Homework 1

1. ­Problem 1: Packet switching vs. Circuit switching
   1. The networks such as the Internet are a shared network of millions and millions of people. Thus, the medium must effectively send the data of large number of people. The packet switching acknowledges this point since it keeps transferring data, thus sending the overall data as fast as possible. However, the circuit switching dedicates the communication channel for connection between two nodes. This means that when the two nodes do not constantly send data, the communication channel is empty, in other words, wasted. Thus, the speed of overall data transfer is slower than the packet switching.
   2. Packet switching: packet switching queues the packets that arrives when the network communication channel is busy. However, when there are too many packets coming in, the packet switching will simply drop the packet after queuing a certain number of packets.  
      Circuit switching:
2. Problem 2: Modulation and Encoding

a)

* 1. By Shannon’s theorem, C = (3300 – 300) \* log2(10^(30/10) +1) = 3000 \* log2(1001), which is about 30 Kbps. Thus, this connection cannot support 56 Kbps modem.
  2. One can increase the bandwidth of the connection or the signal-to-noise ratio in order to support a 56Kbps modem.
  3. If the modem is restricted to use only a binary signal, then the level is the minimum. As shown in the email from Professor Fonseca, 2B\*log2(M) = C. So the less M (level), the lower the C is. Then, the restriction of level to two will slow down the connection.

b)

1. 7E 01 7D 7E 65 7D 7D 7D 7E 61 7E
2. The worst case is when every byte needs to be escaped. So you need to transmit 2n bytes. But you also need to signify the start and the end. Thus, you need to send 2n+2 bytes.

c)

1. The worst case scenario is when all bits are 1’s. Then every 5 bits to send, we need to insert a 0. That is, we need to send (8n + (8/5)n) bits. Adding the start and end mark, we need to send total of (48/5)n + 16 bits.
2. With HDLC, we can detect a bit-stuffing error when we have more than 6 consecutive 1’s. This should not happen as if 1’s are part of the data, then a 0 should be inserted after five 1’s. If 1’s are part of the ending mark, then, it should only have 6 consecutive 1’s followed by a zero. Thus, this scheme should never send 7 or more consecutive 1’s.
3. Problem 3: Bandwidth, Delay, and Windows
   1. Propagation delay = distance/speed = 8 \* 10^5/(2\*10^8) = 5\*10^(-4) sec.
   2. Transmission delay = size/bandwidth = (1250 \* 8)/(10^7) = 10^(4-7) = 10^(-3) sec.