Assignment 2

1. Treating the last two digits of your BCIT ID as a 2-digit hexadecimal number, write the bits in order from most- to least-significant. For example, if your BCIT ID was A00123456 then the binary value would be 01010110.

   Show the waveform that would result from encoding this 8-bit value using the following line codes. Assume the bits are transmitted in the order written above (MS to LS bit):

   (a) NRZ unipolar with 0V for zero and +3V for '1'

   (b) Manchester (using ± 1V)

   (c) differential Manchester (same voltages as above)

   (d) 4B5B (unipolar, same voltages as (a))

   You can find the 4B5B encoding table in the Wikipedia entry for "4B5B". Do not include frame start/end markers.

2. An encoder stuffs a '1' bit after five zero bits. What would be the output of the bit stuffer if the input sequence was 0001 1000 0010? Please format your answer in groups of four bits. What is the output of the de-stuffer if the input sequence was 0110 0000 1110?

3. What is the noise margin when data is transmitted using the voltage levels of +1V and -1V?

4. The rise time of a TTL level signal as it goes from 0.5 to 4.5V is measured to be 80ns. What is the slew rate during this time?

5. A tri-state line driver has an output enable input labelled OE* (or $\overline{OE}$). To what will the output be set if this enable pin is set to 0V?

6. Two OC (open collector) outputs are connected together and to a 1k resistor to +5V. Write out the truth table for the joint output as a function of the individual outputs. For the individual outputs, use the notation L to indicate that the OC output transistor is turned on. For the joint output use the notation L to indicate that the common output voltage is low. What logic function does this represent (NAND, OR, ... etc).

7. Consider a lossless transformer. How are the primary and secondary currents related to their turns ratios? Show that the voltage ratio is equal to the turns ratio and the impedance ratio is equal to the square of the turns ratio.

8. A channel has a bandwidth of 4kHz and white noise with an SNR of 20dB. What is the maximum data rate that could ever be transmitted with arbitrarily low error rate? What is the maximum symbol rate that could be transmitted without inter-symbol interference?

9. You measure the DTR pin on an RS-232 interface and find no voltage. Is this device a DTE or DCE? Would the Transmit Data pin be an output or input?

10. Draw the waveform that would appear on an RS-232 interface data line when an ASCII character corresponding to the last digit of your BCIT ID is transmitted at a rate of 9600 bps. Show the time and voltage scales.