**The simulation of LDPC**

This is our third group-homework. You need to finish the homework with your group members.

1. Please use MATLAB to simulate the decoding algorithm of LDPC, namely, bit flipping (BF) decoding algorithm. In the simulation, you need to do as follows.
2. Generate a parity check matrix of LDPC with size .
3. Use the BF algorithm to decode a codeword generated by using 1).
4. Give the bit error probability of your decoding algorithm when the SNR is 1, 1.5, 2, 2, 5, 3 dB with BPSK modulation and AWGN channels.

Note:

1. you can use a codeword with all zero entries, e.g., a codeword c=(0,0,0), to avoid encoding process.
2. In the practical scenario, the codeword should be modulated before transmitting to the physical channel. In our homework, you need to modulate the codeword by BPSK, which maps 1 to -1 and maps 0 to +1. For example, for a codeword , it becomes after BPSK modulation.
3. The physical channel in our homework is AWGN channel, where the probability density function of noise follows Gaussian distribution . It means that the received vector is , where is a noise vector whose every entry follows the above Gaussian distribution.
4. The SNR is denoted as

where is the power of signal. In the simulation, for convenience, let the power of signal be 1. It means that the received vector is

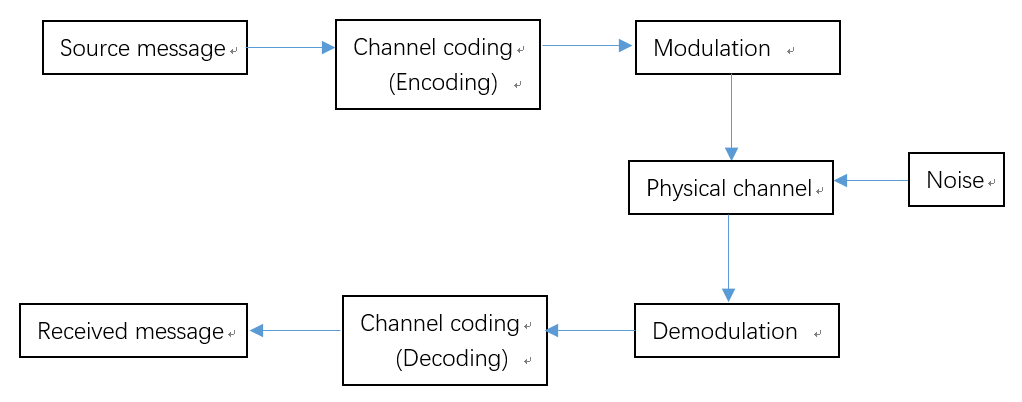
where follows the standard Gaussian distribution .

1. Before the decoding, you need to demodulate the received vector as follows. If , we set it to be 0, otherwise, it is 1. For example, for a received vector , you need to demodulate it as .
2. You need to use the vector after demodulation to finish decoding process and obtain the decoding output . For example, you need to use to do decoding and obtain the final decoding output.
3. For a codeword and the corresponding decoding output , the bit error probability can be defined simply as

1. Please write a report according to your experiments. Note that in your report, you need to include the following contents:
2. The contributions of different members.
3. Simulate the regular LDPC by using the codes given in the homework.
4. Show the difference and the corresponding reasons among different algorithms, i.e., you need to write the difference among different given algorithms and the corresponding reasons to result in the different performances.
5. Simulate the irregular LDPC by yourself.
6. Show the difference among different algorithms and the corresponding reasons to resulting in the difference. Note that you need to use one hard decision decoding algorithm and one soft decision algorithm (two algorithms are enough).
7. Modify any one given algorithm in regular LDPC and show your results (one is enough).
8. Modify any one algorithm in irregular LDPC and show your results (also one is enough).

Note：

1. Deadline is Jan. 6.
2. Each group has at most three students.



A simple digital communication system