ECE6606 Coding Theory and Applications

Homework 2

Do the following problems from Chapter 4 in textbook: 1, 2, 3, 6, 8ab, 11-15

EE 6082
Coding I
Exam 1

8:05-9:25 am Oct 21, 1997

Problem 1

Indicate whether each statement below is **true** or **false**. You need to give a short justification if your answer is false, no justification is required if your answer is true. Hint: each problem does not require very much work.

a) The set S={0,1,2,3,4,5,6,7,8} under mod-9 addition and multiplication forms a Galois field GF(9)

Ans:_____ Reason (if false)_____

b) Given the following generator matrix G for an (8,4) linear block code over GF(2), the vector v=01101001 is one of the codevectors generated by G.

$$G = \begin{matrix} 1\,1\,0\,1\,1\,0\,0\,0 \\ 1\,0\,1\,1\,0\,1\,0\,0 \\ 0\,0\,1\,0\,0\,0\,1\,0 \\ 1\,0\,1\,0\,0\,0\,0\,1 \end{matrix}$$

Ans:_____ Reason (if false)_____

c) The (15,11) Hamming code has one and only one parity check matrix H.

Ans:_____ Reason (if false)_____

d) For any a in GF(p) (assume p is prime), the additive inverse of a and the multiplicative inverse of a cannot be equal.

Ans:_____ Reason (if false)_____

Problem 2 Consider a systematic (5,2) linear block code whose codevectors $\underline{c}$ can be expressed in terms of message bits as:

$$\underline{c} = (m_0 + m_1 , m_0 + m_1 , m_1 , m_0 , m_1)$$

a) Find the generator matrix G and parity check matrix H in systematic form.
b) Find the codevectors $\underline{c}$ generated by G.
c) A portion of the standard array for this code is given below. Complete the standard array. (Next to the standard array is a list of the sequences that need to be added to the array.)
d) What is the error correcting and error detecting capability of this code?

	Standard Array			Syndrome $\underline{s}$	Sequences to be added to table	
00000				000	11010	01011
	11100	11011	00110	111	10000	11000
	11111		00101		00100	10111
	11001	11110			00001	10101
		10010	01111	010	00010	10011
	01101	01010			01001	00011
	10100		01110	101	10001	11101
	01100		10110		01000	00111

Problem 3 Consider a code C={0000,1111,0101,1010}

a) Is the code linear? Justify your answer.
b) What is the code dimension? Justify your answer.
c) Give a basis for the code subspace.
d) What is the error correcting/detecting capability of the code?
e) Find the dual code of C and its dimension.
f) Give a basis for the dual space.