INFSCI1072/TELCOM 2700: Wireless Networks, Fall 2016
Homework 2

Read the articles posted on the webpage. Install R Studio and R on your computer (see the links on the course web page). Answer the following questions.

1. How is a wireless network different from a wired network? Explain at least three differences.
2. Compute the wavelength of a sinusoid of frequency 2.4 GHz. Compare this with the wavelength at 900 MHz.
3. The spectral efficiency of a transmission scheme, denoted as η is defined as the data rate that can be supported in 1 Hz of bandwidth and it is measured in bps/Hz. Show how you will calculate the spectral efficiencies of all of the 2G cellular systems and the early wide area data systems discussed in class.
4. What was the modulation scheme for voice in 1G cellular systems?
5. The AMPS system supports two-way communication using frequency division duplex with the uplink and downlink channels separated in the frequency spectrum by 45MHz. Determine the uplink and downlink carrier frequency for channel 40.
6. A wireless transmission scheme employs 16 QAM (16-quadrature amplitude modulation - there are 16 different symbols) and a symbol is sent every millisecond.
    a. What is the data rate of the system in kbps?
    b. What is the symbol rate of the system?
    c. What is the approximate BW of the signal?
    d. If the code rate is ½, what is the useful data rate?
7. Consider a CDMA system with three users – Alice, Bob, and Cara. They are assigned the following orthogonal codes respectively: [1 1 1 1], [1 -1 1 -1] and [1 -1 -1 1]. Alice sends two zeros, Bob sends a zero and a 1 and Cara sends a one and a zero. Show the composite baseband signal if all three users are perfectly synchronized. Assume NRZ signaling with a chip duration of 1 μs.
8. In problem 7, show how the receiver decodes the bits transmitted by Cara. Do this in R or Matlab (using either a script or the command line) and attach the code or a screenshot. Please make sure it shows the details.