Homework assignment 2, CIS 427, Fall 2022

**Submission Due: 11:59 PM, 10/13/2021.**

1. **28 points, 6 points each for a, b, and c, 10 for d.**

Hosts 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 acknowledgment 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 destination port number?

b - If the first segment arrives before the second segment, in the acknowledgment of the first

arriving segments, what is the ACK number, the source port number. and the destination port

number?

c - If the second segment arrives before the first segment, in the ACK of the first arriving

segment, what is the ACK number?

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 acknowledgment 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 acknowledgment that you add, provide the acknowledgment number.

1. **40 points, 10 points each**

Consider a TCP flow over a 1 Gb/s link with a round tip time of 1 second that transfers a 10 MB file. The receiver advertises a receiver window (rwnd) size of 1MB, and the sender has no limitation on its congestion window (i.e., no ssthresh or ssthresh is set to a very high value and will not affect this transmission). Assume the TCP packet size is 1500 Bytes (i.e., MSS).

* 1. If the initial send window starts from 1MSS, how many transmission rounds does it take until slow start opens the send window to 1 MB?
  2. How many transmission rounds does it take to send the file?
  3. If the time to send the file is given by the number of required transmission rounds multiplied by the RTT of the link, what is the effective throughput of the transfer?
  4. What percentage of the link bandwidth is utilized?

**Hints:** Throughput tells you how much data was transferred from a source at any given time and bandwidth tells you how much data could theoretically be transferred from a source at any given time.

1. **32 points,4 points each**

Assuming TCP Reno is the protocol experiencing the behavior shown in the Figure. Answer the following questions:

1. Identify time intervals where TCP slow-start is operating.
2. identify time intervals where TCP congestion-avoidance is operating
3. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout event?
4. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout event?
5. What is the ssthreshold value at the first transmission round?
6. Ssthreshold at 18th transmission round?
7. Ssthreshold at 24th transmission round?
8. Cwind and ssthreshhold at 26th transmission round after receiving triple duplicate ACKs?

