SC461- Coding Theory and Applications

Home Work 2

Spring 2014

(1) Show that the generator matrices G and G' generates equivalent binary codes. Find their parameters $[n, k, d]$.

$$G = \begin{bmatrix} 1100 \\ 0110 \\ 0011 \end{bmatrix} \text{ and } G' = \begin{bmatrix} 1001 \\ 0101 \\ 0011 \end{bmatrix}.$$

(2) Let $\mathbb{C}$ be the binary linear code with generator matrix G given below. Find a generator matrix G in standard form. Hence find parity check matrix H in standard form. Show that $GH^t = 0$.

$$G = \begin{bmatrix} 1110000 \\ 1001100 \\ 1000011 \\ 0101010 \end{bmatrix}.$$

(3) List all the codewords for each code $\mathbb{C}_i, 1 \leq i \leq 3$ having parity check matrices H_i given below. Also find the generator matrix as well for each. Find their parameters $[n, k, d]$.

$$H_1 = \begin{bmatrix} 1010 \\ 1101 \end{bmatrix}, \; H_2 = \begin{bmatrix} 0111 \\ 1101 \end{bmatrix} \text{ and } H_3 = \begin{bmatrix} 0111100 \\ 1011010 \\ 1101001 \end{bmatrix}.$$

(4) Let $\mathbb{C}$ be a binary code generated by the following parity check matrix H. Find the parameters $[n, k, d]$ of the code. Construct a generator matrix G for $\mathbb{C}$ and use it encode the message 0110. Use G to encode $x_1x_2x_3x_4$. Use H to encode the message 0110 and $x_1x_2x_3x_4$.

$$H = \begin{bmatrix} 0111100 \\ 1011010 \\ 1101001 \end{bmatrix}.$$

(5) Construct standard arrays for codes having each of the following generating matrices:

$$G_1 = \begin{bmatrix} 10 \\ 01 \end{bmatrix} \text{ and } G_2 = \begin{bmatrix} 101 \\ 011 \end{bmatrix} \text{ and } G_3 = \begin{bmatrix} 10110 \\ 01011 \end{bmatrix}.$$

Using array decoding of third array (formed by G_3) (a) decode the received vectors 11111 and 01011

(b) give examples of (i) two errors occurring in a codeword and being corrected. (ii) two errors occurring in a codeword and not being corrected.