# Hamming Distance

## Information Theory Exercises

1. For the following error control code, do the following:

   a. compute the minimum Hamming distance and indicate how many errors it can detect and how many errors it can correct, with the nearest neighbor decoding algorithm;

   b. considering two received codewords, $\mathbf{r_1} = 11100$ and $\mathbf{r_2} = 00011$, perform decoding and say if there are errors, and if so then correct the errors (find the correct codeword and indicate where the errors are located);

   c. Give an example of errors the code cannot detect, and another example of errors it can detect but it cannot correct, using the nearest neighbor decoding algorithm.

   | Message | Codeword |
   |---------|----------|
   | $s_1$ | $c_1 = 00000$ |
   | $s_2$ | $c_2 = 10011$ |
   | $s_3$ | $c_3 = 11100$ |
   | $s_4$ | $c_4 = 00111$ |

2. Design a block code consisting of 4 codewords, with minimum codeword length, which is able to detect 3 errors in a codeword.

3. Design a block code consisting of 4 codewords, with minimum codeword length, which is able to correct 2 errors in a codeword.