KFUPM-EE DEPT.
EE430: Information Theory and Coding
Problem Set # 5

1. Perform the following calculation in GF(2)[x]
   a) $(1+x)(1+x^2)+x^3$
   b) $x+x^4 \bmod x^2+1$
   c) $1+x+x^2 \bmod 1+x$

2. For polynomials in GF(2)[x], show that

$$\left(1+x^n\right)^2 = 1+x^{2n}$$

3. Given that $X^9+1=(X+1)(X^2+X+1)(X^6+X^3+1)$ determine the cyclic codes with block length 9.

4. Determine the parity-check polynomial of the (15,5) cyclic code with generator polynomial given by:

$$g(X)=1+X+X^2+X^4+X^5+X^8+X^{10}$$

5. Show that the following linear code with generator matrix **G** is not cyclic:

$$\mathbf{G}=\begin{bmatrix} 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \end{bmatrix}$$

6. The generator polynomial of a (15,11) Hamming code is defined by:

$$g(X)=1+X+X^4$$

   Develop the encoder and syndrome calculator for this code, using a systematic form for the code.

7. Consider the (7,4) Hamming code defined by the generator polynomial:

$$g(X)=1+X+X^3$$

   The code word 0111001 is sent over a noisy channel, producing the received word 0101001 that has a single error. Determine the syndrome polynomial s(X) for this received word, and show that it is identical to the error polynomial e(X).

8. Construct a systematic (7,3) cyclic code.

Try problems from the textbook by *Richard B. Wells.*

Note: *answers will not be posted. If you have any question you may visit in the office hours or by an appointment***.**

Doing a mistake in the HW is better than doing it in the exam! **Best regards, Dr. Ali Muqaibel**