

Math 641, Fall 1999

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**Exercise Set 3, \* exercises due Friday, October 15, 1999**

\* 1. Let  $C$  be the Hamming code over  $F_q$  with parameters  $n = (q^r - 1)/(q - 1)$ ,  $k = n - r$  and  $d = 3$ . Define the  $q$ -ary *simplex code* to be the dual of  $C$ . Prove that the minimum distance of the  $q$ -ary simplex code is  $q^{r-1}$  and find its weight distribution. Also show that the  $q$ -ary simplex code meets the Griesmer bound.

\* 2. Consider the linear code  $C$  over  $Z_5$  with generator matrix

$$\begin{bmatrix} 1 & 0 & 4 & 2 & 3 & 1 \\ 0 & 1 & 4 & 1 & 0 & 2 \end{bmatrix}.$$

(i) Find the weight distribution of  $C$ .

(ii) Apply the MacWilliams identity to obtain the weight distribution of  $C^\perp$ .

\* 3. Prove that all binary simplex codes of dimension at least 3 are self orthogonal.