Assignment 3

CN8811 Multimedia Processing and Digital Communications

(Chap4: Channel coding)

1. Considering the following $(k+1,k)$ systematic linear block code with the parity-check digit c_{k+1} given by

$$c_{k+1} = d_1 + d_2 + \cdots + d_k$$

   (a) Construct the appropriate generator matrix for this code.

   (b) Construct the code generated by this matrix for $k = 3$.

   (c) Determine the error detecting or correcting capabilities of this code.

   (d) show that

$$\mathbf{c}\mathbf{H}^T = 0$$

   and

$$\mathbf{r}\mathbf{H}^T = \begin{cases} \mathbf{0} & \text{if no error occurs} \\ \mathbf{1} & \text{if single error occurs} \end{cases}$$

2. Consider a (6,2) code generated by the matrix

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

   (a) Construct the code table for this code and determine the minimum distance between code words.

   (b) Prepare a suitable decoding table. *Hints:* This code can correct all single-error pattern, seven double-error patterns, and two triple-error patterns. Choose the desired seven double-error patterns and the two triple-error patterns.

3. (a) Construct a systematic (7,4) cyclic code using the generator polynomial $g(x) = x^3 + x + 1$.

   (b) What are the error correcting capabilities of this code?

   (c) Construct the decoding table.

   (d) If the received word is **1101100**, determine the transmitted data word.

4. Textbook: 6.2, 6.8, 6.9, 6.10, 6.18, 7.1, 7.3,