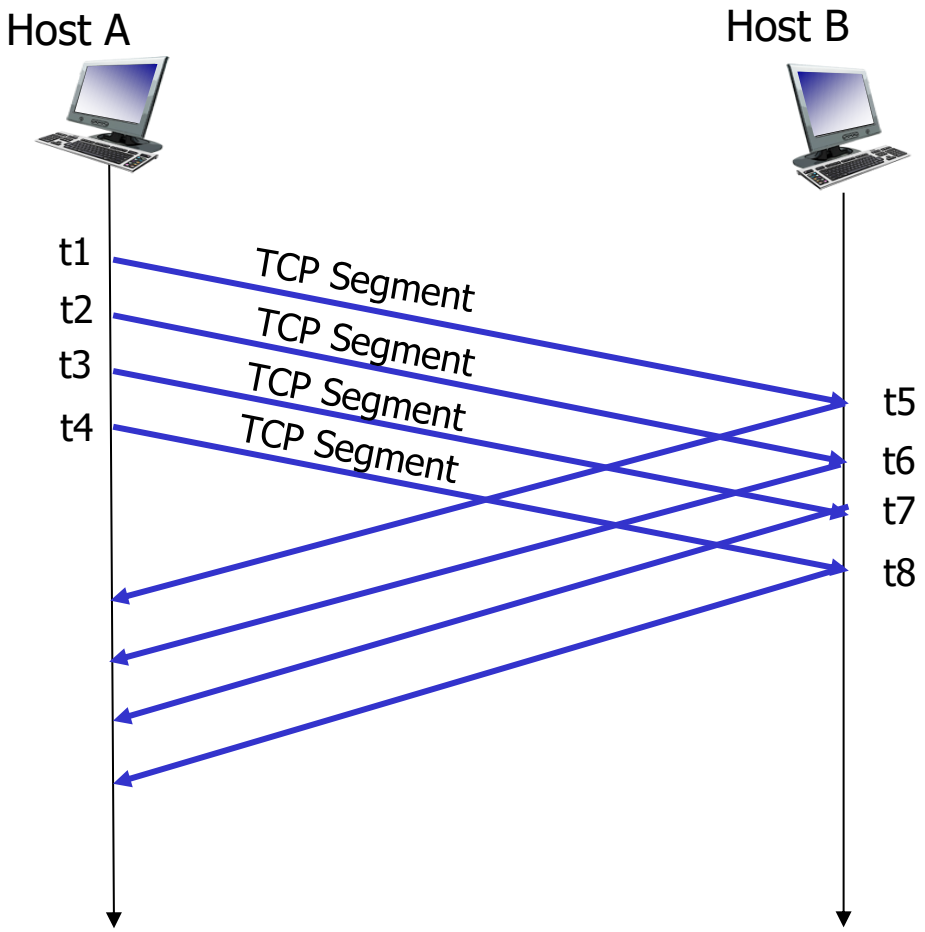
Assignment 3

Due: Nov 9, 2023

Q1:

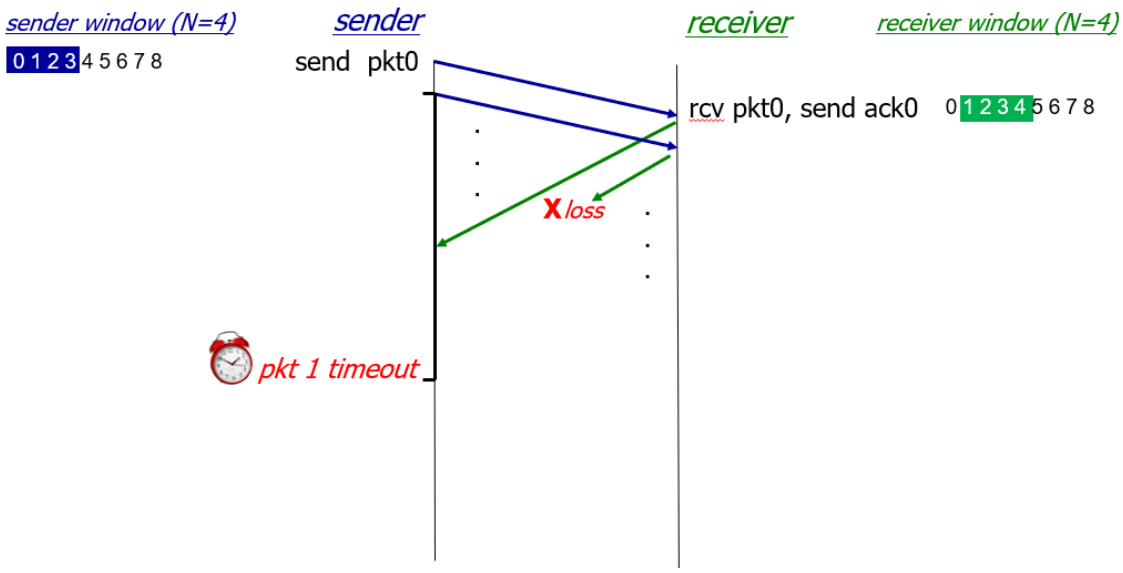
Consider the timing diagram below in which a TCP sender (host A) and receiver (host B) communicate over a connection in which the sender->receiver segments may be lost. We assume data is sent only in one direction (i.e., only host A has data to send to host B). The TCP sender sends an initial window of 4 segments. Suppose the initial value of the sender->receiver sequence number is 202 and the first 4 segments *each* contain 350 bytes. Suppose that all 4 segments arrive at the destination intact (no loss). Also, suppose that "delayed ACK" and "fast retransmit" techniques in the receiver and the sender sides, respectively, are not used in the TCP implementation considered here.



(a) Give the sequence numbers associated with each of the 4 segments sent by the sender.
(b) Give the ACK numbers the receiver sends in response to each of the segments.
(c) What would be the answer to questions (a) and (b) if the second packet (packet sent at t_2) is lost?
(d) What would be the answer to questions (a) and (b) if the second ACK (ACK sent at time t_6) is lost?
(e) Draw the timing diagram for these 4 TCP segments for the case that "delayed ACK" technique is used in the receiver side, and t_6-t_5= 300ms, and t_8-t_7=600ms. This means you should draw a diagram like above showing all TCP segments sent from the sender to receiver and all ACKs sent from the receiver to the sender. For each ACK sent from the receiver, specify the ACK number in your diagram.

Q2:

Suppose that we use Selective Repeat protocol for reliable data transfer in transport layer. Consider that host A wants to send a file to host B. The file is decomposed into **6 segments**. Suppose that the second ACK packet is lost (as shown in figure) and the timer for that packet expires a few milliseconds after the ACK packet for the fourth packet (i.e., ack3) arrives at the sender side. All other segments and acknowledgments are delivered correctly. Draw the timing diagram for the file transmission. Mention clearly sequence numbers of data and ack packets, as well as the window at sender and receiver (Assume infinite sequence number size and assume window of size 4 on each side). **You MUST specify the window status (at sender and receiver) whenever a packet (data or ack) is received or sent in the diagram, just like the one shown below for the first packet and ack.**



Q3:

Suppose that TCP's current estimated values for the round-trip time (*estimatedRTT*) and deviation in the RTT (*DevRTT*) are 320 msec and 15 msec, respectively. Suppose that the next four measured values of the RTT are 270 msec, 430 msec, 360 msec, and 300 msec, respectively. Compute TCP's new value of *DevRTT, estimatedRTT,* and the TCP timeout value after the fourth measured RTT values is obtained. Use the values of $\alpha = 0.125$, and $\beta = 0.25$. Round your answers to two decimal places after leading zeros.