ECS 452 Additional Examples for Section 5.1

1. Suppose the generator matrix of a linear code is given by

$$\mathbf{G} = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix} \begin{matrix} \underline{g}^{(1)} \\ \underline{g}^{(2)} \\ \underline{g}^{(3)} \end{matrix}$$

   a. Find the codeword for the message $\underline{\mathbf{b}}$ = [1 0 0]

$$\underline{x} = \underline{b}\,G = [1\ 0\ 0] \begin{bmatrix} \underline{g}^{(1)} \\ \underline{g}^{(2)} \\ \underline{g}^{(3)} \end{bmatrix} = (1 \cdot \underline{g}^{(1)}) \oplus (0 \cdot \underline{g}^{(2)}) \oplus (0 \cdot \underline{g}^{(3)}) = \underline{g}^{(1)}$$

$$= [1\ 0\ 0\ 1\ 0\ 1]$$

   b. Find the codeword for the message $\underline{\mathbf{b}}$ = [0 1 1]

$$\underline{x} = \underline{g}^{(2)} \oplus \underline{g}^{(3)} = [0\ 1\ 1\ 1\ 0\ 1]$$

2. Suppose the generator matrix of a linear code is given by

$$\mathbf{G} = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{bmatrix} \oplus$$

   a. Find the codeword for the message $\underline{\mathbf{b}}$ = [1 0 0 0] $\quad$ [1 1 1 0 0 0 0]

   b. Find the codeword for the message $\underline{\mathbf{b}}$ = [0 1 1 0] $\quad$ [1 0 1 1 0 1 0]

3. Suppose the generator matrix of a linear code is given by

$$\mathbf{G} = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$$

   Find the complete codebook of this code.