

Problem sheet 6  
2005, Feb. 17th

## MT361 ERROR CORRECTING CODES

**Ex. 1**

There exists a perfect  $[23, 12, 7]$  code. Determine the number of codewords of weight  $0, 1, 2, 3, \dots, 23$  (use the code is perfect!) From this determine the probability  $p_{\text{correct}}$  of correct decoding a word of length 23.

**Ex. 2**

Prove: Suppose  $C$  is a linear  $[n, k]$ -code having generator matrix  $G$ . Then a vector  $\vec{v} \in V(n, q)$  belongs to  $C^\perp \Leftrightarrow \vec{v}G^\top = 0$ , where  $G^\top$  denotes the transpose of  $G$ .

**Ex. 3**

Determine the dual codes  $C_1^\perp$  and  $C_2^\perp$  for  $C_1 = \{000, 111\}$  and  $C_2 = \{00000, 11111\}$ .

**Ex. 4**

Prove that if  $E_n$  is the binary even weight code of length  $n$ , then  $E_n^\perp$  is the repetition code of length  $n$ . Give the generator matrices and the parity check matrices for the two codes.

**Ex. 5**

Let  $C$  be the ternary linear code with generator matrix

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

- Find a generator matrix  $G$  for  $C$  in standard form
- Find a parity check matrix  $H$  for  $C$  in standard form.