Problem Set 2 (due Tuesday, October 2)

(Problem numbers indicated below refer to the problems in the second edition of the course text. The problem numbers in parentheses refer to the problems in the first edition of the course text.)

1. (10 points) Frequency-hopping spread spectrum

Problem 7.4 (Chapter 7, Problem 4).

2. (6 points) Spreading codes in CDMA

Problem 7.7 (Chapter 7, Problem 7).

3. (4 points) Generation of m-sequences

Problem 7.12 (Chapter 7, Problem 12).

4. (4 points) Parity codes

Consider a simple (3,1) linear block code where each codeword consists of three data bits and one parity bit.

(a) Find all codewords in this code.

(b) Find the minimum distance of the code.

5. (4 points) Walsh codes

Demonstrate that codes in a 8×8 Walsh matrix are orthogonal to each other. What are the advantages and limitations of using Walsh codes in spread spectrum applications?

6. (10 points) Convolutional encoding

Consider the convolutional encoder with $n = 3$, $k = 1$, and $K = 3$, defined by $v_{n1} = u_n$, $v_{n2} = u_n \oplus u_{n-1} \oplus u_{n-2}$, and $v_{n3} = u_n \oplus u_{n-2}$.

(a) Draw a shift-register diagram for the encoder.

(a) Draw a trellis diagram for the encoder.

7. (4 points) Block error correction codes

Problem 8.11 (Chapter 8, Problem 11).

8. (8 points) Interleaving

Problem 8.19 (Chapter 8, Problem 19).