Mobile Communication Networks
Exercises 6

1. If 25 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 KHz RF bandwidth, find:
   a. No. of duplex channels
   b. Total no. of channels/cell, if N = 4 cell reuse is used.
   c. If change the system to CDMA, which cluster size will be tipically used? Which spreading factor will be used?

2. Consider four different cellular systems that share the following characteristics. The frequency bands are 825 to 845 MHz for mobile unit transmission (reverse link) and 870 to 890 MHz for base station transmission (forward link). A duplex circuit consists of one 30-kHz channel in each direction. The systems are distinguished by the reuse factor, which is 4, 7, 12, and 19, respectively.
   a. Find the number of simultaneous communications that can be supported by a single cell in each system.
   b. Suppose that in each of the systems, there are 16 of such cluster of cells (4, 7, 12, 19). Find the number of simultaneous communications that can be supported by each system.
   c. In the conditions of the previous item, what is the area covered (in number of cells), by each system (for each cluster size)?
   d. Suppose the cell size is the same in all four systems and a fixed area of 100 cells is covered by each system. Find the number of simultaneous communications that can be supported by each system.

3. Consider a wireless cellular telephone system with a total bandwidth of 50 MHz. Two 25 KHz simplex channels are used to provide a full duplex channel. Consider a square city that is 100 square kilometers (10 km x 10 km). Suppose you design a cellular system for this city with square cells using a reuse factor $f = 1/4$.
   a. What is the total number of available duplex channels?
   b. What is the total number of active users that your system can support for a cell size of 1 square kilometer (1km x 1km)?
   c. What cell size would you use if you require that your system support 250,000 active users.

4. A alocação de frequências de um operador celular GSM é de 890 a 900MHz *uplink* e de 960 a 970 MHz *downlink*. Cada uma dessas bandas está dividida em 100 sub-bandas de 100KHz cada. Por sua vez, cada uma das sub-bandas é dividida em tramas de 5 *timeslots*. Uma chamada de voz ocupa um *timeslot* durante toda a duração da chamada. A cobertura celular é realizada com *clusters* de tamanho 4.

   a. Qual é o número máximo de chamadas que podem ser efectuadas, simultaneamente, numa célula?
   b. Quantas chamadas podem ser efectuadas, simultaneamente, num cluster?
   c. Quantas chamadas podem ser efectuadas, simultaneamente, num sistema composto por 1000 células?
   d. Se operador alterasse a tecnologia do sub-sistema rádio para uma baseada em CDMA, qual passaria a ser o tamanho do *cluster*? Porquê?