Information and Coding Theory

ENEE 5304

Problem Set 6

Convolutional Encoders

1. Consider a convolutional encoder described by the two polynomial functions (1, 1, 1) and (1, 1, 0), where the output bits are related to the input bits by:

$$u_1 = m_t + m_{t-1} + m_{t-2}$$

$$u_2 = m_t + m_{t-1}$$

   a. Find the block diagram of the encoder
   b. Find the rate of the encoder
   c. Use basic equations above to find the output corresponding to (101100)
   d. Construct the state diagram of the encoder
   e. Construct the trellis diagram of the encoder.
   f. Use the trellis diagram to find the codeword corresponding to the message in Part
     c

2. Consider the convolutional encoder shown in the figure below
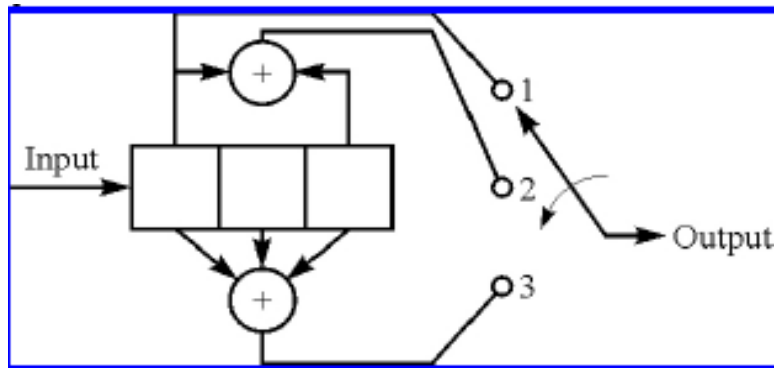
   a. Construct the state diagram for the encoder
   b. Construct the trellis diagram for the encoder
   c. Use either the state diagram or the trellis to find the codeword corresponding to the message 011110
   d. Use Viterbi algorithm (the trellis diagram) to decode the received sequence 101001100001011.

3. Consider the convolutional encoder shown in the figure below
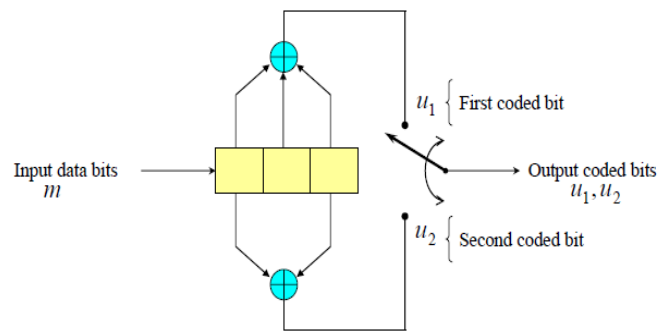
a. Find the codewords corresponding to the messages 01000 and 10100.
b. Find the Hamming distance between the codewords of Part a.