

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Department of Electrical and Computer Engineering

ECE 205A

Fall 2008

Instructor: K. Rose

Homework Assignment #1

(Due on Wednesday 10/15/2008)

Reading: Text, Chapters 1 and 2.

Problem # 1. In class we discussed the threefold repetition code for the binary symmetric channel. In this problem we consider the n -fold repetition code for BSC.

- a) Assume n is odd. Describe a suitable decoding algorithm, and write down an expression for the decoder error probability.
- b) Assume n is even and repeat (a).
- c) Work out your decoder error probabilities of parts (a) and (b) for the special cases $n = 1, 2, 3, 4$. Do you notice anything peculiar, and if so is it a coincidence?

Problem # 2. Text, Prob. 2.1 (Prob. 2.1 in 1st Edition).

Problem # 3. Text, Prob. 2.4 (Prob. 2.5 in 1st Edition).

Problem # 4. Let $f(x)$ be any function defined for all $x \geq 1$. If X is a discrete random variable with probabilities (p_1, p_2, \dots, p_n) , define the f -entropy of X by $H_f(X) = \sum_i p_i f(1/p_i)$. Note that our usual entropy is for the special case $f(x) = \log(x)$.

- a) If $f(x)$ is convex \cap find the best possible upper bound on $H_f(X)$ that depends only on n .
- b) If $f(x) = \log(x)/x$ show that $H_f(X) < \log(e)/e$ (note that $f(x)$ is not convex \cap .)

Problem # 5. Text, Prob. 2.12 (Prob. 2.16 in 1st Edition).