

## EE4440 HW#7

April 4, 2011

1. Draw the waveform for the binary sequence 0100 1011 using each of the following line codes:
  - (a) Unipolar On-Off RZ
  - (b) Unipolar On-Off NRZ
  - (c) Polar RZ
  - (d) Polar NRZ
  - (e) Bipolar RZ
  - (f) Manchester
2. Write a program in MATLAB that uses a bit time of  $1\mu s$  to plot the waveform from Part c of Problem 1 as well as recovering and plotting the bit clock for the signal. Use a  $\frac{1}{4}$  bit time delay on the clock.
3. Re-draw the waveform of Part e of Problem 1 assuming that a bit error has occurred in bit 4. Assume that the bit error has resulted in a spurious, positive pulse.
4. Find an application note or data sheet that describes a piece of hardware or software that performs Manchester encoding and decoding. Describe the method used for signal encoding, decoding, and clock recovery.
5. If I want to stream audio data over a digital data link how much channel capacity is required for stereo 16 bit audio sampled at 44kHz? How does this rate compare to common rates for MP3 formatted audio files? If my channel bandwidth is 4kHz how much SNR must I have?
6. Look up 8b/10b encoding and explain what purposes (NOTE: purposes is plural!) it serves. How would you implement an 8b/10b encoder?
7. Choose a product or technology that uses base band digital communications and find out what line code it uses. You may not choose RS-232 serial links or similar, or Ethernet because we talked about their line codes in class. What do they use? Examples you might look up include USB, Compact Discs, DVD,  $I^2C$ , etc.