

**CMSC 442 Fall 2003**  
**Homework 7**

- **READING ASSIGNMENT:** Peterson & Weldon, “**Error-Correcting Codes,**” MIT Press, (Second Edition), (1986), Chapter 8.

- 1) Let  $V$  denote the cyclic code of length 15 in  $R_{15} = GF(2)[x]/\langle x^{15} + 1 \rangle$  given by the generator polynomial

$$g(x) = x^8 + x^4 + x^2 + x + 1.$$

- a) Use  $g(x)$  to compute the generator matrix  $G$  of  $V$ . What is the dimension of  $V$ ?
- b) Compute the parity check polynomial  $h(x)$  of  $V$ .
- c) Use  $h(x)$  to compute a generator matrix of  $V^\perp$ .
- d) From  $h(x)$ , compute the generator polynomial of  $V^\perp$ .
- e) Use the polynomial computed in d) to compute the parity check matrix  $H$  of  $V$ .

- 2) Let  $V = \langle g(x) \rangle$  be the binary cyclic code of length 7 with generator polynomial

$$g(x) = x^4 + x^2 + x + 1$$

- a) Find the systematic basis  $\{x^j + r_j(x)\}$  of  $V$ .
- b) Use the above systematic basis of  $V$  to construct a systematic generator matrix  $G$  of  $V$ .
- b) Use the remainders  $r_j(x)$  to construct a systematic parity check matrix  $H$  of  $V$ .