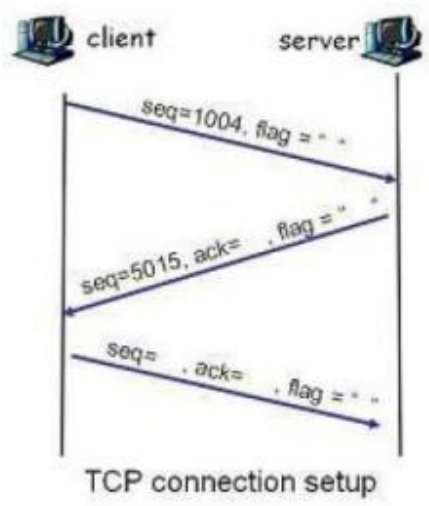
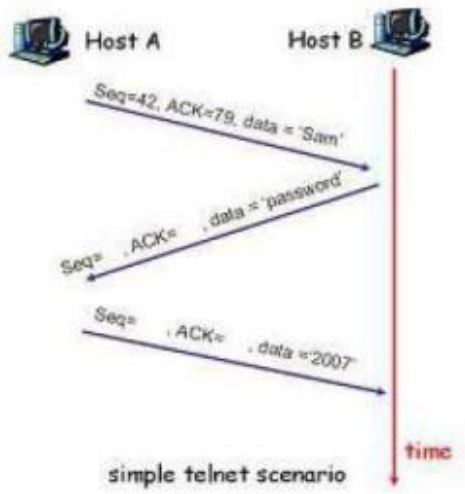
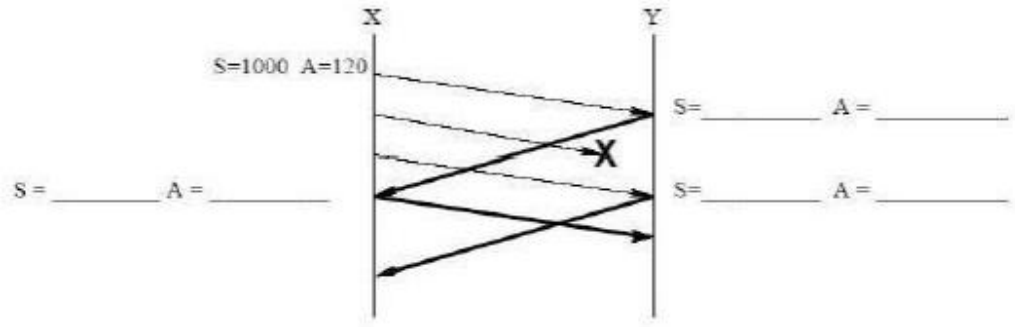
Transport Layer (TCP)

3) Fill in the missing sequence numbers and acknowledgement numbers, knowing that each character is 1 Byte long.





4) The following figure shows two hosts X and Y communicating over a channel using TCP. Hosts X and Y are sending data to each other. If each TCP segment contains 100 bytes of data and the 2nd segment sent by X is lost, complete the below figure by adding the missing sequence numbers and acknowledgment numbers



5) Consider the effect of using slow-start on a line with 20ms RTT and no congestion. The receiver window is 40 KB and the maximum segment size is 1 KB, the slow-start threshold is equal to 16 KB. How long does it take before the 1st full window can be sent?

6) Consider the graph below which shows the size of the TCP sender congestion control window as a function of time (transmission round) in an idealized timing scenario where the sender sends a window worth of packets and then receives ACKs (if any) at the end of the RTT.

a) Why does the congestion window curve have one form from rounds 1 to 6, and then another form from rounds 6 through 16?

b) What event occurs at t=16, given that the result of this event is the sender cutting its congestion control window in half.

c) What event occurs at t=23, given that the result of this event is the sending cutting its congestion window to 1? How is this event different from that which happened at t=16?