CMSC 442/653
Instructor: Dr. Lomonaco
Homework 5

- **Listening Assignment:** Listen to Aaron Copeland's Danzon Cubano
- **Reading Assignment:** http://www.csee.umbc.edu/~lomonaco/f14/653/handouts/Extended-Euclidean-Algorithm.pdf
- **Optional Reading assignment:** Peterson & Weldon, "Error-Correcting Codes," MIT Press, (Second Edition), Chapters 2, 3, 6.

1) Let V be a binary linear code given by the generator matrix

$$G = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

a) Find a parity check matrix H of V.

b) Use H to create an maximum likelihood error/syndrome table without first constructing the standard array.

c) Demonstrate how your error/syndrome table can be used to decode the received vector $\mathbf{r = 111101}$.

2) Let V be the Hamming $[15,11]\, d = 3$ binary linear code.

a) Write down the parity check matrix H.
b) If

$$\vec{r} = 1000 \quad 1000 \quad 0000 \quad 001$$

is a received vector, then what is the most likely error pattern. What is the most likely codevector that was originally sent? Please explain how you obtained your answers.

3) Let V be the Extended Hamming $[16,11]\, d = 3$ binary linear code.

a) Write down the parity check matrix H.
b) Assuming the Binary Erasure Channel (BEC), if

$$\vec{r} = 10?1 \quad 1001 \quad ?001 \quad 1001$$

is the received vector, then what is the most likely most likely codevector that was originally sent? Please explain how you obtained your answers.

4) Use the Extended Euclidean Algorithm to compute the multiplicative inverse

$$497^{-1} \pmod{899}$$

Please show your work.

5) Use the Extended Euclidean Algorithm to compute the multiplicative inverse

$$\left(x^5 + x^2 + 1\right)^{-1} \pmod{x^{10} + x^3 + 1}$$