Exercise for the lecture

**Algorithms for Radio Networks**

Winter 2011/12

Sheet 1

**EXERCISE 1:**

1. **Code Division Multiple Access**
   
   (a) Create a set of code that is capable to handle up to 8 senders at the same time. Give the chip-sequences of the 8 senders.
   
   (b) Let senders $S_1, S_2$ transmit bit ’0’ and senders $S_3, S_4$ transmit bit ’1’. What is received by the receiver on the medium, if the distances between receiver and $S_1, \ldots, S_4$ are $d, 2d, 3d, 4d$ (for some positive $d$) and the path loss coefficient is 2?
   
   (c) Show that the receiver receives the correct bits from the senders.

2. **Multiple Input Multiple Output**

   Assume you have two antenna in distance $\frac{\lambda}{2}$. Both are emitting the same signal in sync characterized with a sinus function. Provide a formula for the receiving energy based on Friis equation, if the receiver $A$ is at distance $d \gg \lambda$ and for antennas $B, C$

   (a) the angle $\angle ABC$ is 0 (receiver is in line with the antennas),
   
   (b) the angle $\angle ABC$ is $\frac{\pi}{2}$,
   
   (c) the angle $\angle ABC$ is $\frac{\pi}{4}$. 