CCE5102 Information Theory and Coding
Tutorial 2
Linear Block Codes

1. Consider the binary linear block code whose generator matrix is

$$G = \begin{bmatrix} 1\,0\,1\,0\,1\,1 \\ 0\,1\,1\,1\,1\,0 \\ 0\,0\,0\,1\,1\,1 \end{bmatrix}$$

   (a) Find the generator matrix in systematic form for an equivalent code
   (b) Find the parity check matrix H for the code in (a).
   (c) Find the codeword that has [110] as its information word.
   (d) What is the minimum distance for the code?

2. A binary linear block code C has a generator matrix

$$G = \begin{bmatrix} 1\,0\,1 \\ 1\,1\,0 \end{bmatrix}$$

   (a) Find the weight distribution W[C]
   (b) Using elementary row operations obtain G' in a systematic form
   (c) Show that the weight distribution W[C'] from G' is the same as W[C]

3. A binary linear block code C has a generator matrix

$$G = \begin{bmatrix} 1\,0\,0\,1\,1 \\ 0\,1\,0\,1\,0 \\ 0\,0\,1\,0\,1 \end{bmatrix}$$

   (a) What are the values of length n, and dimension k of the code?
   (b) Find the weight distribution W[C] and use it to determine the probability of an undetected error
   (c) Determine the error correcting probability, t, of C
   (d) Find the parity check matrix H of C.
   (e) Find the standard array of C, based on H
   (f) Use standard array decoding to find the closest code word to the received word r=[1 1 0 1 1]

4. Consider an (8,4) systematic code whose parity-check equations are given by

$$p_3 = d_0 + d_2 + d_3$$
$$p_2 = d_0 + d_1 + d_3$$
$$p_1 = d_0 + d_1 + d_2$$
$$p_0 = d_1 + d_2 + d_3$$

   (a) Find the generator matrix [P I_4] for the code, C.
   (b) Work out the parity check matrix of C.
   (c) Show that the minimum distance of C is 4.