

EECS 562 Homework 15

1. Suppose a code with $n=5$ where each code word is required to contain exactly 2 1s, i.e., each code word of 5 bits in which 2 bits are 1 and the others 0.
 - a. List the valid codewords.
 - b. How many bits can be transmitted per codeword?
 - c. Define a mapping between message bits and code words.
2. What is the Hamming distance between 11010101 and 10100111?
3. A (7,3) linear code has check bits given by

$$\begin{pmatrix} d_1 \\ d_2 \\ d_3 \\ d_1 + d_2 \\ d_2 + d_3 \\ d_1 + d_2 + d_3 \\ d_1 + d_3 \end{pmatrix}$$
 - a. Find the G matrix.
 - b. Is this a systematic code?
 - c. Find the H matrix.
 - d. This code has N valid code words, what is N?
 - e. List all valid code words.
 - f. Find the minimum distance.
 - g. How many errors can the code detect?
 - h. How many errors can this code correct.
 - i. Use the H matrix to find the syndrome and determine if there is an error in the received code word {0,1,1,1,1,0,1}.
 - j. Find the Hamming distance between the received code word {0,1,1,1,1,0,1} and all valid code words.
 - k. Given a received code word {0,1,1,1,1,0,1} what was the transmitted message bits.
4. Let $g(x)=x^3+x+1$. The message is 0011.
 - a. What is n and k in (n,k) for this code?
 - b. What is r?
 - c. Find the code word.
 - d. Is this a systematic code?
 - e. What is the polynomial that corresponds received code word 1010111.
 - f. Using polynomial division determine if the received code word 1010111 in error?
5. The ASCII code for "g" is 110 0111.
 - a. Using even parity what is the code word?
 - b. If the BER=0.01 what is the probability of an undetected error.
 - c. Using odd parity what is the code word?
6. How many CRC bits are in a code word given $g(x)=x^{16}+x^{12}+x^5+1$?