Lab 5 Report

Channel Coding

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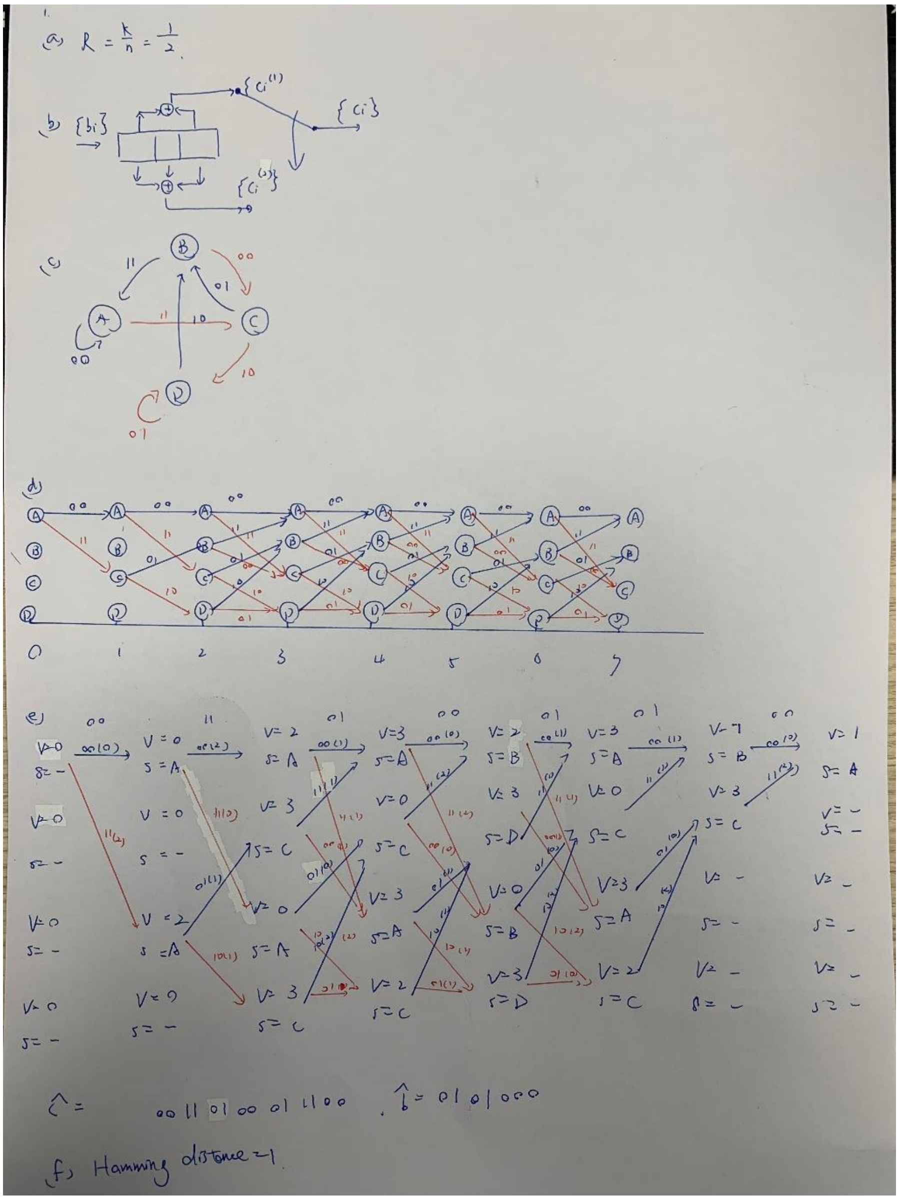
Q1.



Q2

(a)

1 1 1 0 0 1 1 0 0 1 1 0 0 1 0

Which is the same taught in class.

(b)

The decoded bit is

0 0 0 1 0 0 0

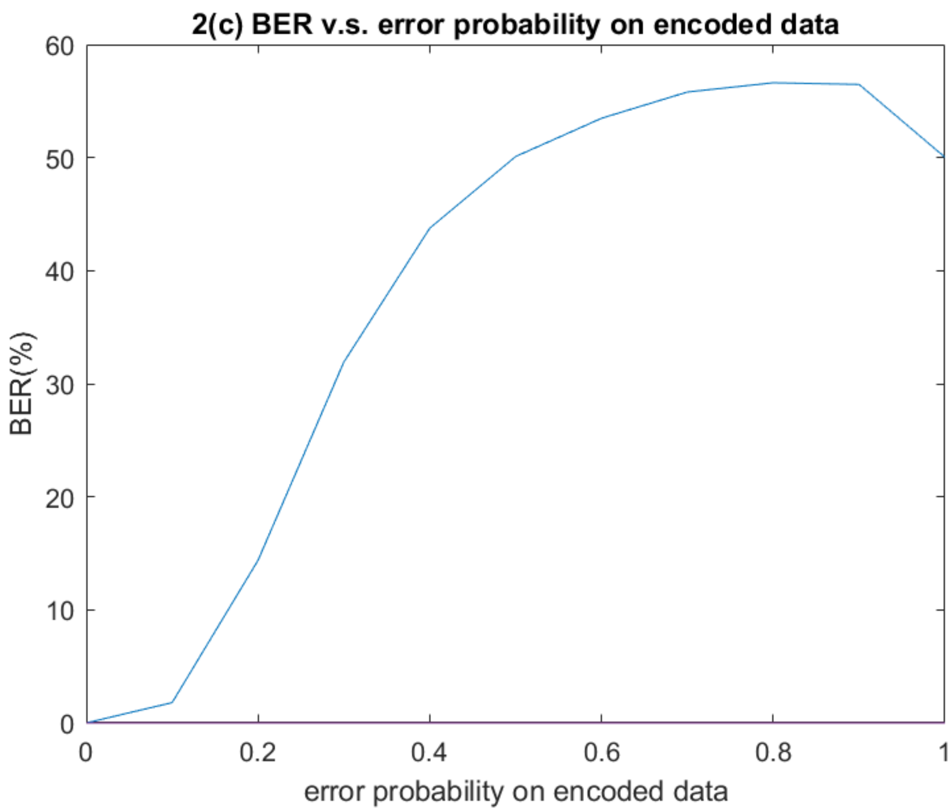
For 1(e)

The decoded bit is

0 1 0 1 0 0 0

Which is the same with 1(e).

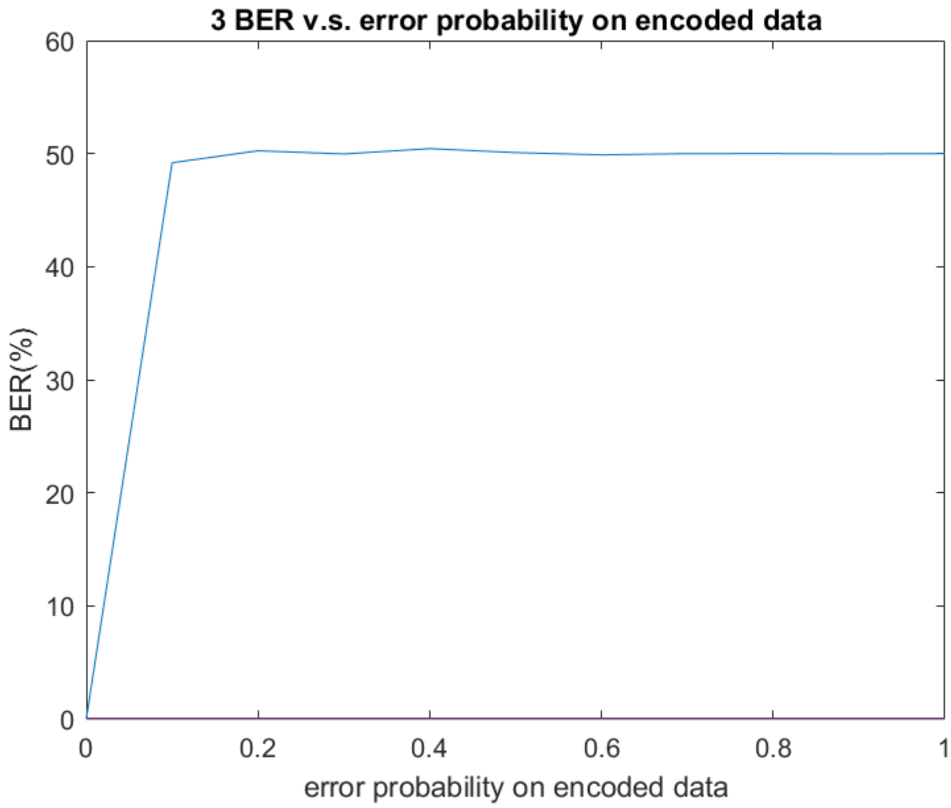
(c)



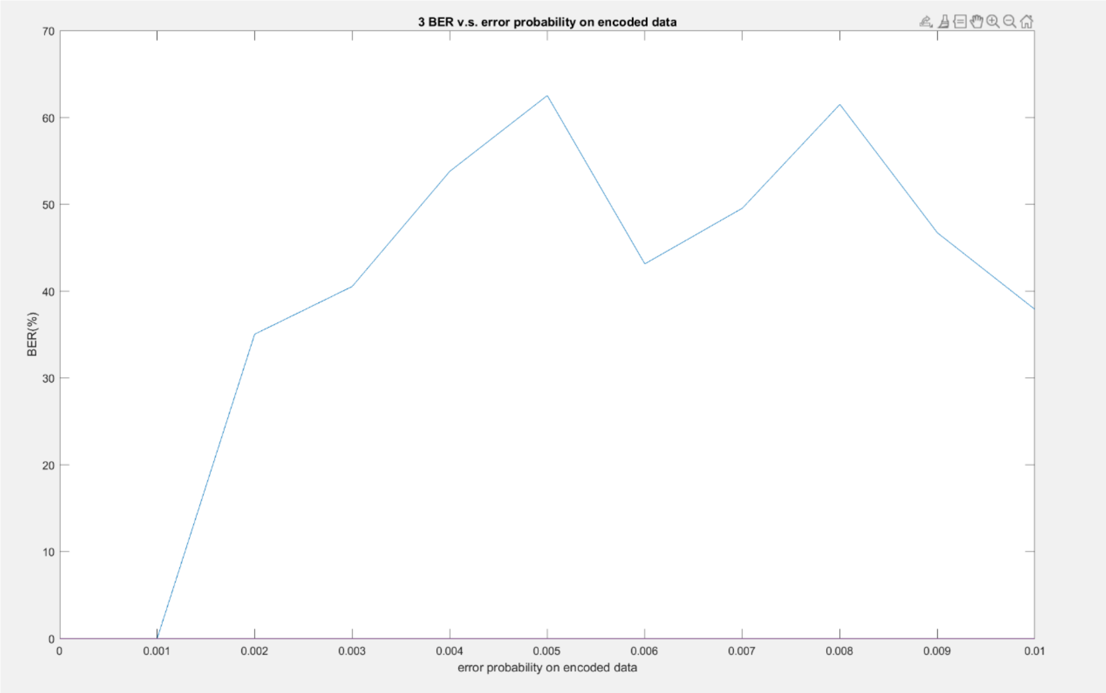
When $p > \frac{1}{2}$, BER is higher but appropriately 50%. For p = 1, BER is exactly 50%.

The reason that large p leads BER to 50% but not 100% is large p makes the encoded bit sequence meaningless, hence the decoded bit sequence is random compared to the original bit sequence. Hence BER = 50%.

Q3



In 2(c). BER increases slowly when p is small, and beyond 50% when $0.6 \leq p \leq 0.9$. In Q3, BER jumps to 50% when p = 0.1 and maintains 50 % when $0.2 \leq p \leq 1$. The reason is that in Q3, $R = \frac{k}{n} = \frac{1}{2}$. Channel coding adds less redundant bits in encoded bit sequence, the ability to against the noise is worse than the encoded bit sequence in 2(c), which $R = \frac{k}{n} = \frac{1}{3}$. To verify my assumption, let error probability from 0.001 to 0.01, and the result shows below.



For p smaller than 0.004, BER is not always 50%. However, when p = 0.002, BER = 35%, which is much larger than p, which means that channel coding in Q3 is not a good approach because little corruption in encoded bit leads to huge BER.

Appendix

Code

https://github.com/yuanchiachang/CommLab/blob/main/Lab5/src