 0... .... = Congestion Window Reduced (CWR): Not set
.... .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
```

5. The sequence number of the SYNACK packet is 0. The acknowledgement field is 1. This value is determined because it is acknowledging this sequenced packet (packet 0). Both the SYN and ACK flags are set to 1.

```
2 0.023172    128.119.245.12        192.168.1.102         TCP
62     80→1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460
```

```
SACK_PERM=1

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

6. The sequence number is 1.
7.

Segment	Sequence Number	Time Sent	ACK Time Received	RTT	Estimated RTT
1	1	0.026477	0.026477	0	0
2	566	0.041737	0.053937	0.012200	0.001525
3	2026	0.054026	0.077294	0.023068	0.004218
4	3486	0.054690	0.124085	0.069395	0.012365
5	4946	0.077405	0.169118	0.091713	0.022284
6	6406	0.078157	0.217299	0.139142	0.036891

Estimated RTT = (1 - α) * EstimatedRTT + α * SampleRTT where α = 0.125.

8. Length of segments: 1 - 619, 2 - 1514, 3 - 1514, 4 - 1514, 5 - 1514, 6 - 1514
9. 6780 bytes. Found by looking at the window size of segments and finding the minimum. This never throttles the sender, as the segment data sizes are always much smaller.
10. There are no retransmitted segments. None of the sequence numbers (besides 1) repeat or have duplicate ACKs.
11. On average, about 60 bytes, which is roughly the amount of space needed for the header and other components. The receiver seems to be ACKing all segments.
12. The throughput is about 3500 bytes per second. Finding a frame about a minute from the first, we can see the amount of bytes that have been acknowledged.
13. We can see the slow start of TCP at the very beginning of the graph. Segments aren't in the same quick succession we see throughout most of the graph. This appears to

differ from the idealized behavior as there are noticeable time gaps between packets being sent. We would expect TCP to always be transmitting.

14. Did not do a trace.

UDP Problems

1. There are 4 fields in UDP segments: source port, destination port, length, checksum.
2. Each field is 2 bytes.
3. Length of the payload of the packet, which is data and headers total.
4. 2^{16} -1 bytes - 8 bytes = 65527 bytes.
5. Largest possible source port is 65535.
6. The protocol number of UDP is 17.
7. The source and destination ports are flipped in the response, relative to the request.