CSE 4215 :: Problem Set 2

1. A cellular telephone system is intended to cover an area of 35 km². Suppose FDMA is used, where the total system bandwidth is 100 MHz, and each call occupies 30 kHz. It is desired to support 40,000 calls in the entire coverage area. Assuming a re-use factor of 7, and assuming cells have the same area, what is the required area of each cell?

2. Explain the concept of frequency re-use in cellular systems. Sketch a typical re-use pattern for a re-use factor of 4, and for a re-use factor of 7.

3. Explain, with an example, how congestion control works in TCP, making specific reference to slow start, congestion windows, and congestion thresholds. Also explain why these methods lead to bandwidth loss if packets are lost to fading, as in a wireless network.

4. A cellular telephone system uses GSM. A GSM TDMA frame occupies 4.615 ms, which is divided among 8 users. Each user's slot includes a burst of 148 bits, as well as a guard time of 0.0305 ms.
   a. What is the raw bit rate?
   b. During the slot, each user may transmit 114 data bits (the rest are for training, synchronization, and control). What is the bit rate per user?

5. Suppose a Bluetooth piconet contains one "master" and three "slaves". What is the raw bit rate of the master? What is the raw bit rate of the slaves?