

ECE4304 Homework Assignment Number 6

Due by 4:50pm on Wednesday 28-Feb-2007

1 Required Reading

- Haykin 9.5-9.11, 10.1-10.3

2 Problems

80 points total. You must show all of your work and your work must be neat to receive credit for a problem. Complete the following problems:

1. 15 points. Consider the discrete memoryless channel shown in Figure 1. Note that this channel is equivalent to two Z -channels in parallel. Compute its capacity as a function of r . Discuss any interesting special cases.

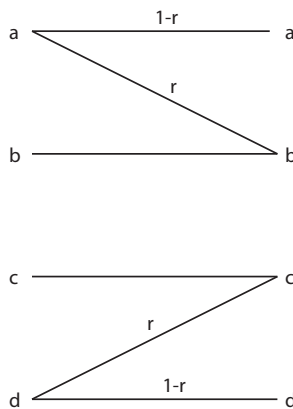


Figure 1: Discrete memoryless channel with $\mathcal{A}_X = \mathcal{A}_Y = \{a, b, c, d\}$.

2. 15 points. Consider the discrete memoryless channel shown in Figure 2. Note that this channel is a cascade of a binary symmetric channel and a Z -channel. Compute its capacity as a function of r and s . Discuss any interesting special cases.

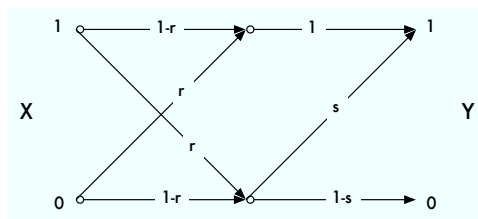


Figure 2: Discrete memoryless channel with $\mathcal{A}_X = \mathcal{A}_Y = \{0, 1\}$.

3. 10 points. Haykin 9.30.

4. 40 points. Suppose you have a 2-PAM communication system that operates with an uncoded signal to noise ratio of $\mathcal{E}_b/N_0 = 3\text{dB}$. Analyze and compare the performance of the uncoded system with the following coded systems:

- (7,4) Hamming coded system
- (15,11) Hamming coded system
- (15,7) BCH coded system
- (15,5) BCH coded system

Make sure your comparison between uncoded and coded systems is fair. Explicitly discuss any tradeoffs in each approach.