1. Consider the GBN protocol with a sender window size of 8. Suppose that the sender has sent packets pkt0, pkt1, …, pkt7 in the pipeline, and pkt6 is lost during transmission (i.e., pkt6 fails to arrive at the receiver). Assume that the medium does not reorder messages.

   a) Please list all the ACKs that the sender will receive for the pipelined 8 packets from the receiver.

   A) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK5
   B) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK5, ACK5
   C) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK7
   D) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK7, ACK 7

   b) If the SR protocol is running, what will be your answer again?

   A) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK5
   B) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK5, ACK5
   C) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK7
   D) ACK0, ACK1, ACK2, ACK3, ACK4, ACK5, ACK7, ACK 7

2. Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Next, Host A 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 Host A to B, what are the sequence number, source port number, and the destination port number?

   A) 206, 80, 302
   B) 206, 302, 80
   C) 207, 80, 302
   D) 207, 302, 80

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

A) 206, 80, 302
B) 206, 302, 80
C) 207, 80, 302
D) 207, 302, 80

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

A) 127
B) 207
C) 246
D) 247

d. Suppose the two segments sent by A arrive in order at B. The first acknowledgement is lost and the second acknowledgement arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgement 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.

3. Given values of EstimatedRTT and DevRTT, what value should be used for TCP's timeout interval value?

4. Suppose that the three measured SampleRTT values are 106ms, 120 ms, 140 ms. Compute the Estimated RTT after each of these SampleRTT values is obtained, using a value of alpha = 0.125 and assuming that the value of EstimatedRTT was 100 ms just before the first of these three samples were obtained. Compute also the DevRTT after each sample is obtained, assuming a value of beta = 0.25 and assuming the value of DevRTT was 5 ms just before the first of these three samples was obtained. Last, compute the TCP TimeoutInterval after each of these samples is obtained.

What is the value of TimeoutInterval after the three measured SampleRTT?

A) 135 ms
B) 147 ms
C) 150 ms
D) 164 ms