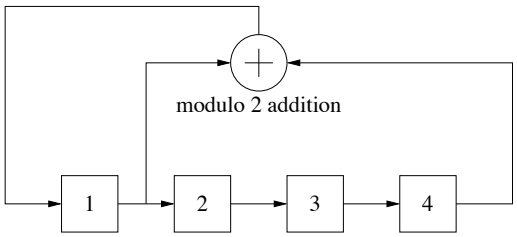
CSE 4214 :: Lab 5

This lab will introduce you to CDMA data transmission.

Feedback shift registers (FSRs) are often specified as a list of feedback connections. For example, the FSR pictured below would be specified as [4,1]. Note that the largest number in the list of connections is equal to the number of flip-flops in the FSR.



In this lab, use two FSRs, with connections [5, 4, 3, 2] and [5, 4, 2, 1]. For each FSR, do the following:

1. Sketch the connections in the FSR.
2. Show that both FSRs produce maximum-length sequences (M-sequences), and give those sequences where the initial state of the shift register is: [1, 1, 1, 1, 1].
3. Calculate the cross-correlation between these two sequences, assuming bits are synchronized.

Propose a simulation scheme for a two-user CDMA system. The users' spreading codes are the M-sequences for the two FSRs specified above. Use Polar NRZ-style chips with $n_c = 8$. You may assume that the users are bit-synchronized. Furthermore, use single-user detection to detect each user's bit.

On the same graph, plot both users' bit error rates with respect to energy per bit on a log-log scale (both users should have the same energy per bit). Also on the same graph, plot the theoretical bit error rates, assuming no interference from the other user.

Deliverables

Your deliverables for this lab are as follows:

- All MATLAB code and plots; and
- A complete description of your simulation scheme, and any results obtained.

Deliverables are due at the end of the lab period on December 4, 2009.

Demonstration

In the lab, the TA will ask you to describe your work. You will demonstrate your simulations, and answer any of the TA's questions. The lab must be demonstrated before the end of the lab period on December 4, 2009; otherwise, the demonstration will be marked as "incomplete".

Evaluation

The following three components of this lab will be evaluated separately:

- Written work;
- MATLAB code and plots; and
- Lab demonstration.

Each component is weighted equally, and graded on the following five-point scale:

- 5: Outstanding work demonstrating original thinking
- 4: Satisfies the lab requirements
- 3: Minor issues in satisfying the lab requirements
- 2: Major problems in satisfying the lab requirements
- 1: Work is incomplete
- 0: Work is missing (or student is absent for the demonstration)

Note that the maximum grade for satisfying the basic lab requirements is an "A" (80%).