

CS305: Computer Networking

2023 Fall Semester Written Assignment # 2

Due: Nov. 22th, 2023, please submit through Blackboard
Please answer questions in English. Using any other language will lead to a zero point.

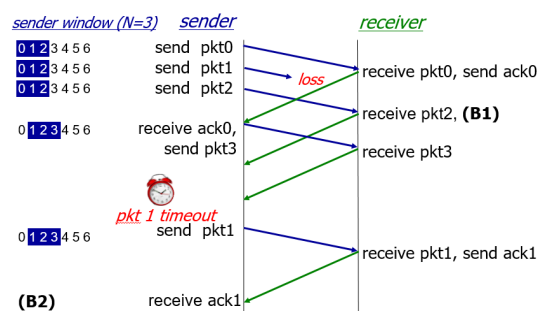
Q 1. The UDP checksum provides for error detection. Consider the following word with 32 bits:

011001100110000001010101010101 (1)

- (a) Compute the checksum. (Recall that UDP computes checksum based on 16-bit word.) Break the 32-bit word into two 16-bit words, and sum their up.
- (b) How does the receiver detect errors?
- (c) If the receiver does not detect any error using the checksum, does it mean that the message was transmitted without any error? Please explain the reason and provide an example.

Q 2. Fill in the blanks (B1) and (B2) in the below figure for go-back-N and selective repeat. Note that (B1) should be fill in with the action of the receiver, and (B2) should be fill in with the sender window. In the figure, all packets are transmitted successfully without error except pkt1.

- (a) (B1) and (B2) for go-back-N
- (b) (B1) and (B2) for selective repeat



Q 3. The following figure illustrates the convergence of TCP's additive-increase multiplicative-decrease (AIMD) algorithm. Suppose that instead of a multiplicative decrease, TCP decreased the window size by a constant amount.

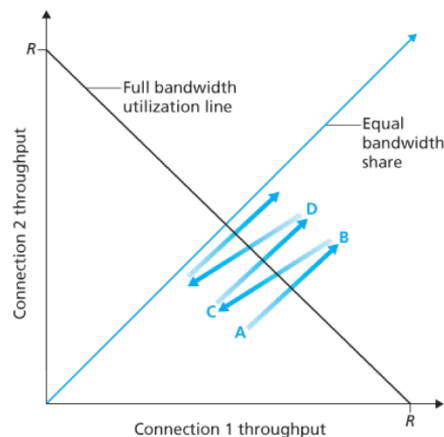


Figure 3.55 Throughput realized by TCP connections 1 and 2

amount. Would the resulting additive-increase additive-decrease (AIAD) algorithm converge to an equal share algorithm? Justify your answer using a diagram similar to the above figure. (Note: Simply draw the diagram is not sufficient. You need to explain what the diagram shows.)

Q 4. Draw the TCP connection-establishment procedure (that is, TCP three-way handshaking) between a client host and a server host. Suppose the initial sequence number of the client host is 25, and that of the server host is 89. For each segment exchange between the client and server, please indicate (1) the SYN bit, sequence number, acknowledgement number (if necessary); (2) whether the segment can carry data in the segment payload (that is, in the segment data field).

Q 5. Consider the TCP procedure for estimating RTT. Suppose that $\alpha = 0.1$, and *EstimatedRTT* is initialized as *EstimatedRTT*₀. Recall that

$$EstimatedRTT = (1 - \alpha)EstimatedRTT + \alpha SampleRTT. \quad (2)$$

- (a) For a given TCP connection, suppose four acknowledgments have been returned in sequence with corresponding sample RTTs: *SampleRTT*₁, *SampleRTT*₂, *SampleRTT*₃, and *SampleRTT*₄. Express *EstimatedRTT* in terms of *EstimatedRTT*₀ and the four sample RTTs.
- (b) Generalize your formula for *n* sample RTTs.