

**CMSC 442 Fall 2003**  
**Homework 4**

- **READING ASSIGNMENT:** Peterson & Weldon, “**Error-Correcting Codes,**” MIT Press, (Second Edition), (1986), Chapter 3, pages 40-47, pages 52-56.

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

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

Determine a parity check matrix  $H$  for  $V$ . What is the dimension of  $V$  ?

2) Form a maximum-likelihood decoding table for the binary code consisting of the four codewords 0000, 0011, 1100, and 1111.

3) 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) Find a parity check matrix  $H$  for  $V$  .
- b) Construct a maximum likelihood decoding table for  $V$  .
- c) Use  $H$  to reduce the maximum likelihood decoding table of **b)** to an error/syndrome table.
- d) Demonstrate how your error/syndrome table can be used to decode the received vector

$$r = 111101.$$

- e) Use the generator matrix to create a list of all code vectors of  $V$ . Then use this list to determine the minimum distance of  $V$ .