Assignment 4

Due Tuesday, December 2. Show your work. Submit your assignment using the appropriate dropbox on the course web site. Assignments submitted after the solutions are made available will be given a mark of zero.

Question 1

(a) What pins are used for ground, TxD and RxD on Cisco router RJ-45 console (serial) port? See: this Cisco document.

(b) What symmetry is there in the assignment of signals to RJ-45 pins?

(c) What kind of cable can make use of this symmetry?

(d) Assuming the same type of DB-9 to RJ-45 adapter on a PC and a router and that the router is a DCE, would you use "rolled" or straight-through cable? Rollover Cable.

(e) What signal(s) that appear on the DB-9 RS-232 connector were left out of the RJ-45 connector?

Question 2

The figure below shows an RS-232 waveform transmitting two ASCII characters. If both characters are transmitted using the same parity setting, how many data bits are being transmitted per character? What are the two characters?

Question 3

A channel is operating with AWGN and an SNR of 6 dB. You are given a choice of doubling the SNR or doubling the bandwidth. By what factor does channel capacity increase in each case?

Question 4

A telephone channel has a frequency response that is constant ("flat") up to approximately 4 kHz and is zero for frequencies above that. Approximately what is the maximum symbol rate that can be transmitted over this channel? If we transmitted 7 bits per symbol, what would be the bit rate?

Question 5

The 4G wireless cellular standard, LTE, uses OFDM on the forward (base to mobile) link. The subcarrier spacing is 15 kHz and each OFDM symbol is 2048 samples. The cyclic prefix is 144 samples.

(a) What is the sampling rate?

(b) What is the symbol duration including the cyclic prefix?

(c) How far will the signal propagate during the cyclic prefix duration?