

Exercises of lecture
Wireless Sensor Networks
 Winter 2006/2007
 Sheet 3

SECTION 1:

From waves to bits, channel model, CDMA, DSSS

1. Briefly explain techniques used to share the medium.
2. Consider a wireless network in which DSSS is used in implementing multiple-access. The spread factor used is $k = 8$. The code sequence (i.e., chip sequence) assigned to a particular channel (namely Channel A) is

$$C = +1+1-1+1+1-1+1+1 \text{ (i.e. 11011011)}$$

Suppose a logical bit 0 (-1) is sent using on this channel,

- (a) How does Channel A sender spread this bit to the chip sequence?
 - (b) Denote the above transmitted chip sequence signals as $S_i (i = 1, 2, \dots, 8)$. What is the code chip sequence used by Channel A receiver to de-spread the received signals?
 - (c) What is the rule applied by the receiver while decoding the received signals? And based on this rule, what is the decoded bit?
 - (d) Suppose the transmitted chip sequence $-1-1+1-1-1+1-1-1$ was hit by interference and one chip was affected to become $-1-1+1-1-1+1-1+1$ that was received. How does Channel A receiver de-spread and decode then? And what do you think about the tolerance level of DSSS to bit error?
 - (e) Suppose a different channel, namely Channel B, uses a code chip sequence of $C' = +1+1+1-1+1+1+1-1$ (i.e., 11101110). As channel A and B use the same frequency band, how does a receiver of channel B de-spread S_i and what is the decoded bit?
3. We are using CDMA and has received $(-1, 1, 1, 3)$ from nodes A, B and C. The code for A was equal to $(1, 1, 1, 1)$, B was equal to $(1, 1, -1, -1)$ and C was equal to $(1, -1, 1, -1)$. What actually was send by A, B and C?

SECTION 2:

Transceiver Design, Networking Basics Revisit.

1. What are the considerations to be taken into while designing the transceiver for wireless sensor network?

Choose between true and false for the following questions.

1. In packet switching, packets from a source can be received in out of order at a destination? (True/False)
2. In packet switching individual packets from a source can travel to a destination using different paths? (True/False)
3. Frame synchronization tells when a packet starts and ends? (True/False)
4. To correctly receive a message, the signal-to-noise-and-interference ratio (SINR) should be very small? (True/False)
5. Addition of white noise results in variation of signal to noise ratio (SNR)? (True/False)
6. Using frequency-hopping-spread-spectrum a missile can be controlled by the destination country to divert back? (True/False)