EE450: Midterm Solutions

1. F, T, F, F, F, F, T, T, T, T, F, F, F, T, F, T, T, F, F, T, T, F

   No. The connect () will NOT successfully return allowing the Client to send () before the server accepts ()

   No. The Server is NOT listening () when the Client attempts to connect ()

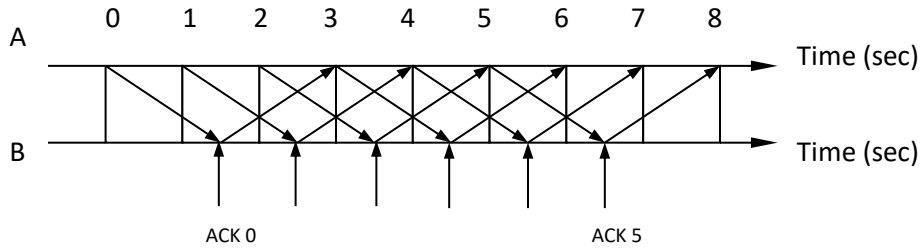
   Yes

2. 50Km, 20%, 800Hz, 00111110010100000, 2000sec, 500sec, 31bits, 155Kbps, 5K frames/sec, 0.2msec/frame, 90.2Kbps, 333.3Kbps, 285.5Kbps, 25dB, 2.008sec, 1.258sec, 0.758sec, 1.508sec, 4-Sockets, 9-Sockets

3.
   a. Transmitted pattern: 100010100010. The red bits are the FCS bits
   b. Received Pattern 010010101101. Six Errors did occur (Since the received Pattern is NOT the same as the Transmitted Pattern). Receiver will divide this pattern by the generator pattern and observe a zero remainder. The receiver **was NOT able** to detect the error. According to the receiver, the transmitted sequence was indeed 010010101101 and hence he will decode the data sequence as 01001010. Of course he is wrong.
   c. Received pattern = 100010100010 ⊕ 100010000101 = 100111. When we divide this pattern by the generator pattern, the reminder is 1101 which is NOT 0 and hence the receiver is able to detect the error (The receiver does not know how many errors or where are they located). **Note the receiver does NOT know the error pattern. He only observes the received pattern.**

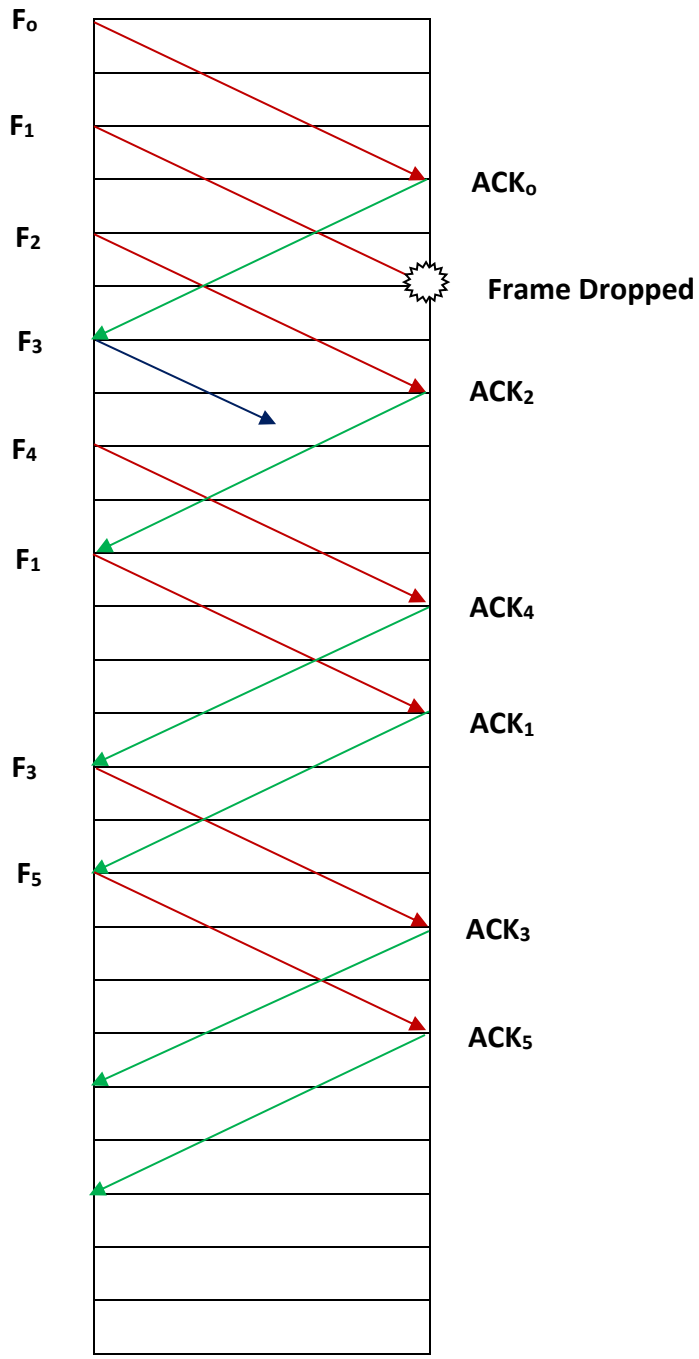
4.

a. Since the question states that the window size at sender "A" is 4 and it is sending 6 frames in a row that implies that the window is not closing, and that the receiver is acknowledging each frame individually. The diagram below illustrates the timing. The propagation delay is 0.5 sec and the transmission times of the data and of the acknowledgement frames are 1 sec each. It will take 8 seconds for "A" to finish transmitting all its frames and receive ACKs for all of them. Hence the throughput is 6 frames/8seconds or 3/4 frames/sec. If each frame is 1000 bits long, then the throughput is **750 bits/sec**. The Link utilization is 6/8 = **75%**.



b. In this case, frame F_1 was received in error (and dropped by the receiver) and F_3 was dropped in the channel. Node B will receive frames #2 and #4 out of sequence and will Ack them (but the sender window does not advance since F_1 has not been acknowledged yet). The following notes explain the graph.

- At t = 3, the sender window advances by 1 unit upon receive of ACK_0.
- At t = 5, the timeout for frame F_1 expires and is retransmitted again. Note the sender window is closed even though the sender received ACK_2.
- At t = 6, nothing happens since the window is closed.
- At t = 7, the time out for F_3 expires and is retransmitted again.
- At t = 8, the sender receives ACK_1 and slides his window by 2 units enabling the sender to send F_5 (He does not have any more frames to send)
- At t = 11, the sender will receive the last ACK. Hence the throughput is = 6(1000)/11 = **545.5 bps** and the link utilization is **54.5%**.



5.

a. Transmission Time of the HTML file over LAN = 1Gbit/1Gbps = 1 sec

Transmission Time of file over WAN Link (R1 ---- R2) = 1Gbit/10Mbps = 100 sec

Step	Action	Delay (sec)
1	Host A contact the Local DNS server about IP address of X	0.05
2	Local DNS server contact the RNS and get IP address of TLD	0.4
3	Local DNS server contact the TLD and get the IP address of X	0.3
4	Local DNS server cache the address and return it to the Client	0.05
5	Client establish a TCP connection with server X (Handshaking)	0.2
6	Client request downloading the HTML file	0.1
7	HTML file downloaded over LAN & WAN Links (Transmission + Propagation) = 1+100+0.1+1 = 102.1	102.1
8	Total Delay	103.2

b. Average Rate = (0.4)(10Mbps)+(0.6)(1Gbps) = 604 Mbps