Homework V

Due: February 26, 2009

Problem 1. Let $n = 15$ and let C be the linear cyclic code generated by the polynomial

$$g(x) = 1 + x^4 + x^6 + x^7 + x^8.$$

(a) Decode $w = 111011101100000$.

(b) Find a generator matrix for $C^{\perp}$.

Problem 2. Let $n = 15$ and let C be the linear cyclic code generated by the polynomial

$$g(x) = 1 + x + x^2 + x^3 + x^6.$$

(a) Decode $w = 111011101100000$.

(b) Find a generator matrix for $C^{\perp}$.

(c) The code $C^{\perp}$ was used and the following words were received:

$$v_1 = 111100010111101\,,\ v_2 = 101110111011111\,,\ v_3 = 101111110001011\,,\ v_4 = 111101000001000\,;$$

correct those words using the *Cyclic Decoding Algorithm* and indicate all the corrected words that are in $C^{\perp}$.

Problem 3. Let $n = 9$ and let C be the linear cyclic code generated by the polynomial

$$g(x) = 1 + x + x^2.$$

(a) Find a generator matrix for $C^{\perp}$.

(b) Find all the words of $C^{\perp}$

(c) Suppose the following words are received:

$$\widehat{w}_1 = 011101011, \quad \widehat{w}_2 = 001110110, \quad \widehat{w}_3 = 101111101, \quad \text{and} \quad \widehat{w}_4 = 100001111\,.$$

If $\mathcal{L} > 1$, then use burst-error-correcting algorithm to decode each word.

Problem 4. Consider the Hadamard code $C_{4m} = C_8$, then:

(a) Use the generator matrix to encode:

$$m_1 = 1\,1\,0\,1, \quad m_2 = 0\,1\,0\,0, \quad m_3 = 1\,0\,1\,1, \quad \text{and} \quad m_4 = 0\,0\,1\,0\,.$$

(b) Suppose the following words are received:

$$\widehat{w}_1 = 1001\ 1110, \quad \widehat{w}_2 = 1100\ 1110, \quad \widehat{w}_3 = 1101\ 1011, \quad \text{and} \quad \widehat{w}_4 = 1001\ 1001\,.$$

Then decode each word.