COMP 375 (Computer Networks): Quiz #4
Monday, March 12, 2018

Name: _____**SOLUTIONS**_____

1. Assume that you have an 80 Mbps connection, your segment size is 4 KB, and your RTT is 50 ms. What is the link/bandwidth utilization of the sender (i.e. U_{sender}) if we are using a stop-and-wait protocol? Use the common network convention of assuming 1M = 1,000,000, and 1K = 1,000. Also remember that 1 byte is 8 bits (i.e. 1B = 8b). Note: You may leave your final answer in fractional form.

   L = 4KB,
   R = 80Mbps = 10 MBps = 10000 KBps
   RTT = 50ms = 0.05 s

   U = L/R / (L/R + RTT)
   L/R = 4KB / 100000KB/s = 4 / 10000 s = 0.0004 s
   U = 0.0004s / (0.0004s + 0.05s) = 0.0004 / 0.0504 = 0.0079 = 0.79% (i.e. real bad)

2. When adding timeouts to our reliable transport protocol, we also needed to introduce sequence numbers. Explain why sequence numbers are required in this case.

   An ACK may come after the timeout (i.e. a slow ACK). In this case, the sender will resend the original message. This duplicate message would confuse the receiver if it didn't have an ID (i.e. sequence number) associated with it, as it wouldn't know it was retransmission of the original message instead of a new message.

3. Describe a scenario where the UDP checksum would fail to detect an error and explain why it wouldn't be detected. Assume that the only errors possible are "bit flip" errors during transmission (e.g. 0 became a 1 while sending over the network).

   Assume we have two bit flips during transmission: one from 1 to 0, and another from 0 to 1. If they both happen to be in the same column during addition, they will offset each other and the checksum will be the same as the original, uncorrupted message.