ECE 360 – Computer Networks

Assignment 3

1. Suppose that A is connected to B through an intermediate router R. The A-R and R-B links each accept and transmit only one frame per second in each direction (so two packets take two seconds). The two directions transmit independently. Assume A sends to B using the sliding window protocol with send window size (SWS) equal to 4.
   - For Time t=0,1,2,3,4,5, state what packets arrive at and leave from each node and label them on a timeline.
   - What happens if the links have a propagation delay of 1.0 seconds, but accept immediately as many packets as are offered (i.e., latency= 1 second and bandwidth is infinite)?
   - What happens when A-R link is instantaneous, but the R-B link transmits only one packet each second, one at a time (so two packets take 2 seconds). Assume A sends to Busing the sliding window protocol with SWS=4. For time = 0 1, 2, 3, 4, state what packets arrive at and are sent from A and B. How large does the queue at R grow?
2. Suppose that you design a sliding window protocol for 1 Mbps point-to-point link to the moon, which has one-way latency of 1.25 seconds. Assuming that each frame carries 1KB of data, what is the minimum number of bits you need for the sequence number?
3. Frames of 1000 bits are sent over 1 Mbps channel using a geostationary satellite whose propagation time from the earth is 270msec. Acknowledgements are always piggybacked onto data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for
   a. the stop-and-wait protocol,
   b. the go back *N* protocol and
   c. the selective repeat protocol.
4. Consider an error-free 64-kbps satellite channel used to send 512-byte data frames in one direction, with very short acknowledgements coming back the other way. What is the maximum throughput for window sizes of 1, 7, 15, and 127? The earth-satellite propagation delay is 270 msec.
5. Describe the Finite State Machine that captures the behavior of the Stop-and-Wait protocol. The state definition has been given in the class.
6. Describe the Petri Net model that captures the behavior of the Stop-and-Wait protocol. The state definition has been given in the class.