

EE 484

Homework 3

Due Monday, February 5, 2018

Work all 2 problems.

Note: For any Matlab exercises you should submit your Matlab code along with the rest of your solution to the given problem.

Problem 1. Recall that for BPSK signaling the probability of a bit error is

$$P_b = Q\left(\sqrt{\frac{2E_b}{N_0}}\right).$$

Now suppose we implement an error correction code, say, a (7,4) Hamming code ($n = 7$, $k = 4$). This code can correct 1 bit error in a block of size 7 bits. Plot on the same graph P_b vs. E_b/N_0 for both the uncoded and coded waveform. Remember to account for the coding overhead in your plot since E_b/N_0 applies to information bits. Your E_b/N_0 values should be in dB on the graph and should range from 0 to a large enough value so that $P_b \leq 10^{-10}$.

Problem 2. A receiver front end has a noise figure of 10 dB and a gain of 60 dB and a bandwidth of 8 MHz. The input signal power is 10^{-11} W. The antenna temperature is 170 K and $T_0 = 290$ K. Find T_e , T_s , N_{out} , SNR_{in} and SNR_{out} .