Digits of Pi Circuit
PC/CP220 Project Phase III
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Logic Equation

The first 10 digits of pi after the decimal point are :

Places After Decimal	Digit
0	3
1	1
2	4
3	1
4	5
5	9
6	2
7	6
8	5
9	3
10	5

So for the Digits of Pi circuit there would be four outputs to display the binary numbers. The final equations for the outputs are:

$p_1 = a_1'a_2a_3'a_4$

$p_2 = a_2'a_3a_4' + a_1a_2'a_4' + a_1'a_2a_3'a_4' + a_1'a_2a_3'a_4'$

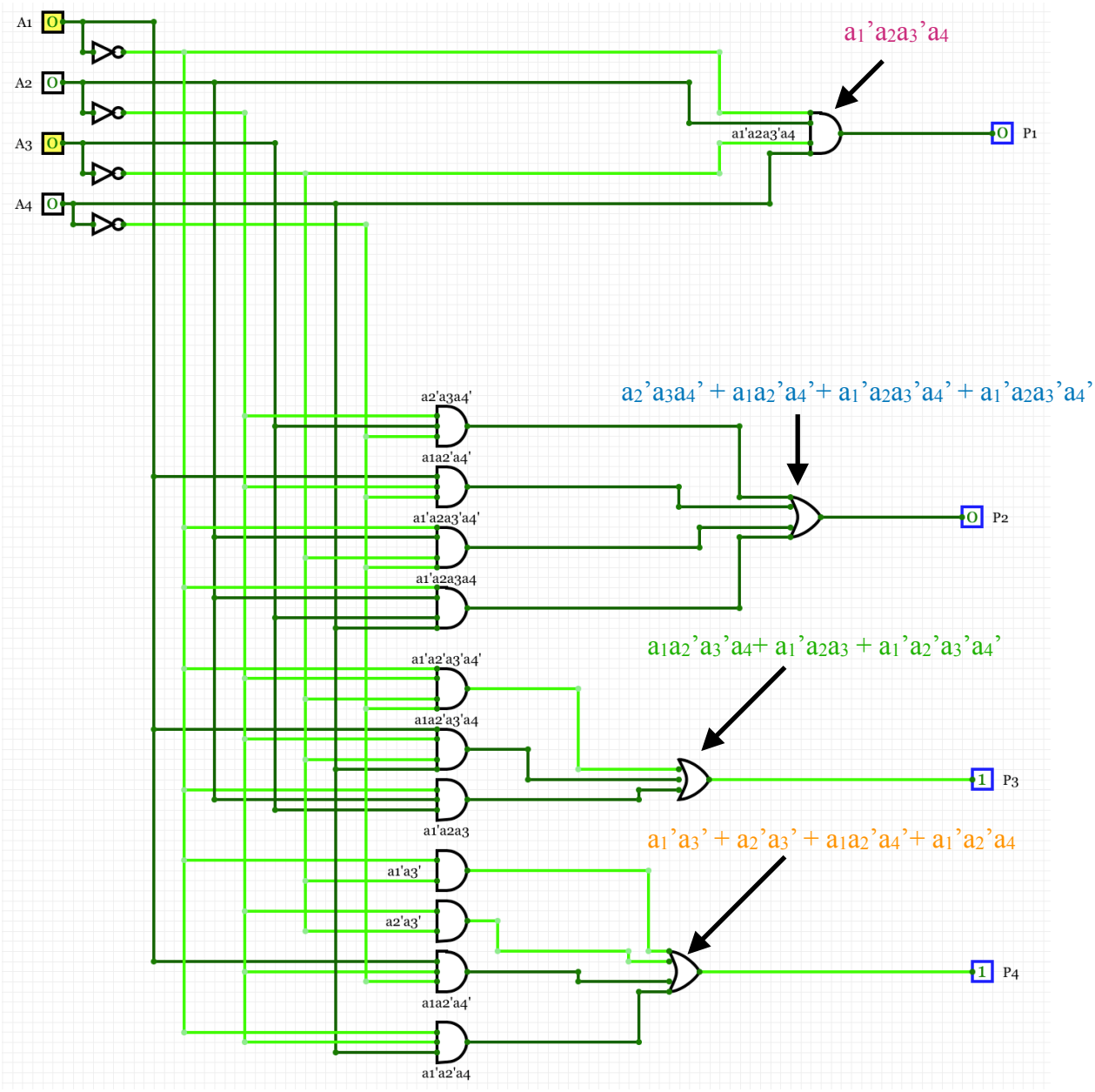
$p_3 = a_1a_2'a_3'a_4 + a_1'a_2a_3 + a_1'a_2'a_3'a_4'$

$p_4 = a_1'a_3' + a_2'a_3' + a_1a_2'a_4' + a_1'a_2'a_4$

Where a_1 , is the MSB and a_4 , is the LSB of the inputs and outputs, respectively.

Logic Diagram

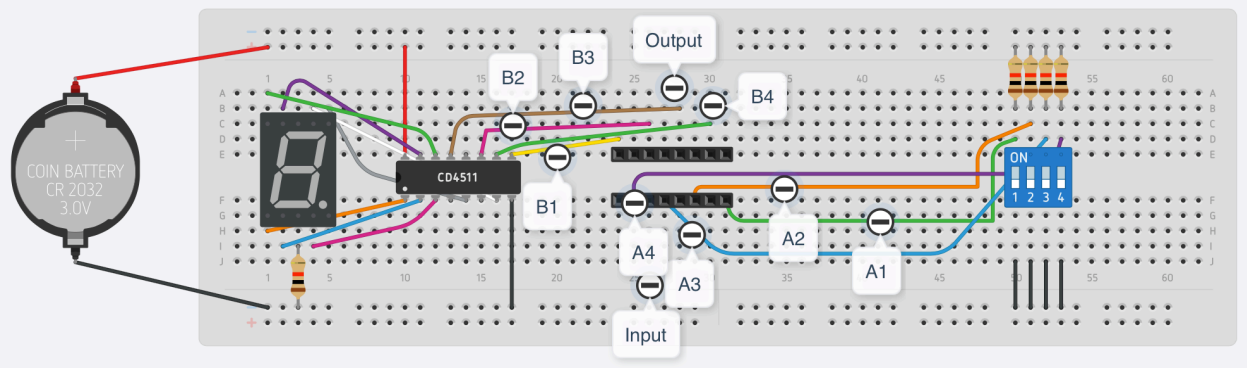
The circuit was drawn using CircuitVerse, and is shown in the following in the following figure:



The four equations corresponding to each output is indicated by the four arrows pointing to the 3 OR gates and AND gate.

Input/Output Diagram

The breadboard to implement the logic circuit would look something similar to this:



Parts List

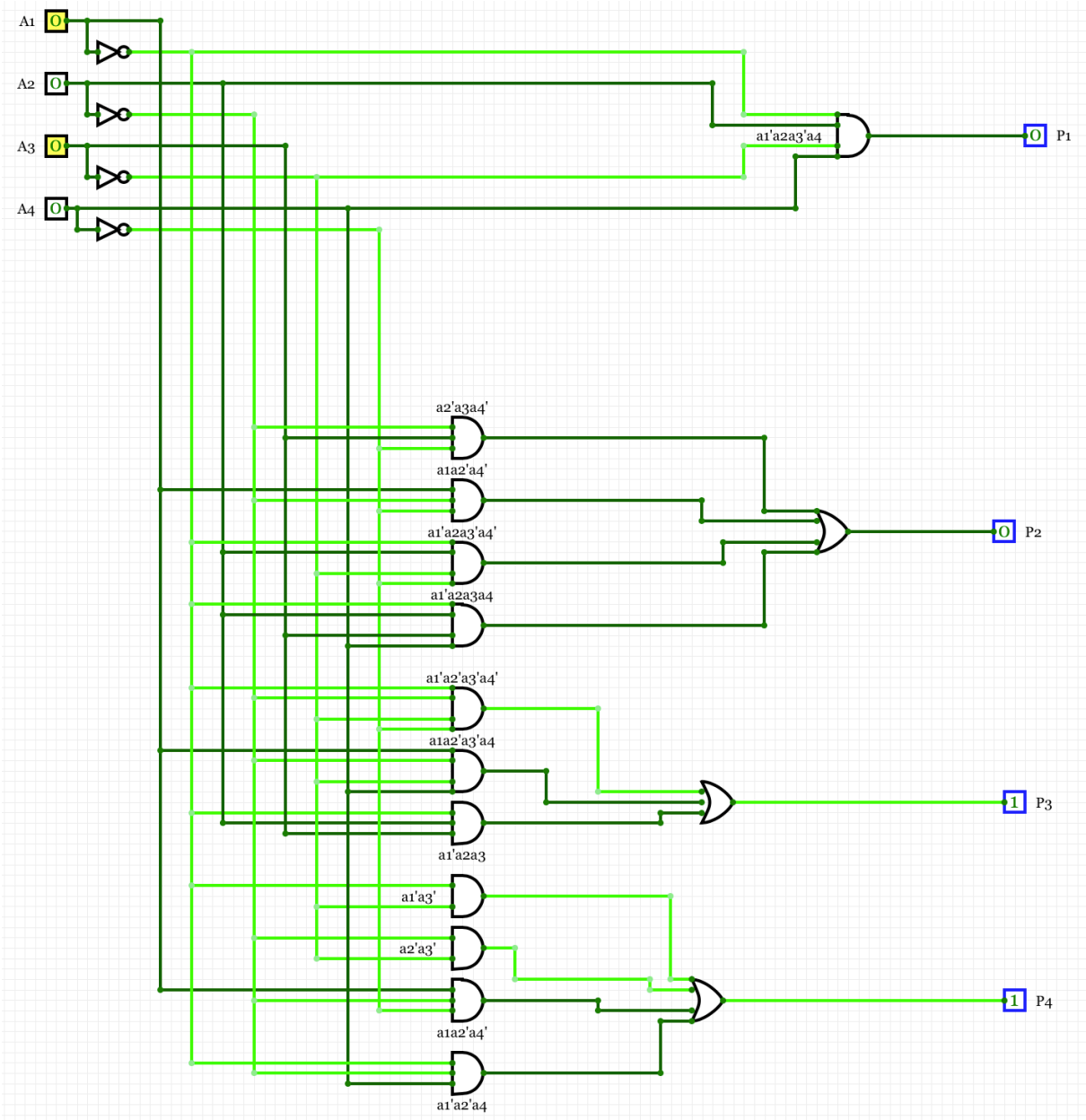
In addition to the breadboard the circuit needs the following parts:

- 1 DIP Switch, for input
- 5 resistors, for the segment display and the switch
- 1 7-Segment display, for output
- 1 Coin-Cell 3V Battery, for power
- 2 8-pin header, one for input and one for output
- 1 7-segment decoder, to decode the binary numbers of the output. It also contains the logic circuit.

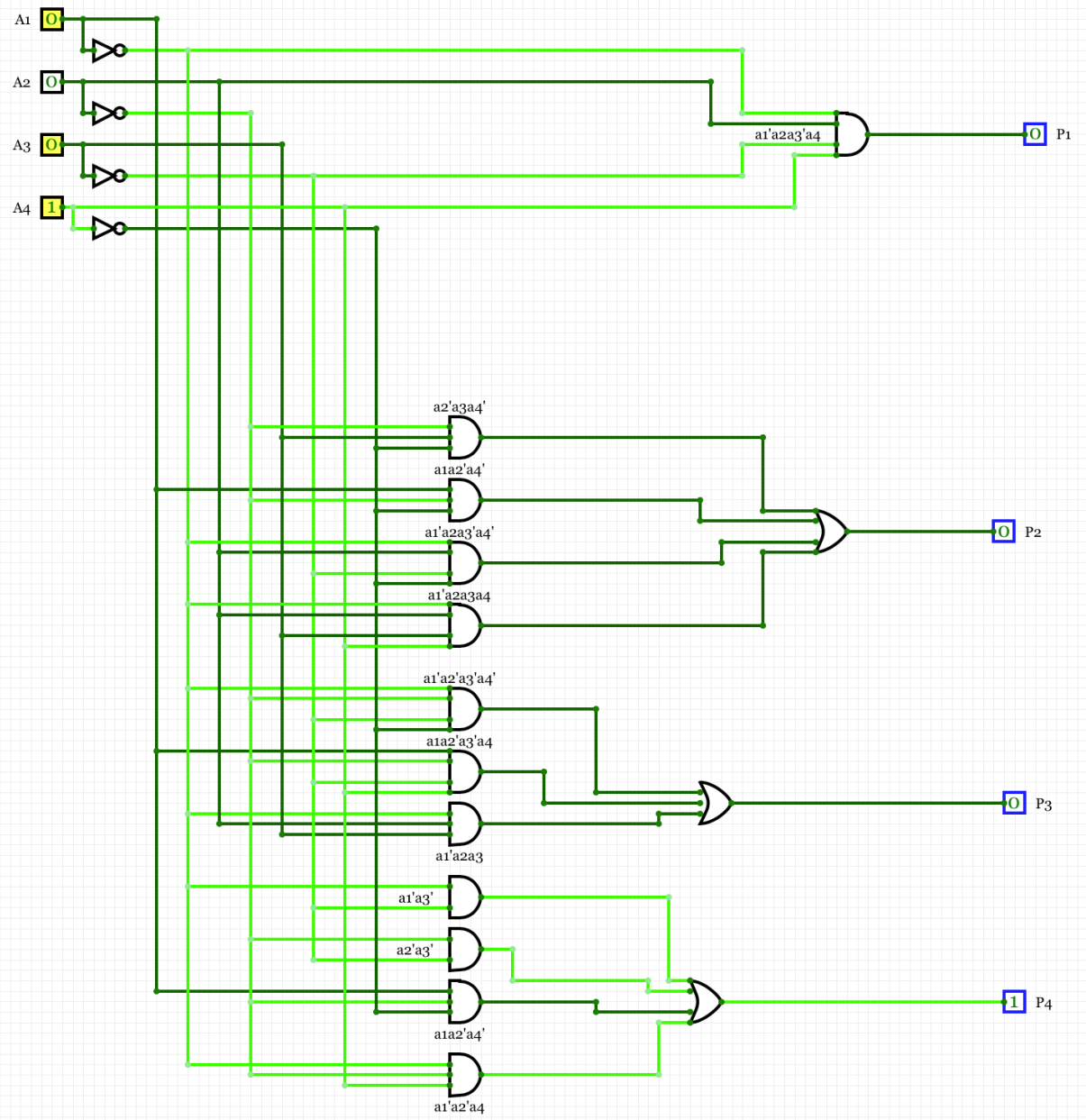
Circuit Simulation

a_1	a_2	a_3	a_4	p_1	p_2	p_3	p_4
0	0	0	0	0	0	1	1
0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	0	0	1	0	1
0	1	0	1	1	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	1	1	0
1	0	0	0	0	1	0	1
1	0	0	1	0	0	1	1
1	0	1	0	0	1	0	1

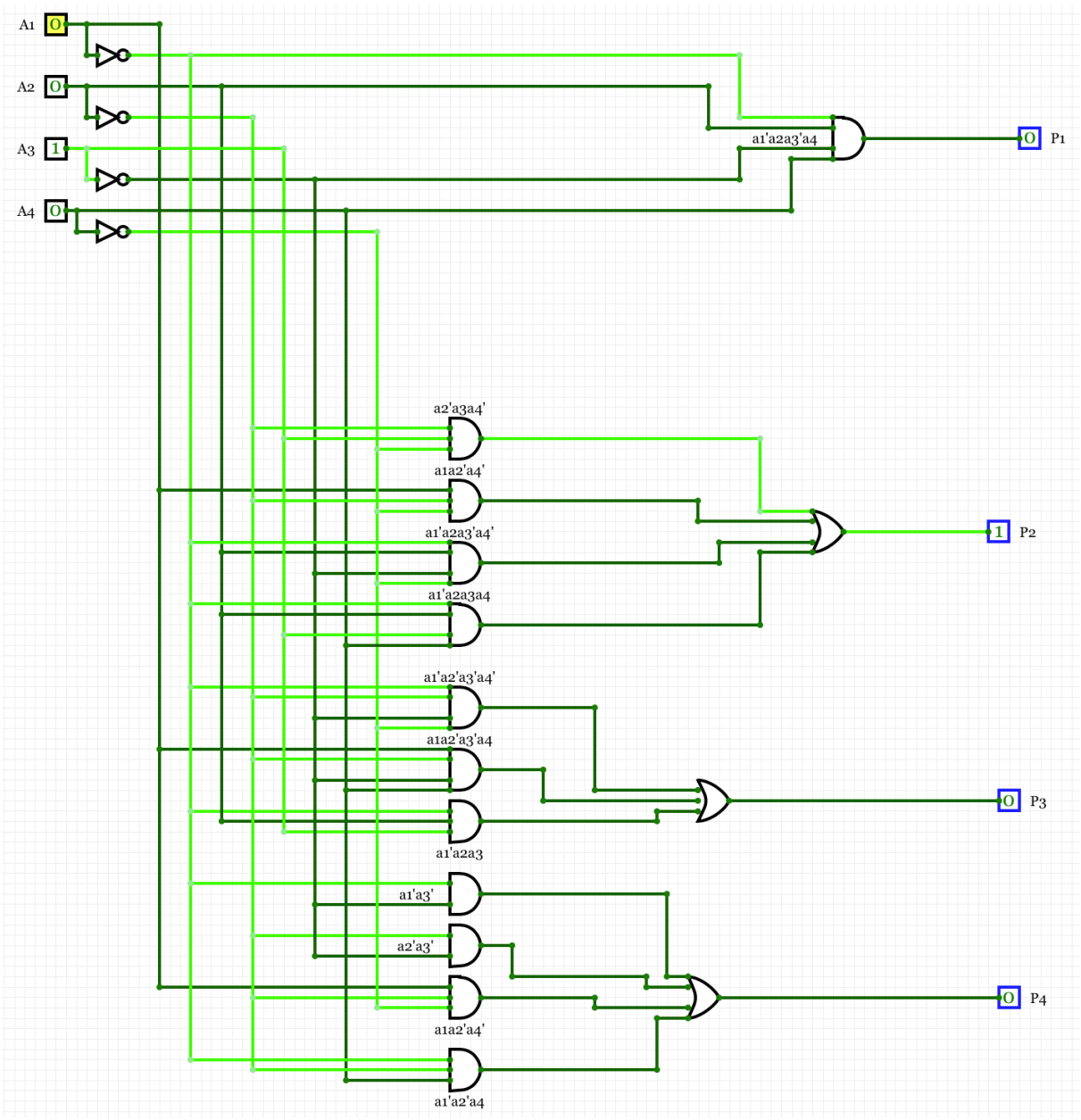
Truth Table showing only binary inputs and outputs



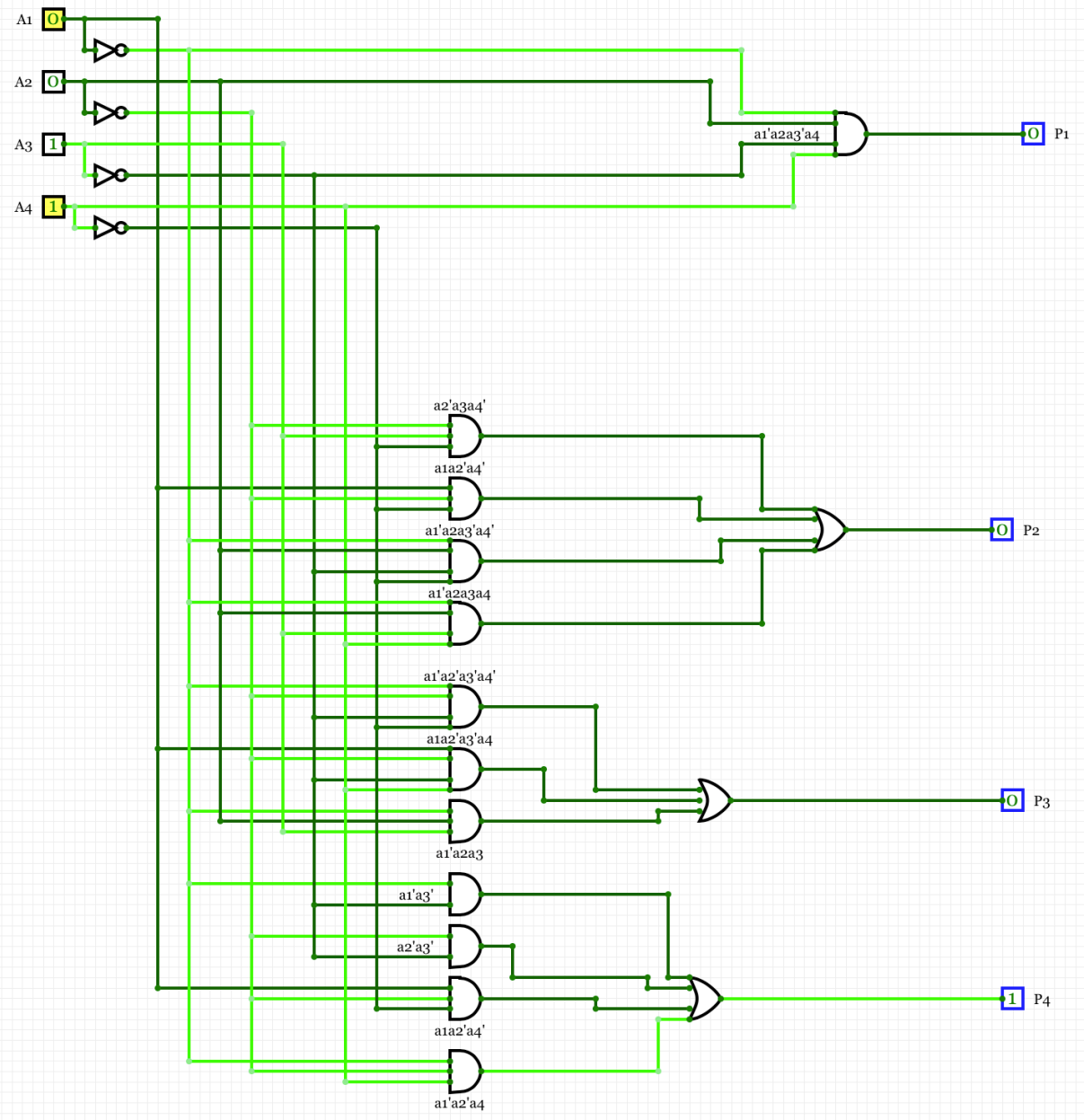
The output for the circuit,0011, corresponds to the output in the truth table for this combination of input, 0000.



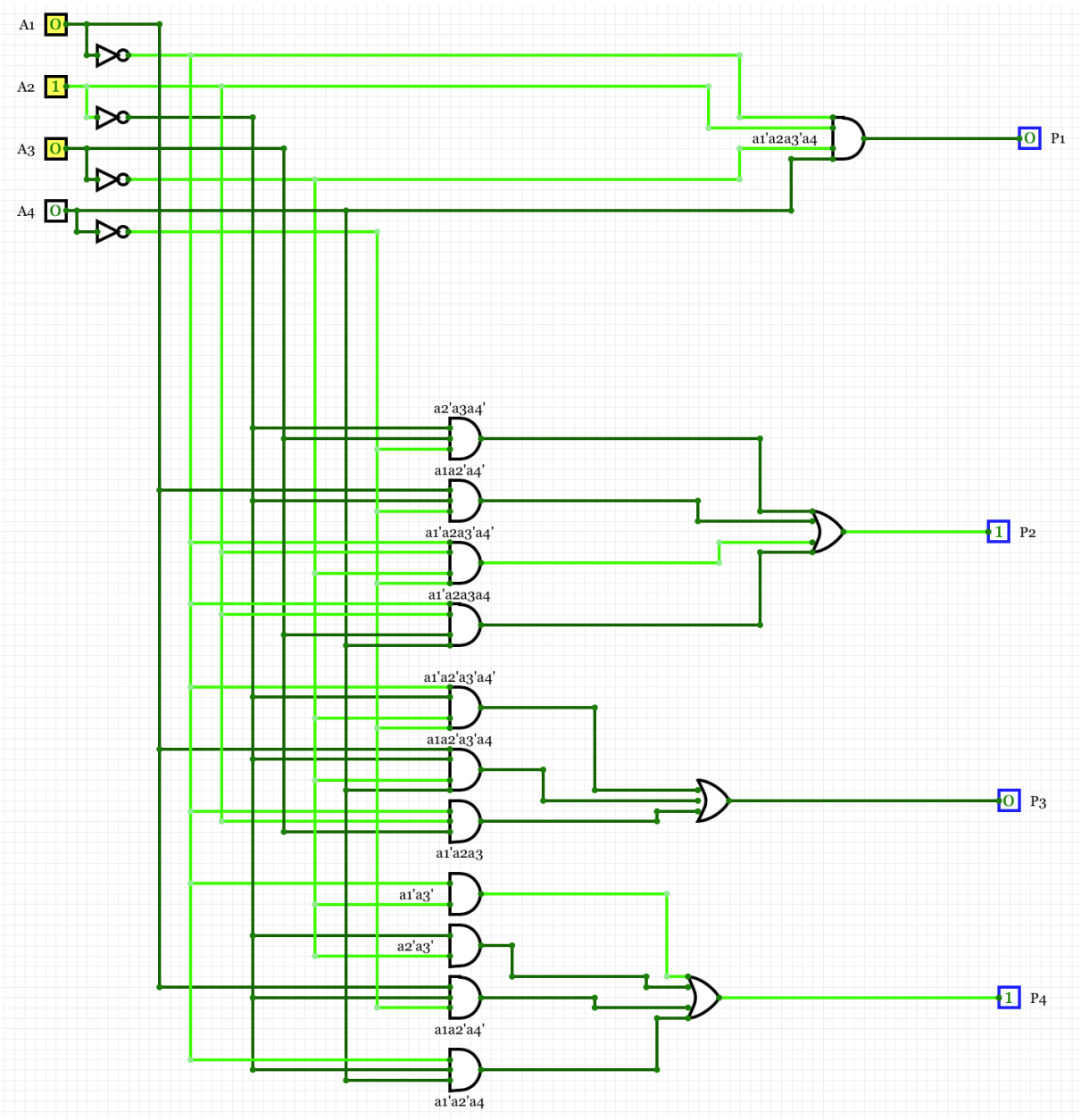
The output for the circuit,0001, corresponds to the output in the truth table for this combination of input, 0001.



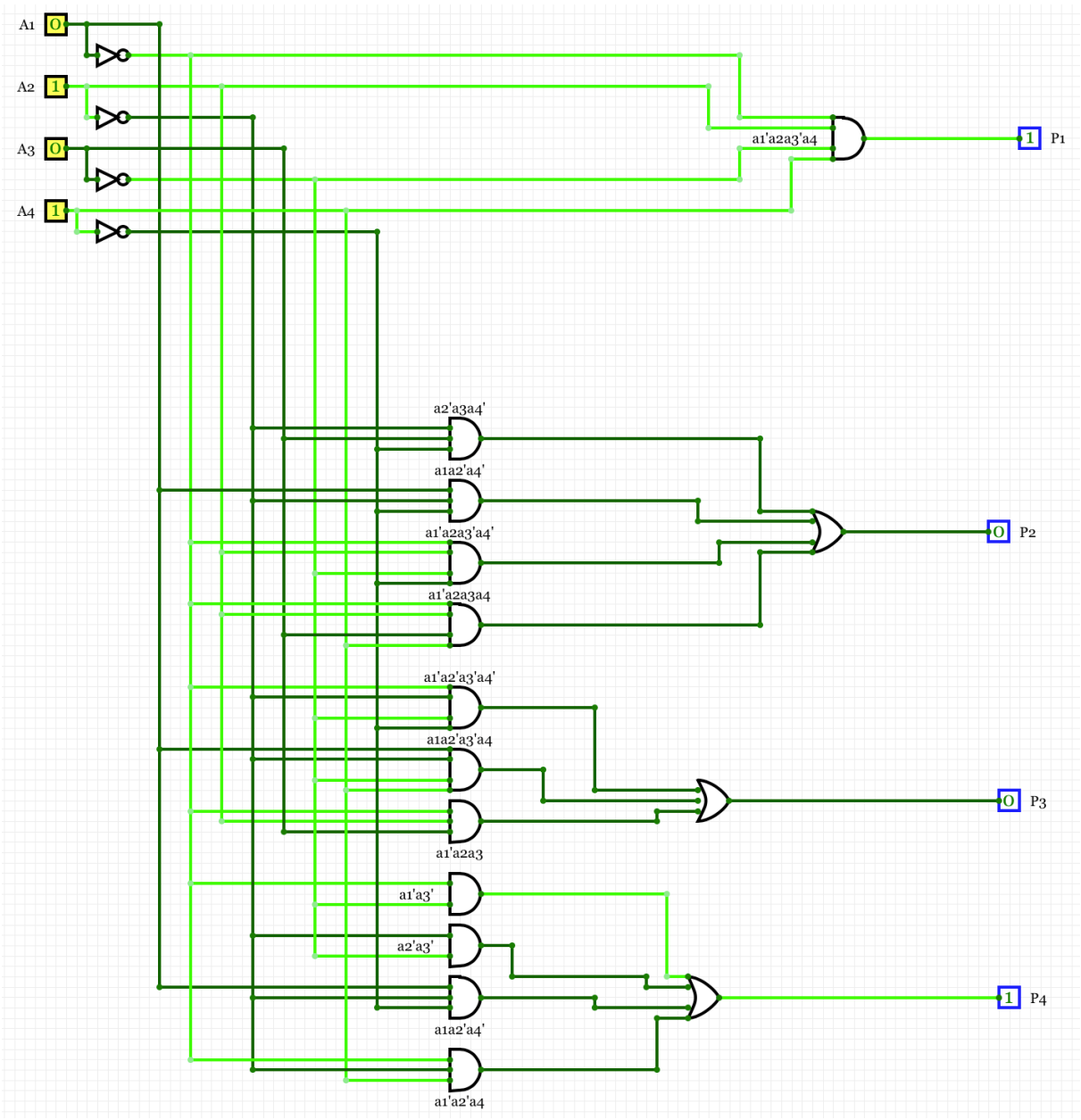
The output for the circuit,0100, corresponds to the output in the truth table for this combination of input, 0010.



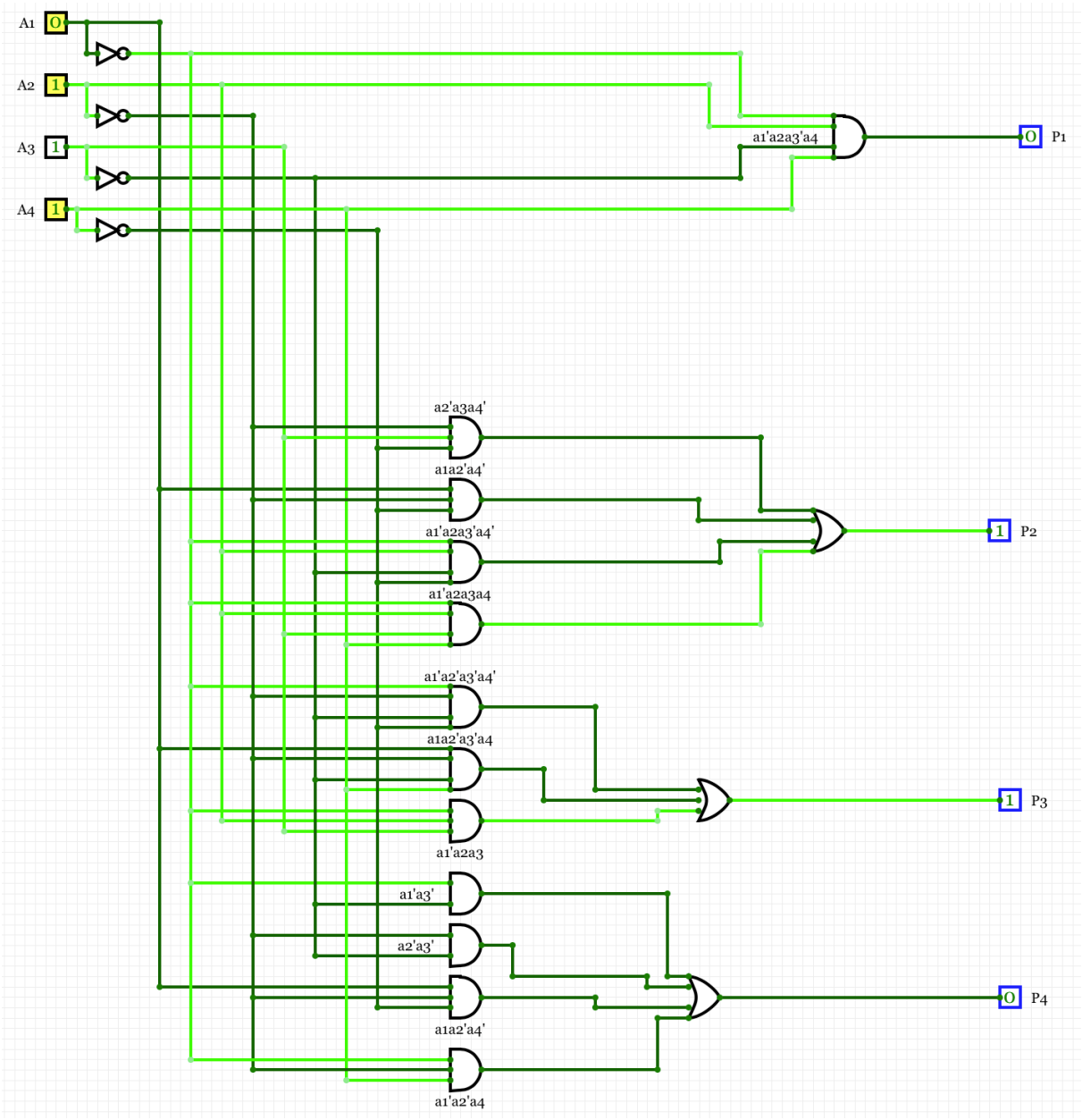
The output for the circuit,0001 corresponds to the output in the truth table for this combination of input, 0011.



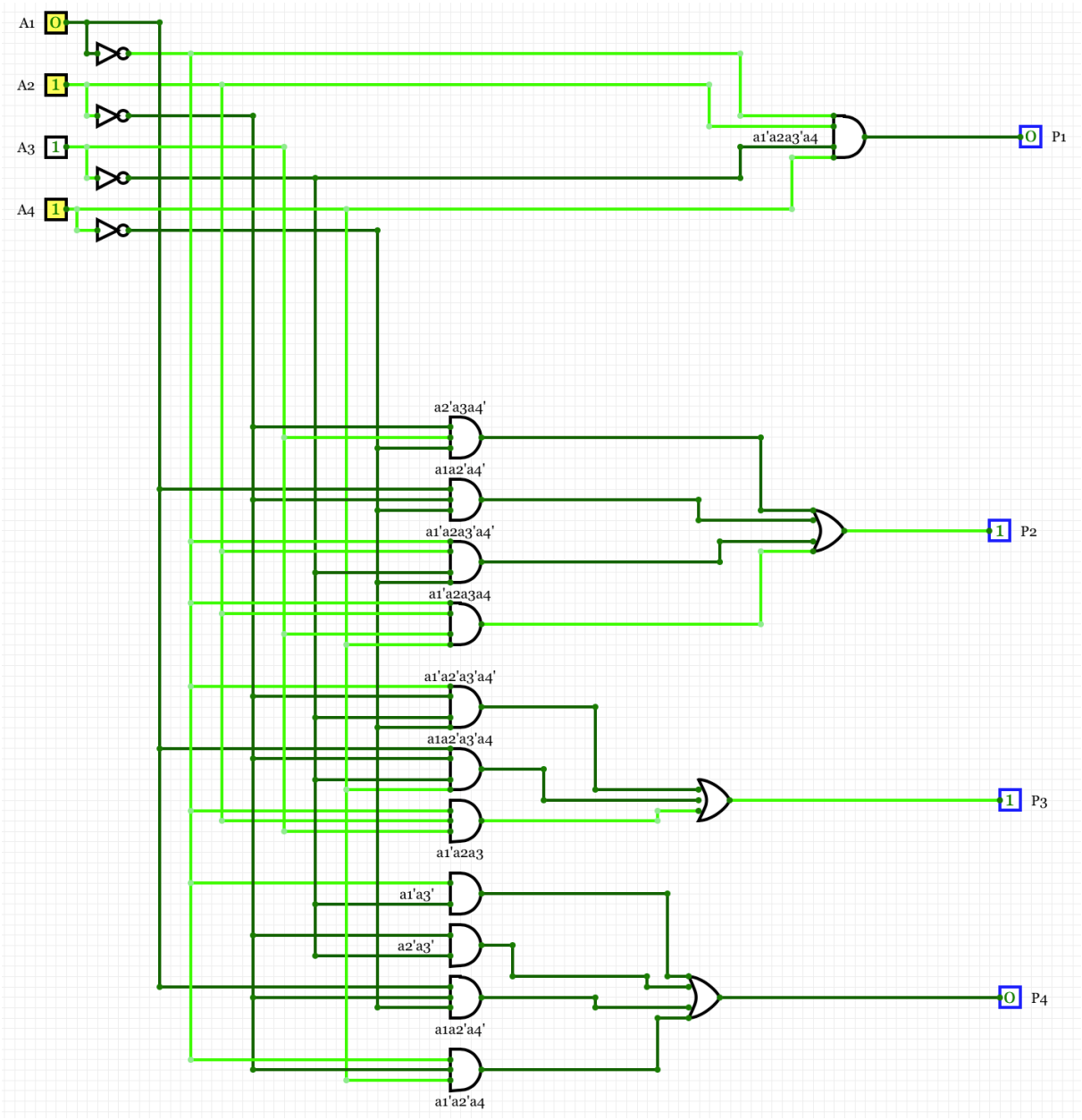
The output for the circuit,0101, corresponds to the output in the truth table for this combination of input, 0100.



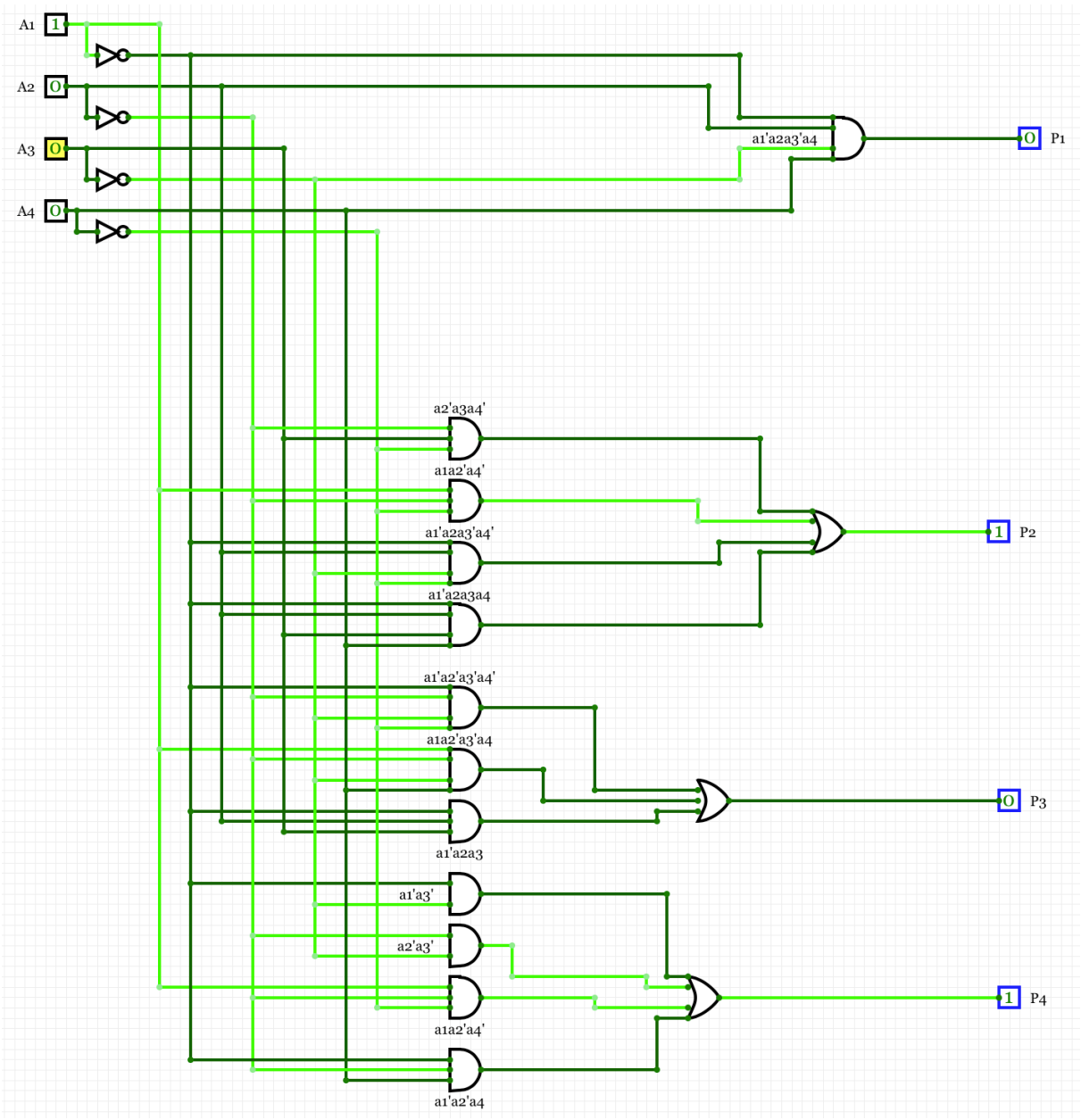
The output for the circuit,1001 corresponds to the output in the truth table for this combination of input, 0101.



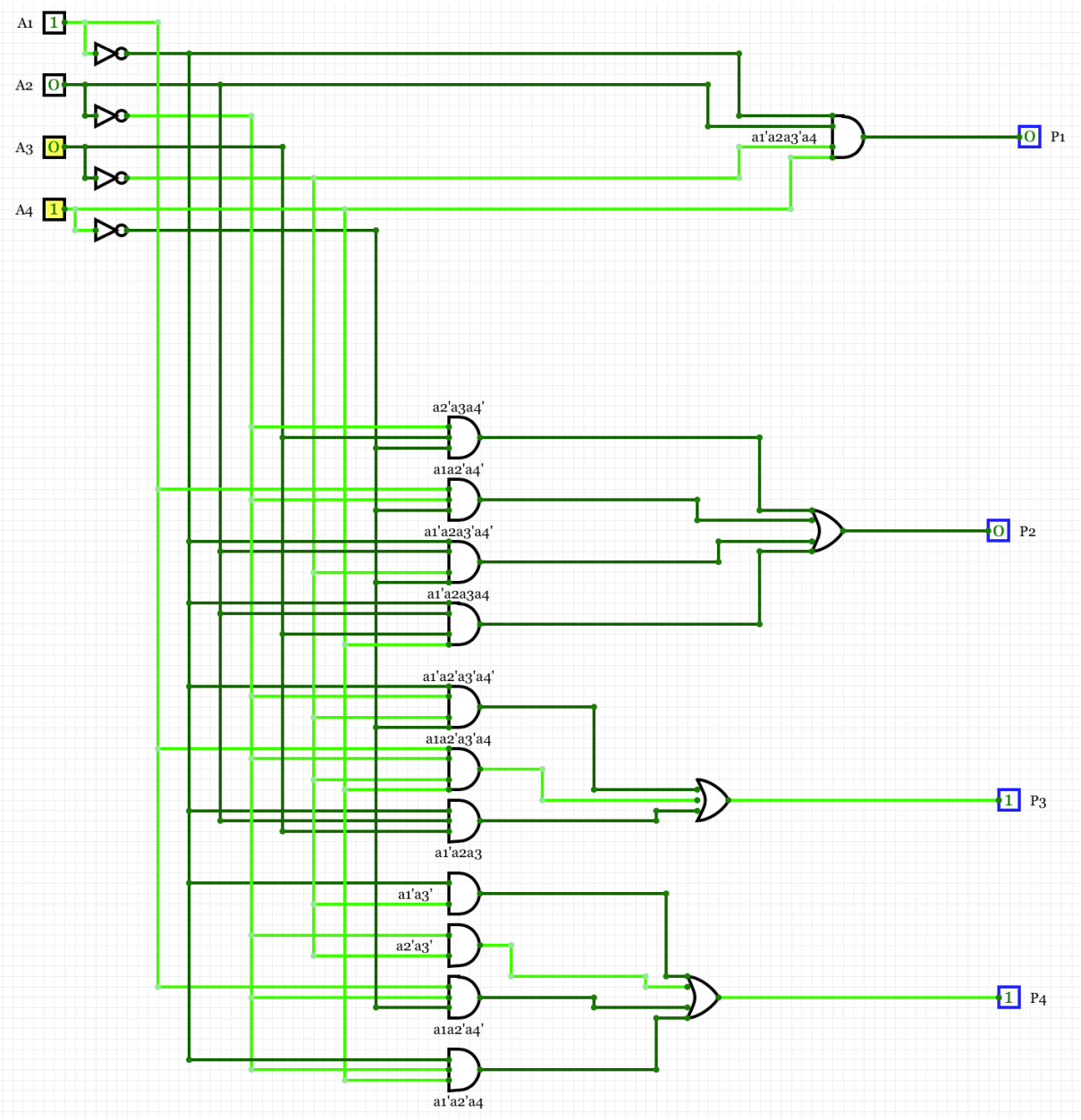
The output for the circuit,0010, corresponds to the output in the truth table for this combination of input, 0110.



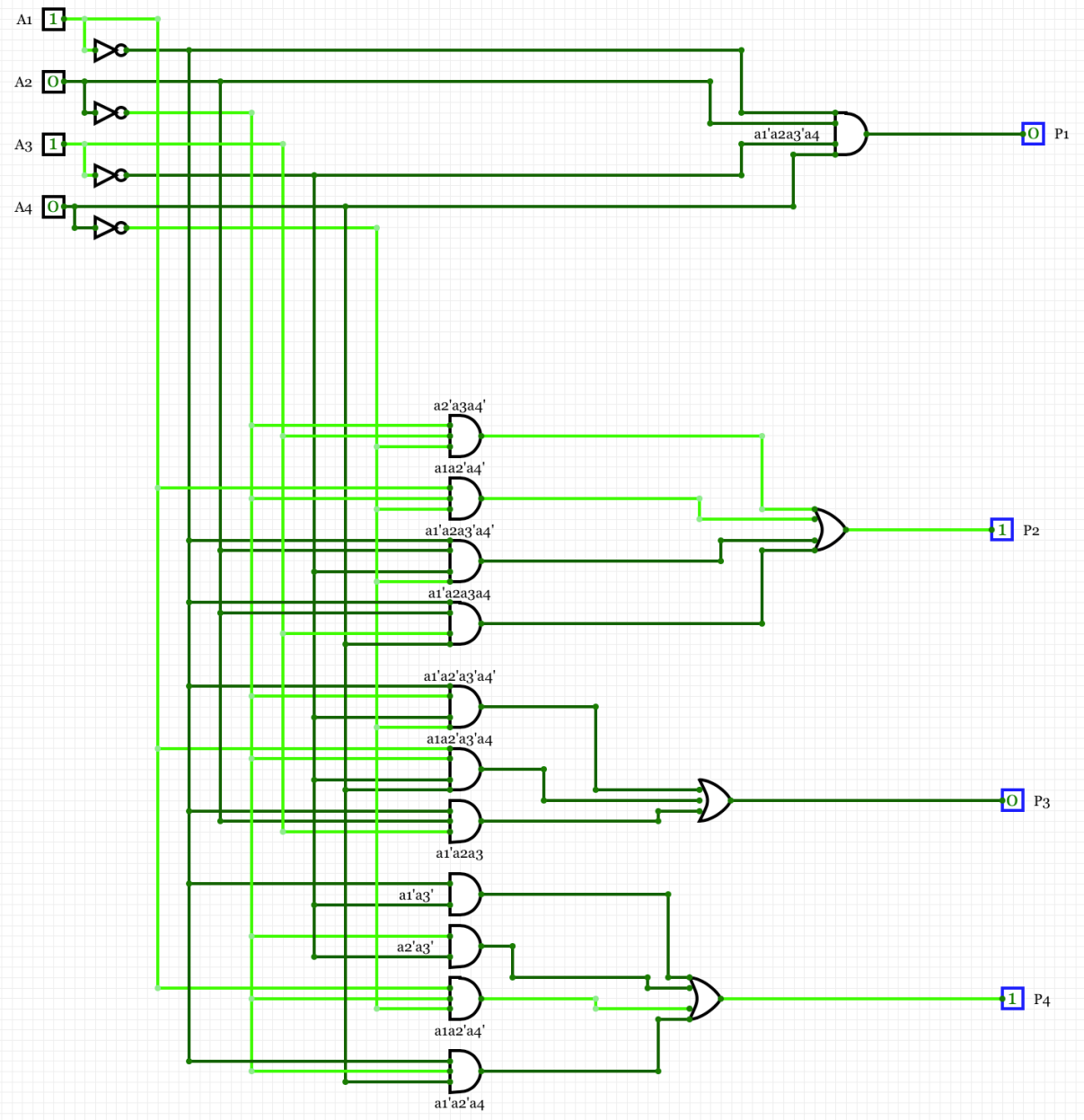
The output for the circuit,0110, corresponds to the output in the truth table for this combination of input, 0111.



The output for the circuit,0101, corresponds to the output in the truth table for this combination of input, 1000.



The output for the circuit,0011, corresponds to the output in the truth table for this combination of input, 1001.



The output for the circuit,0101, corresponds to the output in the truth table for this combination of input, 1010.

After going through all the combinations of inputs with the logic circuit and getting results that correlate to the truth table, one can say that the circuit passed the simulations.