

Assignment 1 report

Boolean Algebra

Task 1.1

X1	X2	X3	X4	Z1	Z2
0	0	0	0	1	0
0	0	0	1	1	1
0	0	1	0	0	0
0	0	1	1	1	1
0	1	0	0	1	0
0	1	0	1	0	1
0	1	1	0	1	0
0	1	1	1	1	1
1	0	0	0	1	1
1	0	0	1	0	1
1	0	1	0	0	1
1	0	1	1	1	0
1	1	0	0	1	1
1	1	0	1	0	1
1	1	1	0	1	1
1	1	1	1	0	0

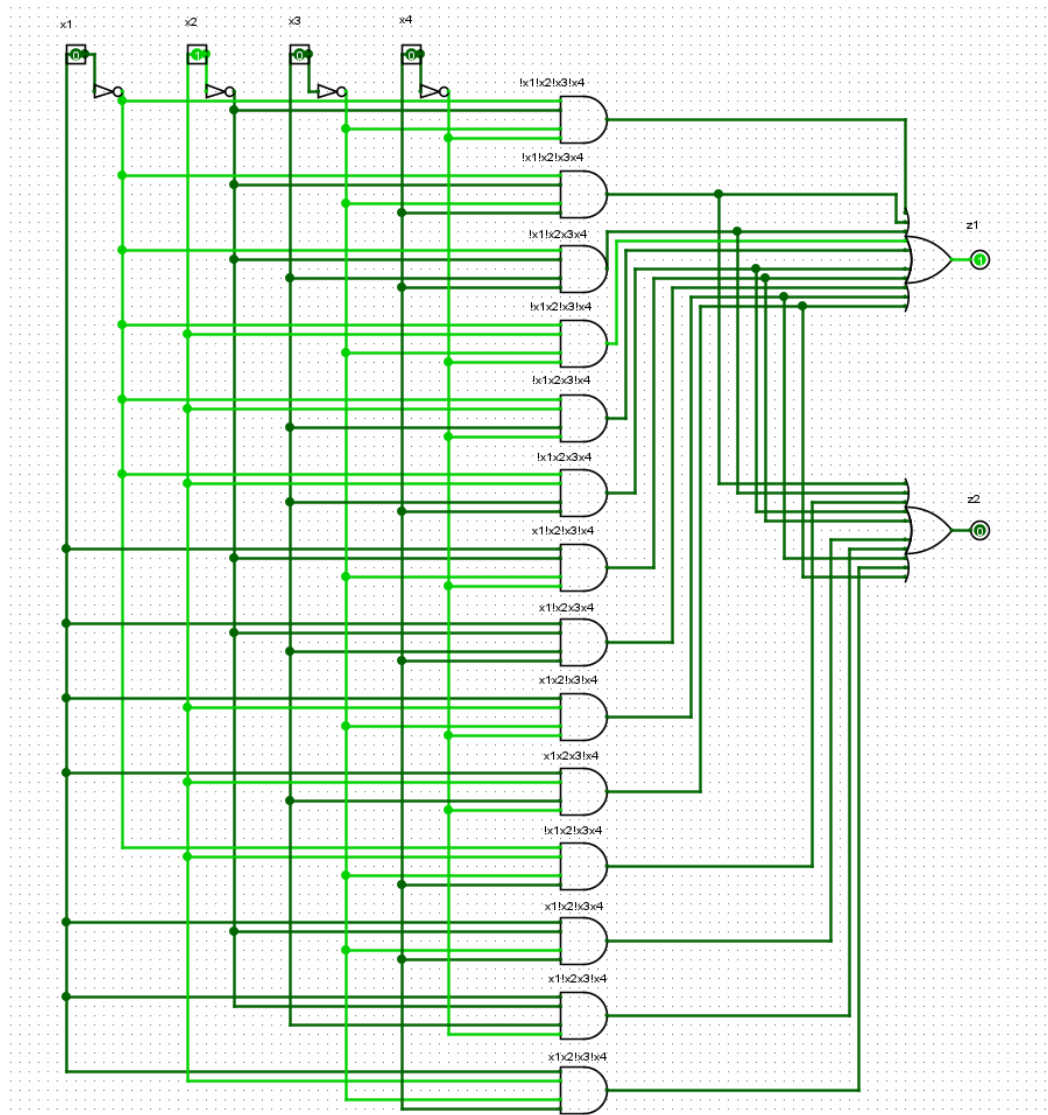
$$Z1(x1, x2, x3, x4) = \overline{x1} \overline{x2} \overline{x3} \overline{x4} + \overline{x1} \overline{x2} \overline{x3} x4 + \overline{x1} \overline{x2} x3 x4 + \overline{x1} x2 \overline{x3} \overline{x4} + \overline{x1} x2 x3 \overline{x4} + \overline{x1} x2 x3 x4 + x1 \overline{x2} \overline{x3} \overline{x4} + x1 \overline{x2} \overline{x3} x4 + x1 \overline{x2} x3 x4 + x1 x2 \overline{x3} \overline{x4} + x1 x2 x3 \overline{x4}$$

$$Z2(x1, x2, x3, x4) = \overline{x1} \overline{x2} \overline{x3} x4 + \overline{x1} \overline{x2} x3 x4 + \overline{x1} x2 \overline{x3} x4 + \overline{x1} x2 x3 x4 + x1 \overline{x2} \overline{x3} \overline{x4} + x1 \overline{x2} \overline{x3} x4 + x1 \overline{x2} x3 \overline{x4} + x1 x2 \overline{x3} \overline{x4} + x1 x2 \overline{x3} x4 + x1 x2 x3 \overline{x4}$$

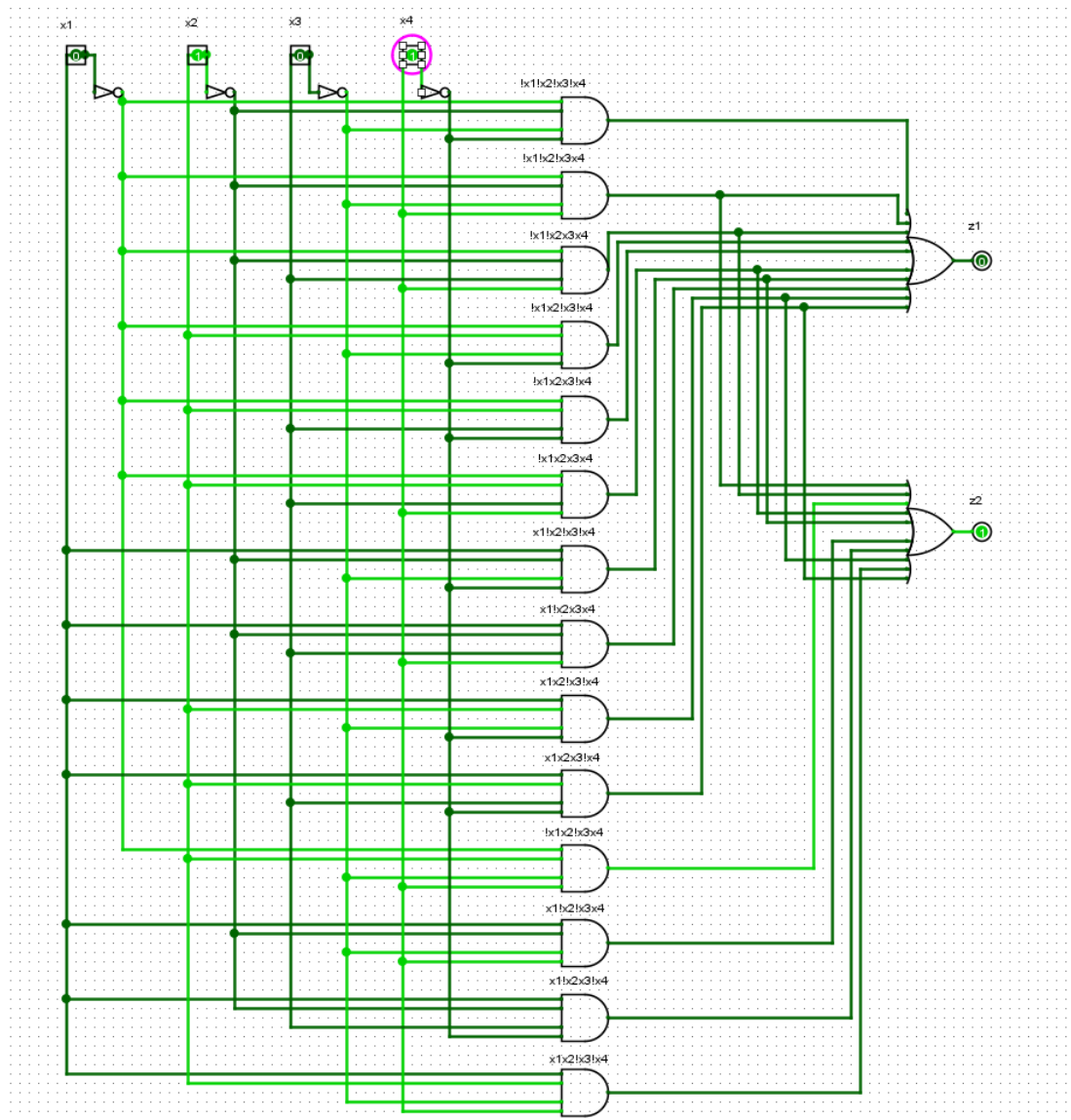
Task 1.2

In this part, we have X1-4, therefore we create 4 input inside the Logical circuit. Then drawing 2 lines in every input, one is original, the other one has to give it the not gate. Because we have 10 expressions for Z1, so create 10 and gates, and all and gate should have 4 inputs. The line connection should follow the table. For example, if $\overline{x1} \overline{x2} \overline{x3} x4$, then connecting not gate's line of X1X2X3, and connecting normal X4 line to the or

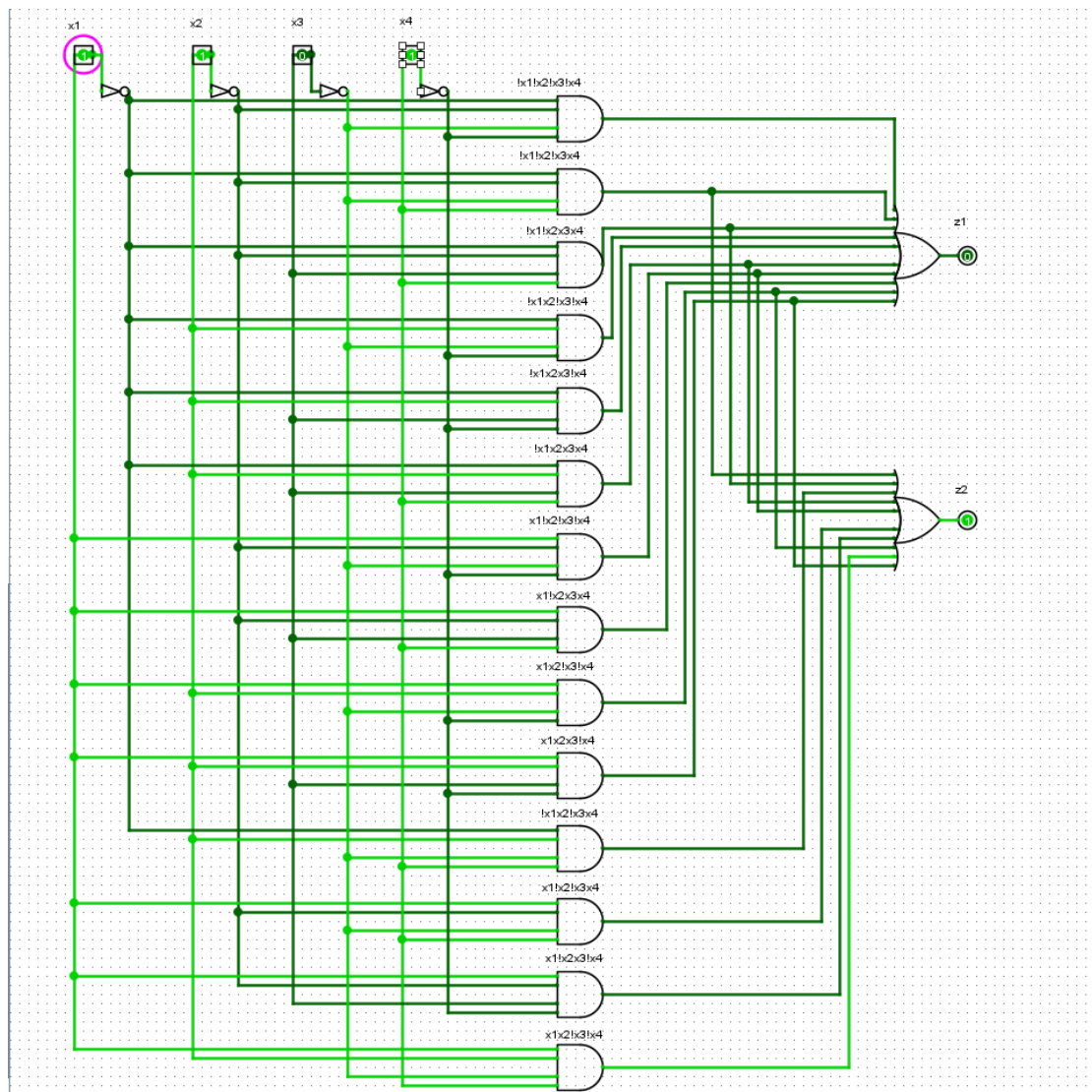
gate. For Z2, because some expressions are repeated, according to my table, we just need to create more 4 gates. In the end, creating an or gate for z2 and connect with other and gate. Here is the testing case.



Case 1



Case 2



Case 3

Task 1.3

1, K-Map

K map solves the equation is according to the equation, put 1 in blocks in K map and the other place is 0. If number change, ignore the match, if number not change, 1 means stay normal (x), 0 means change to 'not' (!x).

Z1

	X3X4				
X1X2		00	01	11	10
	00	1	1	1	
	01	1		1	1
	11	1			1
	10	1		1	

$$Z1 = \overline{X3} \overline{X4} + \overline{X1} X2 X3 + \overline{X1} \overline{X2} \overline{X3} + X2 \overline{X4} + \overline{X2} X3 X4$$

Z2

	X3X4				
X1X2		00	01	11	10
	00	0	1	1	0
	01	0	1	1	0
	11	1	1	0	1
	10	1	1	0	1

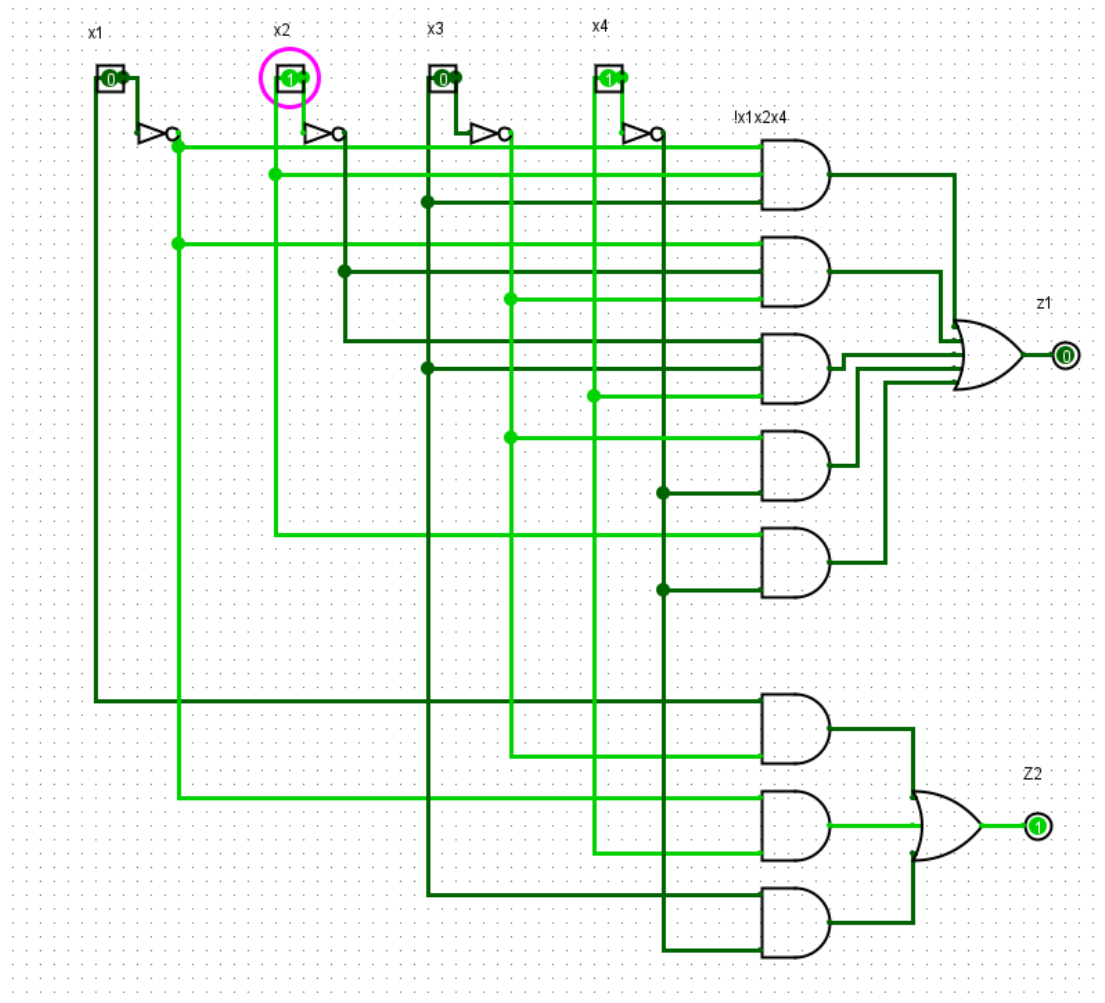
$$Z2 = X1\overline{X3} + \overline{X1}X4 + X1\overline{X4}$$

Boolean Identity

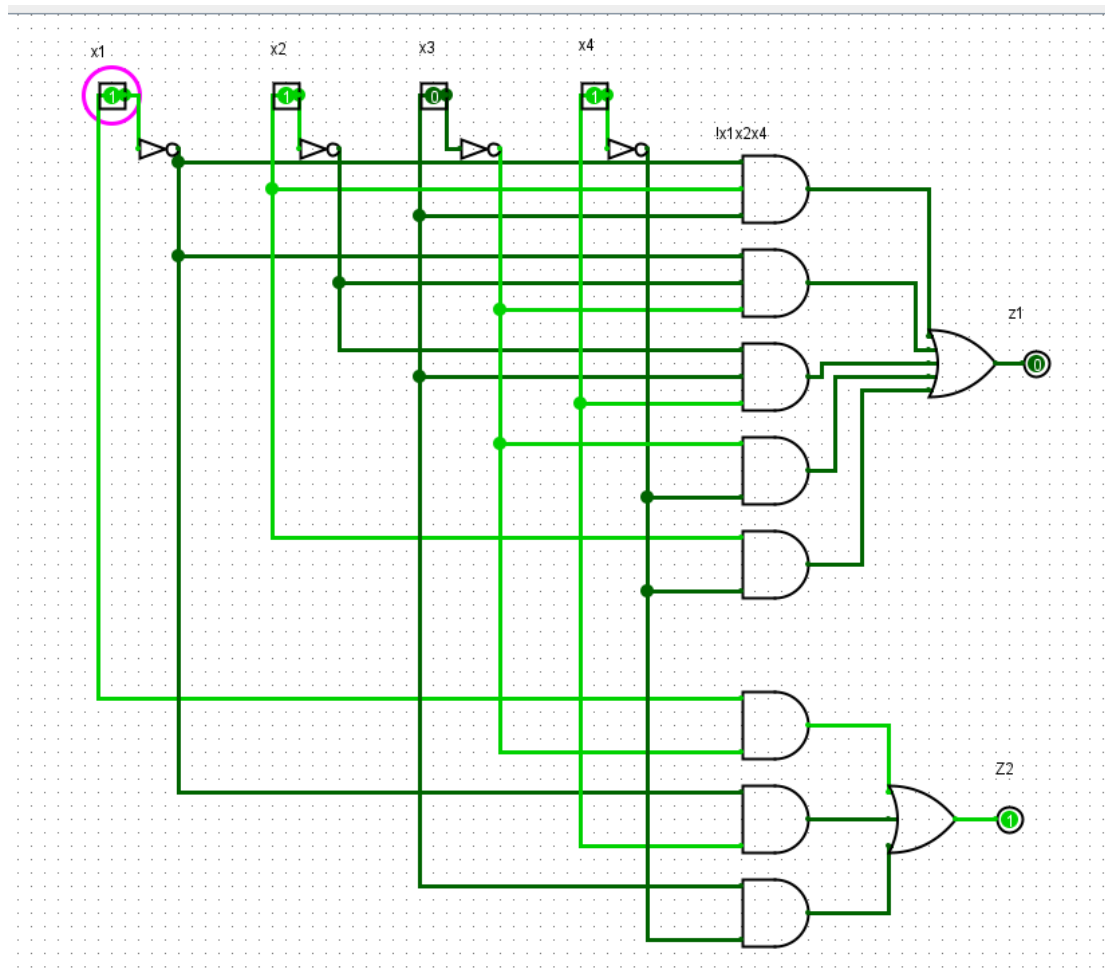
$$\begin{aligned}
 Z_1 &= \overline{x_1} \overline{x_2} \overline{x_3} \overline{x_4} + \overline{x_1} \overline{x_2} \overline{x_3} x_4 + \overline{x_1} \overline{x_2} x_3 \overline{x_4} + \overline{x_1} \overline{x_2} x_3 x_4 + \overline{x_1} x_2 \overline{x_3} \overline{x_4} + \overline{x_1} x_2 \overline{x_3} x_4 + \overline{x_1} x_2 x_3 \overline{x_4} + \overline{x_1} x_2 x_3 x_4 \\
 &\Rightarrow \overline{x_1} \overline{x_2} (\overline{x_3} \overline{x_4} + \overline{x_3} x_4 + x_3 \overline{x_4} + x_3 x_4) + \overline{x_1} x_2 (\overline{x_3} \overline{x_4} + \overline{x_3} x_4 + x_3 \overline{x_4} + x_3 x_4) \\
 &\Rightarrow \overline{x_1} \overline{x_2} (1) + \overline{x_1} x_2 (1) \\
 &\Rightarrow \overline{x_1} (\overline{x_2} + x_2) \\
 &\Rightarrow \overline{x_1} (1) \\
 &\Rightarrow \overline{x_1}
 \end{aligned}$$

$$\begin{aligned}
 Z_2 &= x_1'x_2'x_3'x_4 + x_1'x_2'x_3x_4 + x_1'x_2x_3'x_4 + x_1'x_2x_3x_4 \Rightarrow x_1'x_4(x_2'x_3' + x_2x_3 + x_2'x_3 + x_2x_3') \\
 &+ x_1x_2x_3'x_4' + x_1x_2x_3'x_4 + x_1x_2'x_3'x_4' + x_1x_2'x_3'x_4 \Rightarrow x_1x_3'(x_2'x_4' + x_2x_4 + x_2'x_4 + x_2x_4') \\
 &+ x_1x_2x_3x_4' + x_1x_2x_3'x_4' + x_1x_2'x_3'x_4' + x_1x_2'x_3x_4' \Rightarrow x_1x_4'(x_2'x_3' + x_2x_3 + x_2'x_3 + x_2x_3') \\
 Z_2 &= x_1'x_4 + x_1x_3' + x_1x_4'
 \end{aligned}$$

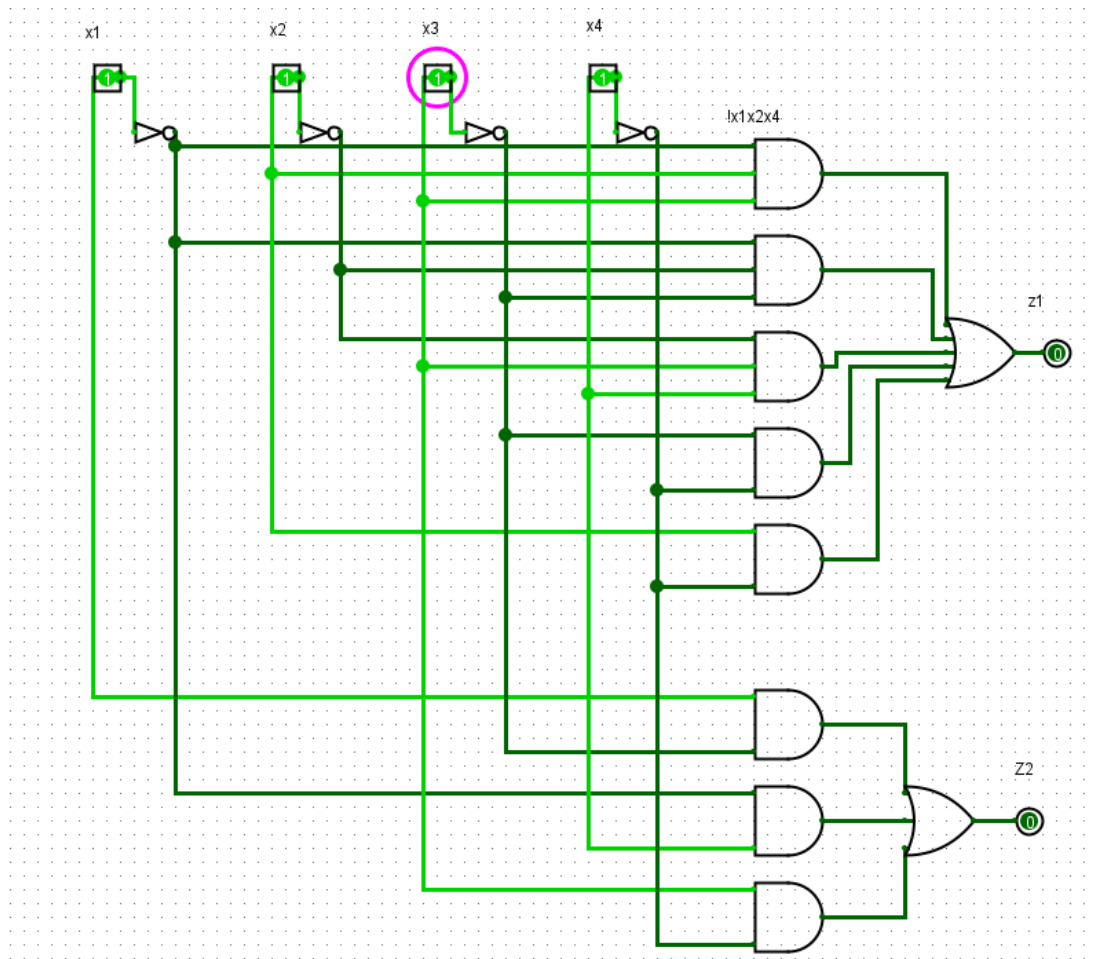
Testing



Case 1



Case 2



Case 3

https://docs.google.com/document/d/1DZ5T9WFKkITCO-o-f5OeWeZqC9_0lf-JbVE-r0voWDI/edit#

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