# COMP2190 – Semester 1 2020/2021

## Tutorial 3

### Problems

1. Both UDP and TCP use port numbers to identify the destination entity when delivering a message. Give two reasons why these protocols invented a new abstract ID (port numbers), instead of using process IDs, which already existed when these protocols were designed.

2. Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. Provide possible source and destination port numbers for:
    a. The segments sent from A to S.
    b. The segments sent from B to S.
    c. The segments sent from S to A
    d. The segments from S to B.
    e. If A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S.
    f. How about if they are the same host?

3. UDP and TCP use 1s complement for their checksums. Suppose you have the following three 16-bit numbers: 0100101101010011, 0101010101010001, 0111010001011100. What is the 1s complement of the sum of these 16-bit numbers? Show all work. Why is it that UDP takes the 1s complement of the sum, i.e., why not just use the sum? With the 1s complement scheme how does the receiver detect errors? Is it possible that a 1-bit error will go undetected? How about a 2-bit error?

4. Consider transferring an enormous file of *L* bytes from Host A to Host B. Assume an MSS of 536 bytes
    a. What is the maximum value of *L* such that TCP sequence numbers are not exhausted? Recall that the TCP sequence number field has 4 bytes.
    b. For the *L* you obtain in (a), find how long it takes to transmit the file. Assume that a total of 66 bytes of transport, network, and data-link header are added to each segment before the resulting packet is sent over a 155 Mbps link. Ignore flow control and congestion control so A can pump out the segments back to back and continuously.

5. Host 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 sends two segments to Host B back-to-back. The

first and second segments contain 70 and 50 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 segment, what is the acknowledgment number, the source port number, and the destination port number?
c. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?
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.

## Acknowledgment

All problems come from “Computer Networking: A Top-Down Approach,” 7/E by J. F. Kurose and K. W. Ross