Homework #6

Instructor: Ali Sharifian

Each question worth 2 points.

For questions 1 to 3, consider a 2 Mbps link with a 50 ms round trip time (RTT). These three questions are related to each other.

1. What is the delay x bandwidth product? Provide your answer in bits.

   The delay x bandwidth product is equal to the amount of data that can be in transit in the network at any given time. It is calculated as the product of the link's bandwidth and its RTT.

   So, we can get the delay x bandwidth product as 2 Mbps * 50 ms = 100,000 bits.

2. Assuming a frame size of 1 KB and the network uses the Stop and Wait Protocol, what is the maximum sending rate? Assume 1 KB = 1,024 bytes. Provide your answer in bits per second (bps).

   With a frame size of 1 KB (1,024 bytes), the sender must wait 50 ms for an acknowledgment before sending the next frame. So, the maximum sending rate is 1 KB * 8 * 1024 / 50 ms = 163840 bps.

3. Continuing from question 2, what fraction of the link's total capacity is being used in this network using the Stop and Wait Protocol?

   From question 2, we know that 163840 bps / 2 Mbps ≈ 8%, so, in this network using the Stop and Wait Protocol, only about 8% of the link's total capacity is being used.

4. For a receiving node, assume the largest acceptable frame (LAF) is 12 and the receiving window size (RWS) is 4, what is the sequence number of the last frame received (LFR)?

   From the question, we know that the LFR would be equal to 12 - 4 = 8. So, the sequence number of the last frame received is 8.

5. Assume the sending window size (SWS) is 8 and the last frame sent (LFS) is 20, what is the last acknowledgement received (LAR)?

   Given the sending window size (SWS) of 8 and the last frame sent (LFS) of 20, we can calculate the value of LAR as follows:

   We can apply to this formula LFS - LAR <= SWS:

   LAR = (LFS - SWS)

   LAR = (20 - 8)

   LAR = 12

   So the value of LAR in this scenario is 12.