Numbers in the Fibonacci Sequence Circuit
PC/CP220 Project Phase II

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Equations

The equations for each output are as follows:

- $b_3 = a_2 a_1$
- $b_2 = a_2 a_0$
- $b_1 = \bar{a}_2 a_1 a_0 + a_2 \bar{a}_1 \bar{a}_0$
- $b_0 = \bar{a}_1 a_0 + a_2 \bar{a}_1 + \bar{a}_1 a_0 + \bar{a}_2 a_1 \bar{a}_0$

a_2 is the most significant input bit, while a_0 is the least significant input bit. b_3 is the most significant output bit, while b_0 is the least significant output bit.

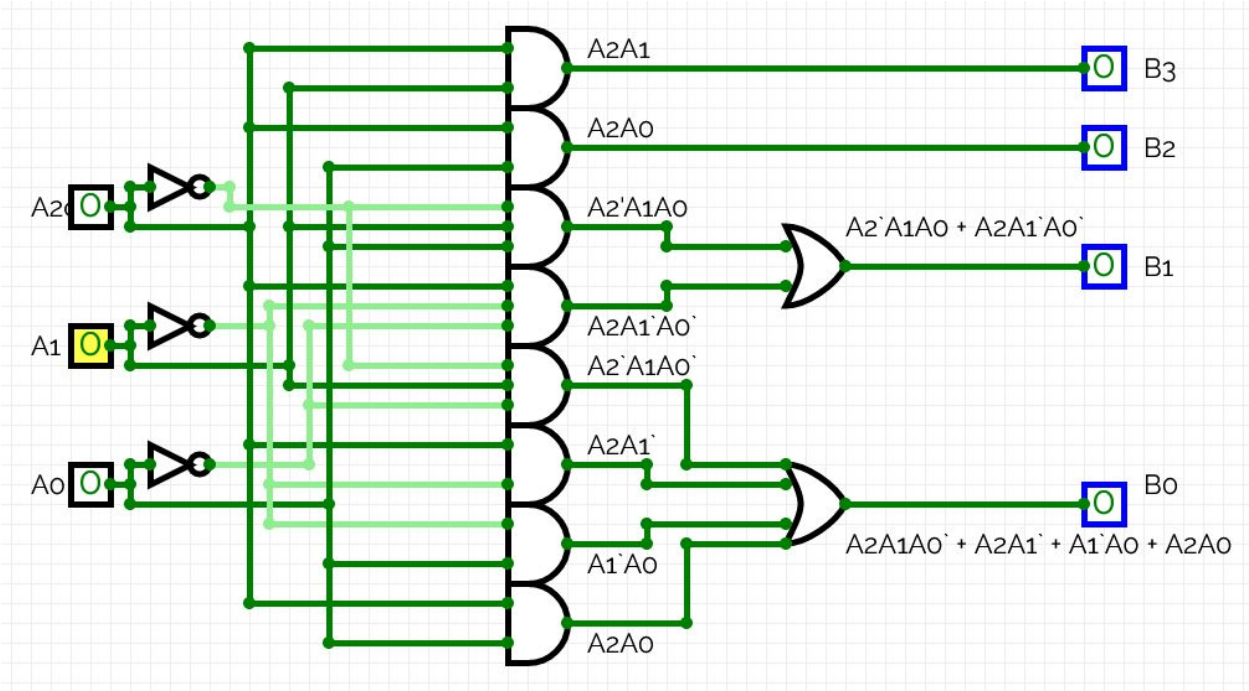
Circuit Diagram

The following circuit was created in Circuitverse. The three inputs, a_2, a_1, and a_0 each represent a bit of the number n, which represents the n^{th} term of the Fibonacci Sequence. The four outputs, b_3, b_2, b_1, b_0, represent one bit of the value of the n^{th} term of the Fibonacci Sequence.

Simulation

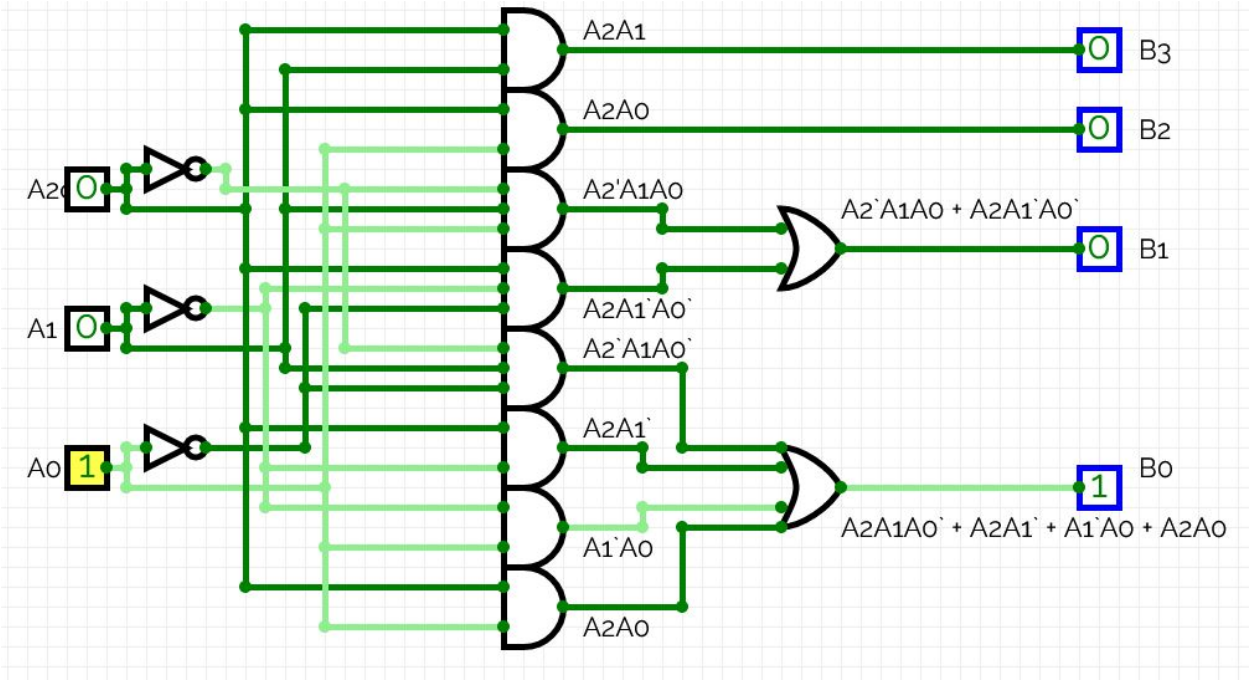
The circuit simulates the input of the numbers 0 to 7 in binary, matched by the corresponding output as seen in the following table.

Number (n)	$a_2a_1a_0$	n^{th} term in the Fibonacci Sequence	$b_3b_2b_1b_0$
0	000	0	0000
1	001	1	0001
2	010	1	0001
3	011	2	0010
4	100	3	0011
5	101	5	0101
6	110	8	1000
7	111	13	1101



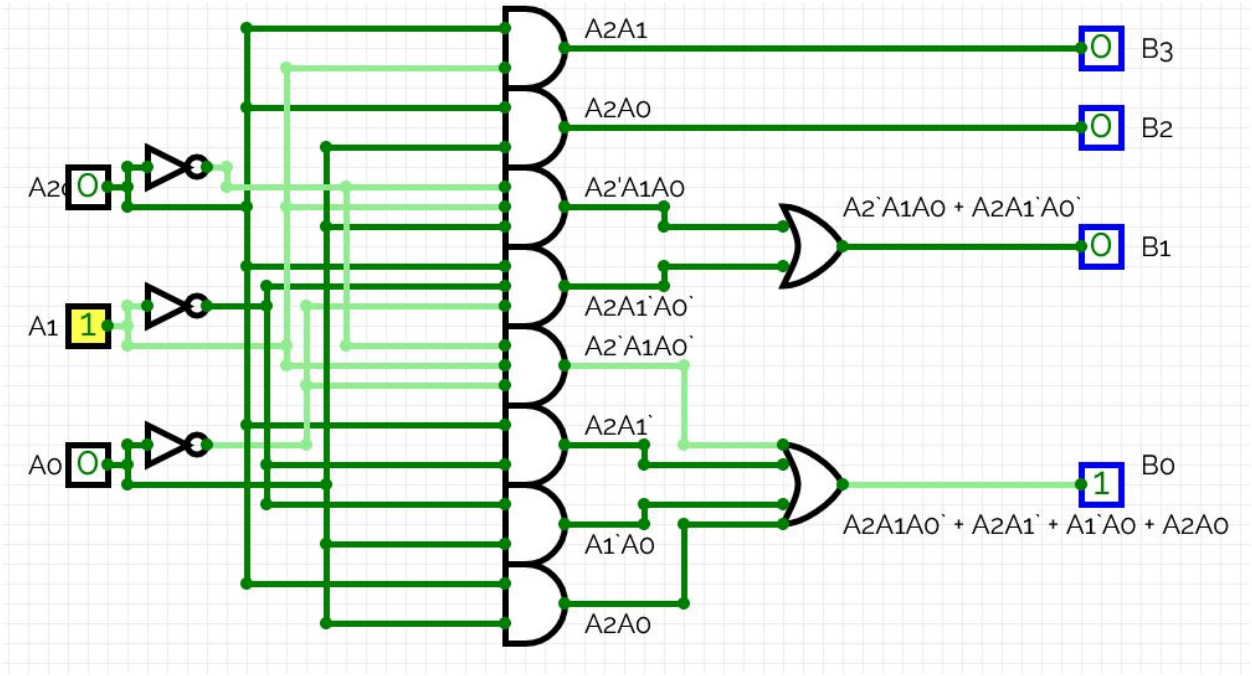
Input: $000_2/0_{10}$

Output: $0000_2/0_{10}$



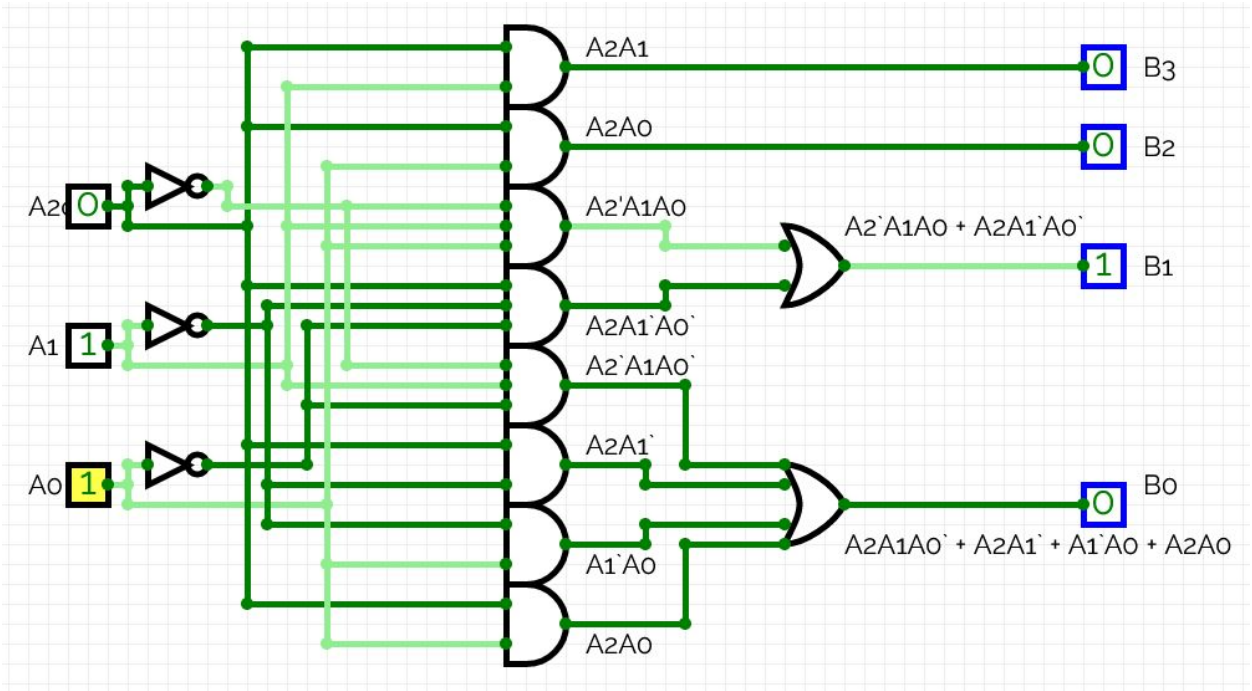
Input: $001_2/1_{10}$

Output: $0001_2/1_{10}$



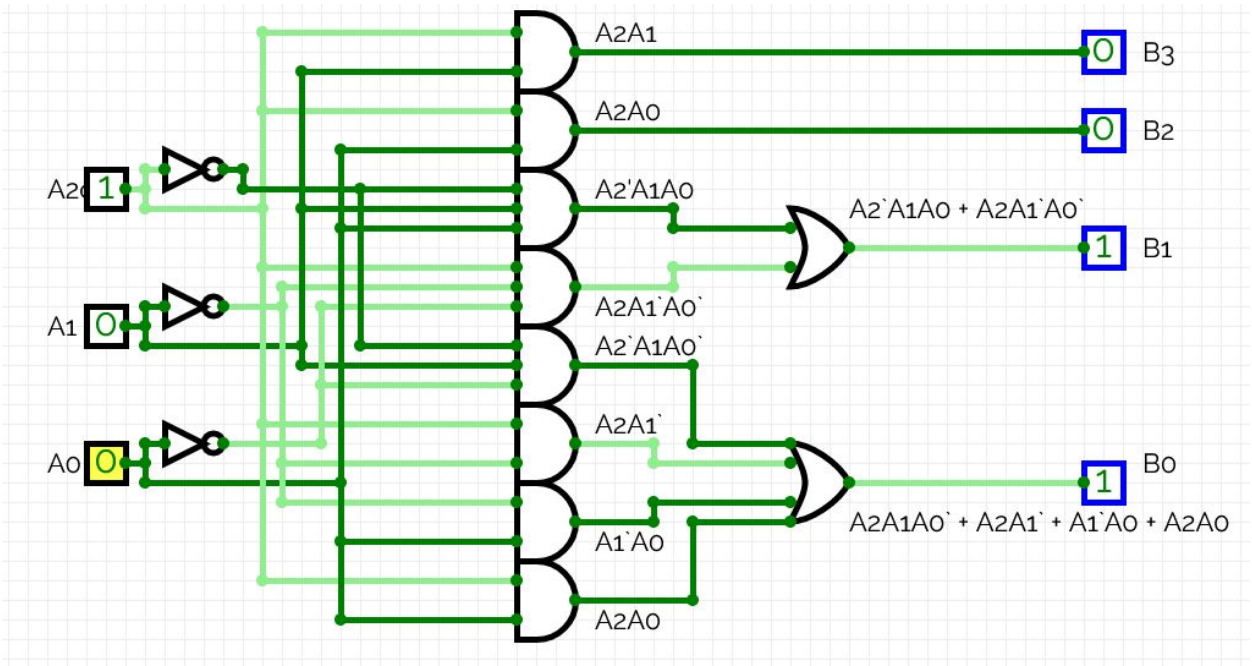
Input: $010_2/2_{10}$

Output: $0001_2/1_{10}$



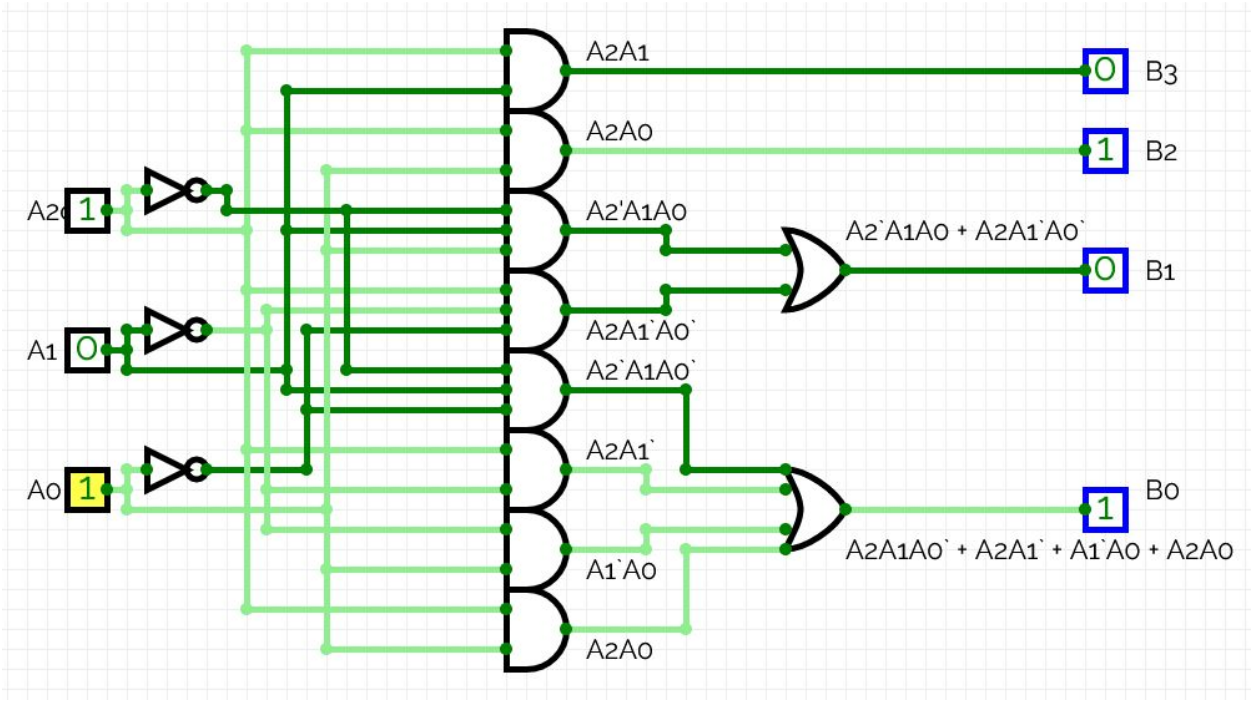
Input: $011_2/3_{10}$

Output: $0010_2/2_{10}$



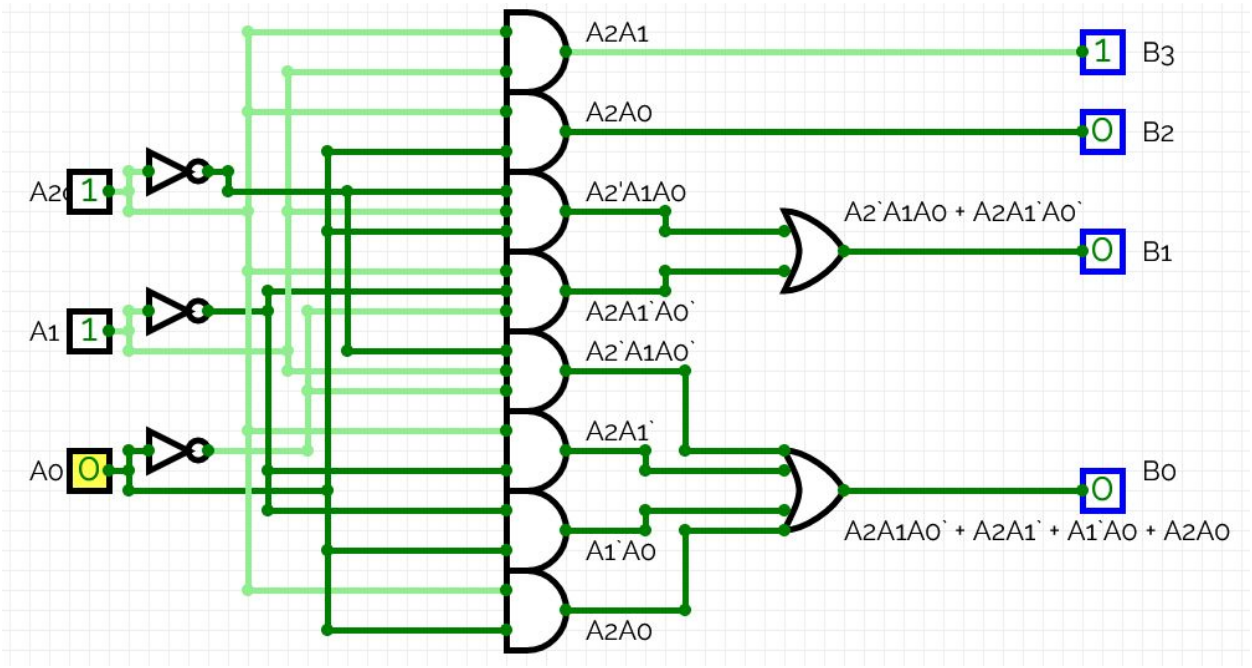
Input: $100_2/4_{10}$

Output: $0011_2/3_{10}$

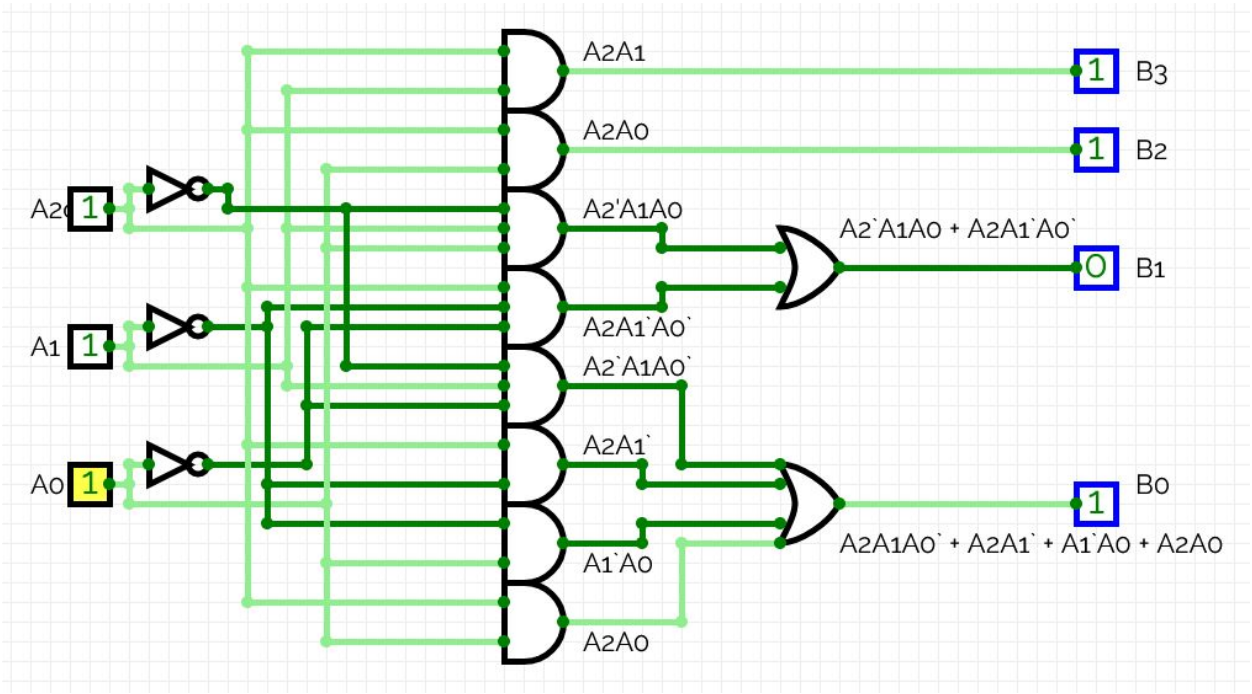


Input: $101_2/5_{10}$

Output: $0101_2/5_{10}$

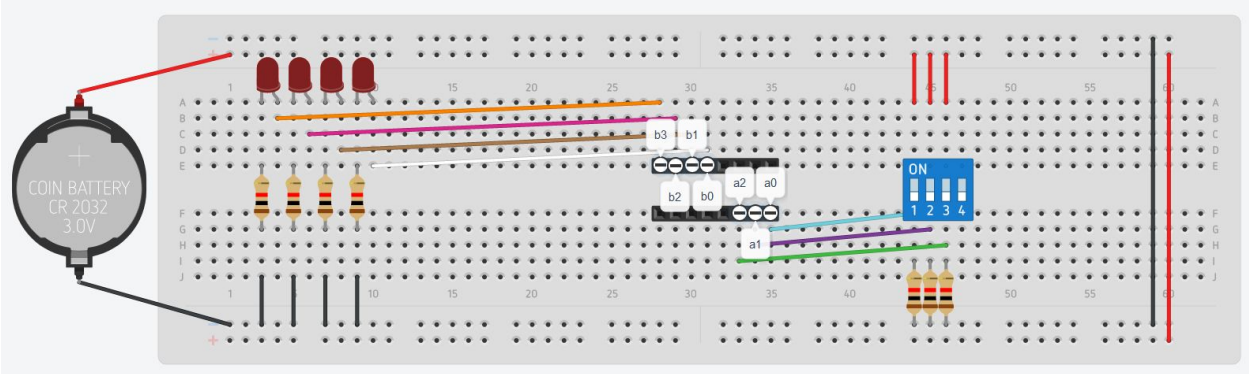


Input: $110_2/6_{10}$
Output: $1000_2/8_{10}$



Input: $111_2/7_{10}$
Output: $1101_2/13_{10}$

Input/Output Circuit



A DIP switch is the method of user input, representing $a_2a_1a_0$. The bottom 8-pin header represents the input of the logic circuit, while the top 8-pin header represents the output of the logic circuit. The 4 LEDs represent the output of the logic circuit in binary, representing $b_3b_2b_1b_0$, the n^{th} term in the Fibonacci sequence.

Parts List

In addition to the CPLD, the circuit needs:

- 1 DIP Switch for input
- 3 resistors for the DIP switch, 1kΩ
- 4 LEDs for output
- 4 resistors for the LEDs, 1kΩ