Programming Assignment 1

The case of uncoded scheme

1. Use an image of your choice as the input message, and convert the image to a sequence of bits
2. Store them over as many capacitors which have a transition probability of p, such that 0 < p < 1. Assume that the flipping process at each capacitor is independent and identically distributed.
3. Recover the bits from the capacitors and reconstruct the image.
4. Showcase the images when p takes values from {10^-4, 10^-3, 10^-2, 0.1}

The case of repetition coding scheme

1. Use an image of your choice as the input message, and convert the image to a sequence of bits
2. Convert the input sequence of bits into coded a sequence using a repetition code (N, 1)
3. Store the coded sequence over as many capacitors which have a transition probability of p, such that 0 < p < 1. Assume that the flipping process at each capacitor is independent and identically distributed.
4. Recover the bits from the capacitors and reconstruct the image. Use majority decoder to recover the input bit sequence from the coded sequence
5. Fix N = 3, and showcase the images when p takes values from {10^-4, 10^-3, 10^-2, 0.1}
6. Fix N = 7, and showcase the images when p takes values from {10^-4, 10^-3, 10^-2, 0.1}
7. What is your inference when comparing the scheme with N = 7 and N = 3?

The case of single error correcting scheme

1. Use an image of your choice as the input message, and convert the image to a sequence of bits
2. Convert the input sequence of bits into coded a sequence using a (7, 4) linear code with dmin = 3.
3. Store the coded sequence over as many capacitors which have a transition probability of p, such that 0 < p < 1. Assume that the flipping process at each capacitor is independent and identically distributed.

4. Recover the bits from the capacitors and reconstruct the image. Use the minimum distance decoder as well as the parity check matrix based decoder to recover the input bit sequence from the coded sequence.
5. Showcase the images when p takes values from {10^-4, 10^-3, 10^-2, 0.1}

The case of double error correcting scheme

1. Use an image of your choice as the input message, and convert the image to a sequence of bits
2. Convert the input sequence of bits into coded a sequence using an (N, k) linear code with dmin = 5. The choice of N and k is yours. You may need to do research to find such a code
3. Store the coded sequence over as many capacitors which have a transition probability of p, such that 0 < p < 1. Assume that the flipping process at each capacitor is independent and identically distributed.
4. Recover the bits from the capacitors and reconstruct the image. Use the minimum distance decoder as well as the parity check matrix based decoder to recover the input bit sequence from the coded sequence.
5. Showcase the images when p takes values from {10^-4, 10^-3, 10^-2, 0.1}