Project 1

EECS243: Error Correcting Codes

Due May 16, 2018

Simulate the bit error rate performance of a regular (3,6) LDPC code over an additive white Gaussian noise (AWGN) channel. The rate of the code is 0.5 and the block length is 260. That means there are 130 input bits for each block. Transmit an all-zero codeword using a BPSK modulation. Use an iterative decoder using the sum-product algorithm to decode the received vector. Limit the maximum number of iterations to 100. The parity-check matrix H of the code is given in the file H.txt. The file contains the list of row and column indices of the non-zero elements of the parity-check matrix. The indices start with zero not one and each line in the file corresponds to one bit of "1" in the H matrix. For example, the first line "6 0" implies that the entry at row 7 and column 1 is one.

The final report for the project (maximum two pages) should include a figure that includes the end-to-end probability of error results (Y axis) for different values of received signal-to-noise ratio (X axis). For example, you may pick the received signal-to-noise ratio range of 2-4 dB. You may use C, C++, or matlab in your simulation. However, you should not use matlab's toolboxes. You should also provide the source code such that I can run your programs and reproduce your results.

Hints:

- It is not necessary to construct the full parity-check matrix from the list of indices of non-zero entries.
- It is easier to work in the log domain, i.e., use log-likelihood ratios (LLRs) instead of probabilities.
- The LLR values have to be clipped to avoid saturation and overflow problems. For example, you may change any number greater than 30 to 30 and any number smaller than -30 to -30.