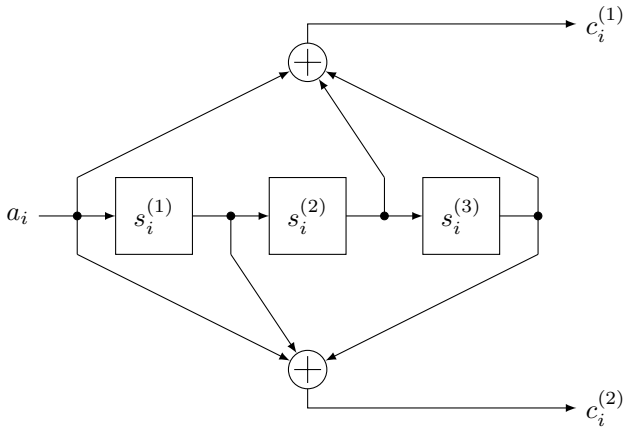
Carleton University

SYSC 5504	**Department of Systems and Computer Engineering**	
ELG 6154	**Principles of Digital Communications**	**Fall 2017/18**

Assignment #4

Due on Tuesday, December 5, 2017

1. For the convolutional encoder shown below:



   (a) Draw the state diagram.

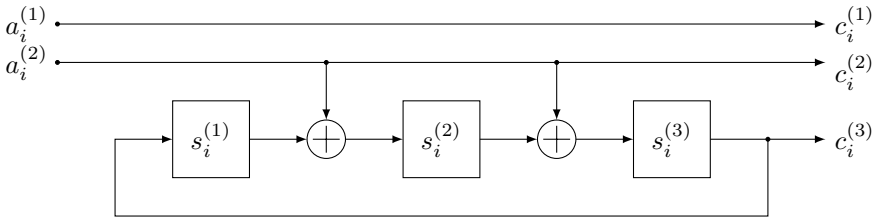
   (b) What is the code sequence corresponding to the message sequence $\underline{a} = 01010$? Do not forget about the trellis termination

   (c) Suppose that a four-bit message sequence has been encoded using this encoder and sent via a binary symmetric channel with crossover probability $p = 0.1$. The received sequence is

   $$\underline{r} = 11\ 11\ 01\ 01\ 10\ 11\ 11\ .$$

   Use the Viterbi algorithm with hard-decision decoding to find the most likely message sequence. Trace the decisions on a trellis diagram, labelling the partial path metric of each survivor at each time unit. What is the smallest possible Hamming distance between any of the possible code sequences and this received sequence?

2. Consider the recursive systematic convolutional encoder shown below.



   (a) Draw the state diagram.

   (b) What is the code sequence for the message sequence $\underline{a} = 10101$?

   (c) What is the code sequence for the message sequence $\underline{a} = 0100$?