

CMSC 442 Fall 2001
Homework 3

- **READING ASSIGNMENT:** Peterson & Weldon, “**Error-Correcting Codes,**” MIT Press, (Second Edition), (1986), Chapter 3, Sections 3.1-3.2
- **READING ASSIGNMENT:** Peterson & Weldon, “**Error-Correcting Codes,**” MIT Press, (Second Edition), (1986), Chapter 5.
- **OPTIONAL READING ASSIGNMENT:** MacWilliams & Sloane, “**The Theory of Error-Correcting Codes,**” North-Holland (Second Edition), (1983), Chapter 1.

1. Consider the Hamming (15, 11) 3 binary code V

- a) Write down the parity check matrix H
- b) Find the generator matrix G for V . Please explain how you obtained your answer.
- c) If

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

is a received vector, then what is the most likely error pattern. Please explain how you obtained your answer.

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) Put G in reduced echelon canonical form. Please show your work.
 - b) Use the generator matrix found in part a) to find a parity check matrix H of V . Please show your work.
 - c) Use the parity check matrix H of b) to find the minimum non-zero distance d of V . Please explain how you obtained your answer.
 - d) Construct a maximum likelihood error/syndrome table for V .
3. Prove that if a binary linear code V has at least one code vector of odd weight, then half the code vectors are of even weight, and the other half are of odd weight.
4. Devise a procedure for correcting double erasures for the Hamming (15, 11) 3 code.