Assignment 3: Transport Protocols

1. (1 point) A process in Host C has a UDP socket with port number 5000. Host A and B each send a UDP segment to Host C with destination port number 5000. Will both of these segments be directed to the same socket at Host C? How will the process at Host C know that these two segments originated from two different hosts?

2. (2 points) True or false?

   a. Host A is sending Host B a large file over a TCP connection. Assume Host B has no data to send to Host A. Host B will not send acknowledgements to Host A because Host B cannot piggyback the acknowledgements on data.

   b. Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receive buffer.

   c. Suppose Host A is sending a large file to Host B over a TCP connection. If the sequence number for a segment of this connection is *m*, then the sequence number of the subsequent segment will necessarily be *m*+1.

   d. Suppose that Host A sends one segment with sequence number 38 and 4 bytes of data over a TCP connection to Host B. In this same segment the acknowledgement number is necessarily 42.

3. (3 points)

   a. Suppose you have the following 2 bytes: 11000011 and 10101010. What is the one's complement of the one's complement sum of these 2 bytes?

   b. Suppose you have the following 2 bytes: 10010001 and 01000101. What is the one's complement of the one's complement sum of these 2 bytes?

   c. Suppose you have the following 3 bytes: 11010010, 00110111, and 10100010. What is the one's complement of the one's complement sum of these 3 bytes?

   (Note that although UDP and TCP use 16-bit words in computing the checksum, for this question you are being asked to consider 8-bit sums for simplicity).

4. (1 point) Consider a cross-country example where a host in East Coast is connected with another host in West Coast by a channel with a transmission rate of 1 Gbps. The round-trip propagation delay between these two end systems is approximately 90 ms. How big would the window size have to be for the utilization over this channel to be greater than 95%? Suppose that the size of a packet is 2 KB, including both header fields and data.

5. (3 points) Host A and B are communicating over a TCP connection, and host B has already received from A all bytes up through byte #126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgement whenever it receives a segment from Host A.

   a. In the second segment sent from A to B, what are the sequence number, the source port number, and the destination port number?

   b. If the first segment arrives before the second segment, in the acknowledgement of the first arriving segment, what are the acknowledgement number, the source port number, and the destination port number?

   c. If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, what is the acknowledgement number?

   d. Suppose the two segments sent by A arrive in order at B. The 1st acknowledgement is lost and the 2nd acknowledgement arrives after the 1st timeout interval. Draw a timing diagram showing these segments and all other segments and acknowledgements sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgement that you add, provide the acknowledgement number.

      For example: