EE450, Homework #3 (due Tuesday October 5)

1. If we want to send data at a speed of 3000 bps through a channel of bandwidth 1000 Hz, what is the minimum S/N ratio required?

2. What is the maximum bit rate that can be transmitted over a channel with bandwidth of 500 Hz and a signal to noise ratio of 5 dB?

3. Encode 00110010 by (a) NRZ-L, (b) NRZI, (c) Manchester, and (d) Differential Manchester.

4. Calculate the <u>signaling rate</u> for the following modulation schemes and bit rates:

   a) 36Kbps, 4-QAM

   b) 8Kbps, 32-QAM

   c) 3Kbps, 8-PSK

5. Calculate the <u>bit rate</u> for the following modulation schemes and signaling rates

   a) 1Kbaud, 32-QAM

   b) 2Kbaud, BASK

   c) 5Kbaud, BFSK

6. A system is operating at sampling rate 8000 samples per second and each sample quantized to 8 bits. What is the bit rate? If we want the send the digital signal through a channel of bandwidth 5000Hz. What is the minimum number of voltage levels from Nyquist theorem?

7. Assume that you are to design a synchronous TDM carrier to support 30 voice channels using 6-bit samples and a structure similar to DS-1. Determine the required bit rate.

8. Find the number of the following devices that could be accommodated by a T1-type synchronous TDM line if 1% of the line capacity is reserved for synchronization purposes.

   a) 110-bps teleprinter terminals,
   b) 300-bps computer terminals,
   c) 1200-bps computer terminals,
   d) 9600-bps computer output ports,
   e) 64-kbps PCM voice frequency lines.

   How would these numbers change if each of the sources were operational an average of 10% of the time? In this case, there will be statistical TDM usage and the line should be utilized at most up to 80% of its capacity.