Principles of Communications Networks
Homework assignment 1

Due date: 2019/4/24 (Friday) 6pm

Note: 請用 A4 空白影印紙做答，並繳交至助教實驗室(工程三館 446B)

Note: please using A4 copy paper as your answer sheet, and turn in your answer sheet to TAs (EC Building 446B)

1. The following matrix represents a generator matrix for a (7,4) block code. What is the corresponding parity check matrix **H**? What's the code word of (10101110)? If the received code word is (00111100001110), what would be the corresponding syndrome? Meanwhile, please validate your answers by using Matlab.

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

2. Consider the convolutional encoder, what's the encoded sequence of message sequence 10011? If the received encoded sequence is (01, 10, 10, 11, 10), what's the decoded transmit sequence? And what's the error rate?

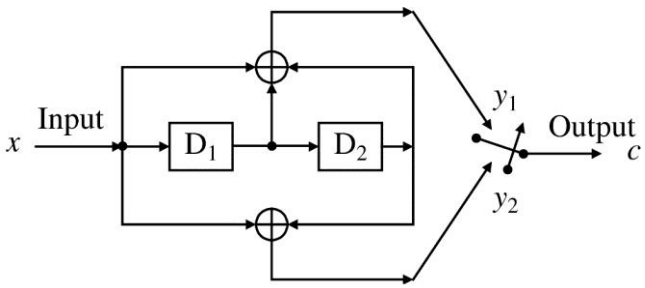
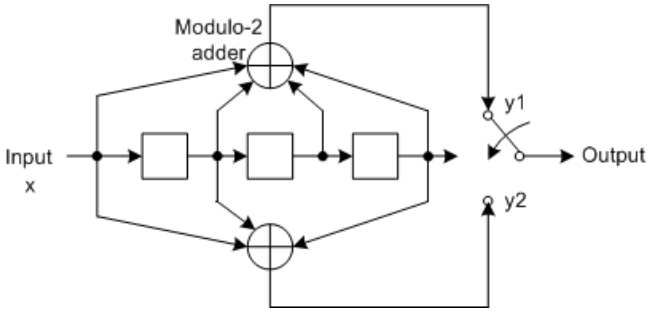


Figure 4.3 Convolutional code encoder.

3. The following figure shows the encoder for a 1/2 rate convolutional code.
   (a) Please find the state diagram.
   (b) Assume the initial state of the encoder is zero. Please determine the encoder output produced by the message sequence 1011.



4. Assume the max retransmission is 5 (最多重傳 5 次，再加上第一次傳送，等於一個 block 可以最多傳送 6 次)。The adopted coding scheme is linear block code (8, 4), and assume the ACK/NAK is error free. We further assume that there are 1,000 blocks to be transmitted, the distance from the transmitter to the receiver is 3 km, the transmission data rate is 1Mbps, and the bit error rate is 10^{-5}. Is it possible that Go-Back-N ARQ scheme performs better than Selective Repeat ARQ scheme in total transmission time, and when?