CMSC 442/653
Spring 2009
Instructor: Dr. Lomonaco
Homework 4

- Listen to Igor Stravinsky's Firebird
- **Reading Assignment:** Review relevant slides on "Overview of Coding Theory" found at http://www.cs.umbc.edu/~lomonaco/f06/653/Slides653.html
- **Optional Reading assignment:** Peterson & Weldon, "Error-Correcting Codes," MIT Press, (Second Edition), Chapter 3, Pages 40-47.

1) Let V be the linear code over $GF(3)$ determined by the generator matrix

$$G = \begin{pmatrix} 0 & 2 & 1 & 2 & 0 \\ 2 & 1 & 1 & 0 & 2 \\ 2 & 2 & 0 & 1 & 1 \end{pmatrix}$$

        a) What is the length n of V.
        b) Put the generator matrix of V in echelon canonical form to find the dimension k of V.
        c) Find a parity check matrix H for the linear code V.

2) Let V be the 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) Use the generator matrix to create a list of all code vectors of V.
        b) Use the list generated in a) to determine the minimum d distance of V
        c) Explain why it is easier to find the minimum distance for a linear code than it is for a non-linear code.
        d) Find a parity check matrix H of the binary linear code V.

3) Let V be the binary linear code given by the parity check matrix

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

    Find a generator matrix G for V.