

# Information and Coding Theory

ENEE 5304

## Problem Set 6

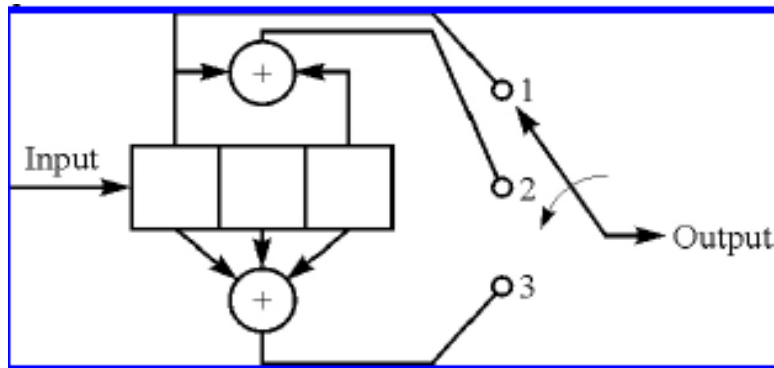
### Convolutional Encoders

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:

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

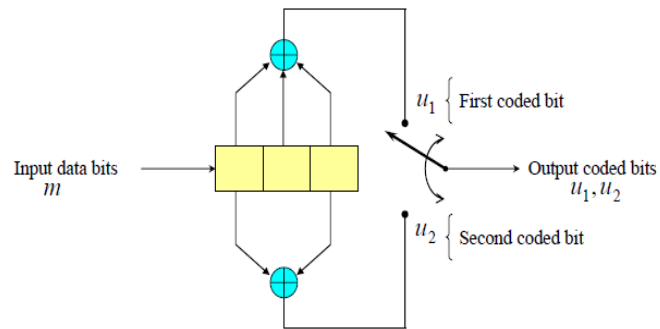
$$u_2 = m_t + m_{t-1}$$

- 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.