Homework 3

CST 311, Introduction to Computer Networks, Spring 2020

READ INSTRUCTIONS CAREFULLY BEFORE YOU START THE HOMEWORK.

This homework is due on Sunday, March 8, 2020.

Homework must be submitted electronically through iLearn on https://ilearn.csumb.edu by 11:55 pm on the due date. Late homeworks will not be accepted.

Homework must in pdf format only. Any other formats will not be accepted. You must submit a single file for the entire homework. The naming convention of the file should be HW3_yourlastname.pdf. **Put your name in the document as well.** Your homework submission should present the problems in the original order and be properly labeled.

This homework is worth 50 points. Each part of a question carries equal weight unless specified otherwise.

Name (1 points): Adam Ayala

Transport Layer

1. (9 points) Solve the following:
    a. Suppose you have the following 2 bytes: 01011100 and 01100101. What is the 1s complement of the sum of these 2 bytes? What is the checksum?

       1s - 11000001 - C1
       checksum - 00111110 - 3E

    b. Suppose you have the following 2 bytes: 11011010 and 01100101. What is the 1s complement of the sum of these 2 bytes? What is the checksum?

       1s - 01000000 - 40
       checksum - 10111111 - BF

    c. For the bytes in part a., give an example where one bit is flipped in each of the 2 bytes and yet the 1s complement doesn't change.

2. (10 points) Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the

checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Explain if yes. Give an example if no.

No. The 1s and the checksum could flip and bit as long as they match up, they will verify. So the receiver cannot be certain of a bit error.

3. (20 points) Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 127. 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?

       SN = 207 SPN = 302 DPN = 80

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

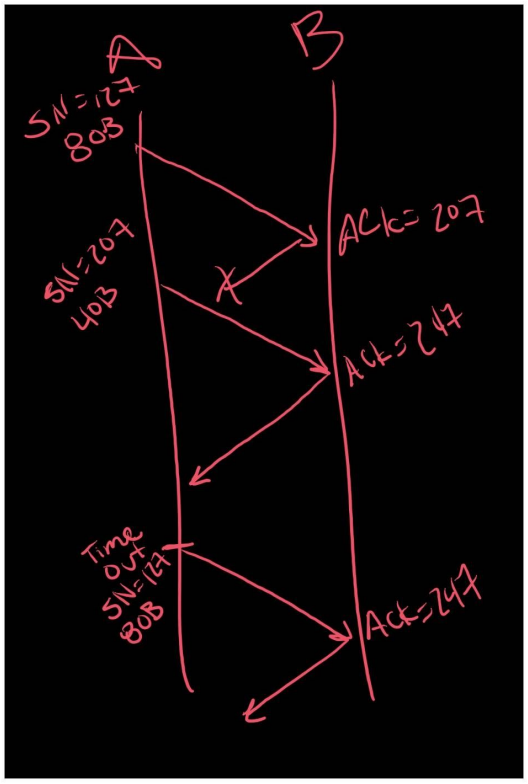
       SN = 207 SPN = 80 DPN = 302

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

       ACK = 127

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

and all other segments and acknowledgments 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



4. (10 points) Consider sending a large file from a host to another over a TCP connection that has no loss.
    a. Suppose TCP uses AIMD for its congestion control without slow start. Assuming cwnd increases by 1 MSS every time a batch of ACKs is received and assuming approximately constant round-trip times, how long does it take for cwnd increase from 6 MSS to 12 MSS (assuming no loss events)?

        it will take 6RTT to go from 6MSS to 12MSS

    b. What is the average throughout (in terms of MSS and RTT) for this connection up through time = 6 RTT?