

MA210

Exercises 10

- (1) Let
- C
- be the linear code of length
- n
- with check matrix

$$H = [\underbrace{1\ 1\ 1\ \dots\ 1}_n].$$

Show that C is the parity check code (defined in lectures).

- (2) Let C be the d -repetition code of length n . Show that C is a linear code.
 (3) (a) Let C be the linear code with check matrix

$$H = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Determine the length n of C , the dimension k of C , the minimum distance d of C . (We then refer to C as an $[n, k, d]$ -code.)

- (b) The following words were received:

$$11111, \quad 011011, \quad 01100.$$

Decide which of the above are codewords, and correct those which are not codewords, assuming that only one error has been made.

- (4) Let
- C
- be the linear code with check matrix

$$H = \begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 \end{bmatrix}$$

If the word 110110 is received, and at most one error has been made, what was the intended codeword?

- (5) (a) Let
- C
- be a code of length
- n
- . Suppose that
- C
- is 1-error-correcting. Prove that

$$|C| \leq \frac{2^n}{n+1}.$$

- (b) Show there is no 1-error-correcting code of length 5 with
- $|C| = 6$
- .

You must justify the answers to all problems!

These exercises are to be handed in **before 16.55pm on May 6, 2009**.