

CMSC 442/653
Fall 2006
Instructor: Dr. Lomonaco
Homework 6

- **Reading Assignment:** Read the handout entitled “The MacWilliams and Pless Identities: A Summary” found at <http://www.cs.umbc.edu/~lomonaco/f06/653/handouts/MacWilliams-Pless-Identities.pdf>
- **Optional Reading assignment:** Peterson & Weldon, "Error-Correcting Codes," MIT Press, (Second Edition), Chapter 3, Sections 3.8
- **Optional Reading assignment:** Vera Pless, “Introduction to the Theory of Error-Correcting Codes,” John Wiley & Son, (1982), Chapter 8.

1U) Let V be the linear code over $GF(2)$ given by the following generator matrix

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

- a) What is the length n of V ? What the dimension k of V ? Please explain your answer.
- b) Find a parity check matrix H for V .
- c) Use the parity check matrix H to list all the elements of the dual code V^\perp .
- d) Use the results of c) to create a weight distribution table, i.e., a table with two columns labeled respectively j and A_j .
- e) Use the table created in d) to find the weight enumerator polynomial $A^\perp(x)$ of the dual code V^\perp .
- f) Use the MacWilliams identity to compute the weight enumerator polynomial $A(x)$ of the original linear code V .
- g) Use the weight enumerator polynomial $A(x)$ to find the minimum distance of V .