

ECE 204L - BINARY NUMBERS AND CODES - LAB 10 TWO'S COMPLEMENTS

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OBJECTIVE

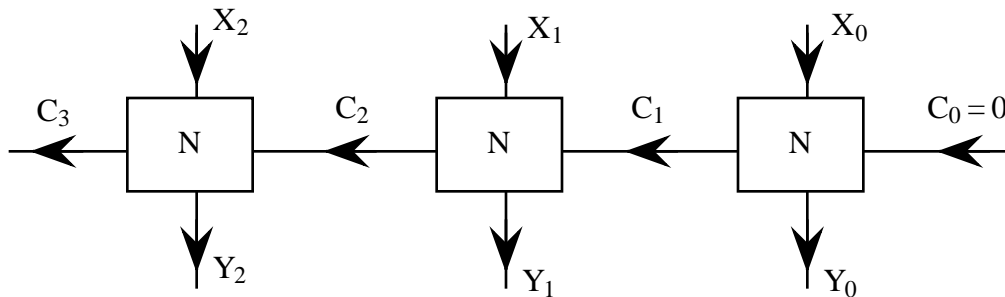
The objective of this lab is to design and build an iterative circuit that produces two's complements of binary numbers.

LAB

1. **Prelab** - What is meant by an iterative circuit
2. **Prelab** - Make use of the following algorithm for taking 2's complements
 - (1) $y_0 = x_0, y_1 = x_1, \dots, y_k = x_k$ until we reach the first bit x_k that is equal to 1
 - (2) $y_{k+1} = x_{k+1}, y_{k+2} = x_{k+2}, \dots, y_n = x_n$ for the remaining bits

to obtain the 2's complement of $x = 111001010^2$. Note that the superscript 2 indicates that x is a 2's complement number

3. The objective of this problem is to implement a 2's complementer as described in Problem (2) with an iterative circuit as follows

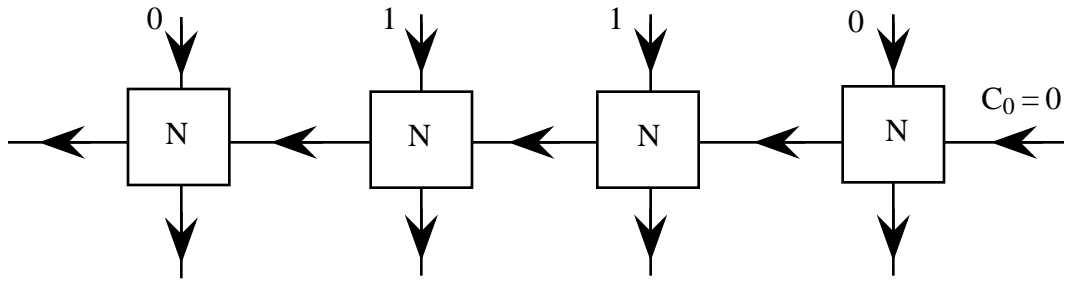


with C_{i+1} and Y_i given by

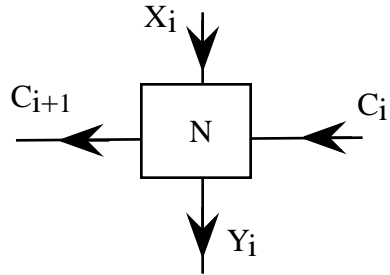
$$Y_i = \begin{cases} X_i & \text{if } C_i = 0 \\ X_i \oplus 1 & \text{if } C_i = 1 \end{cases} \quad C_{i+1} = \begin{cases} 1 & \text{if } C_i = 1 \text{ or } X_i = 1 \\ 0 & \text{otherwise} \end{cases}$$

Note in particular that $C_i = 0$ tells N to not complement x_i
 $C_i = 1$ tells N to complement x_i

- a. **Prelab** - Explain how this circuit takes the 2's complements of X
- b. **Prelab** - Make use of the following circuit to obtain the 2's complement of 01110^2 . Be sure to redraw the circuit with the values of the control signals C



c. **Prelab** - Design a block N of the iterative circuit as follows



- d. Build and test your circuit N in part (c)
- e. Build and test a two stage iterative 2's complementer as follows

