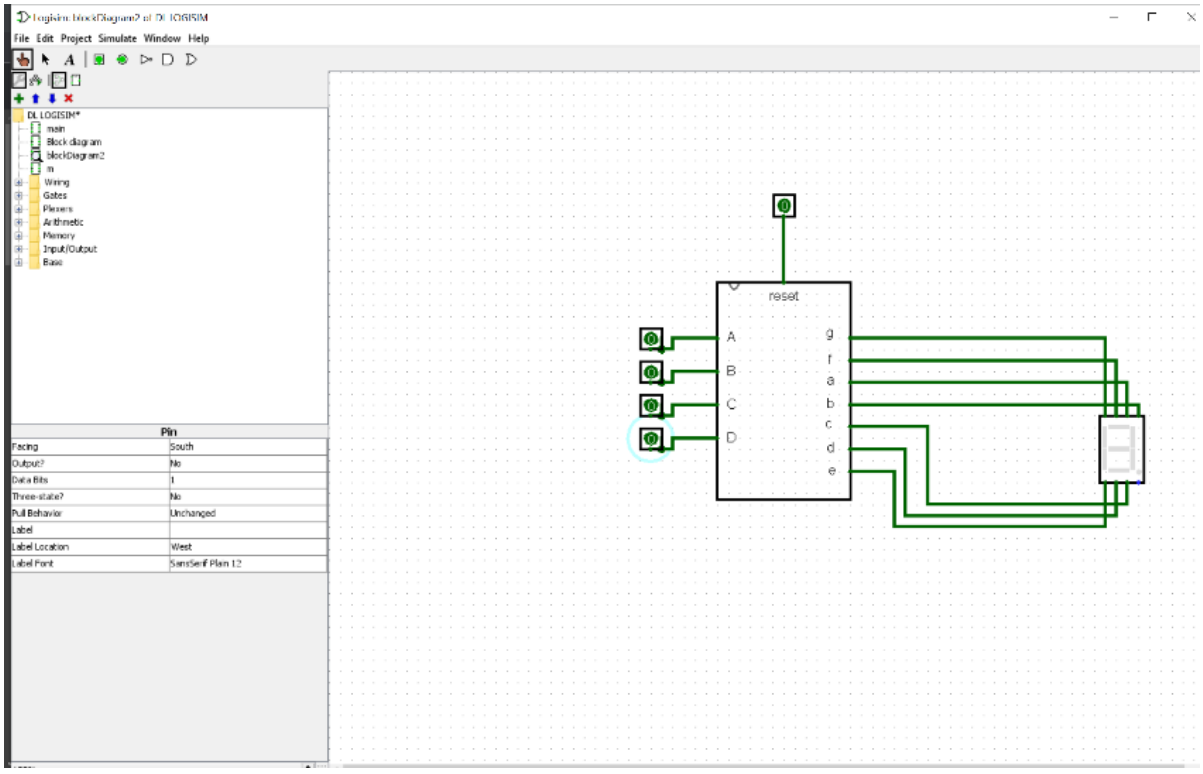
-We designed and simulated a 7 segment display circuits:

- The block diagram containing 4 inputs and 7 outputs (explained in the next page)



The 7-segment display was used in old calculators and computers to display the numbers from 0 to 9, in order to count10 numbers in binary we're going to need 4 inputs that we represented by (A, B, C, D)

And 7 outputs (a, b, c, d, e, f, g), each '1' in the truth table represents the segment that will be enabled

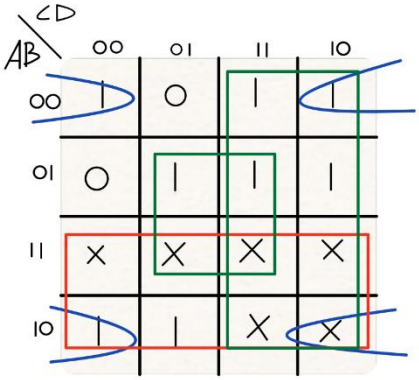
-**First**, we needed to draw a truth table

2^4 = 16

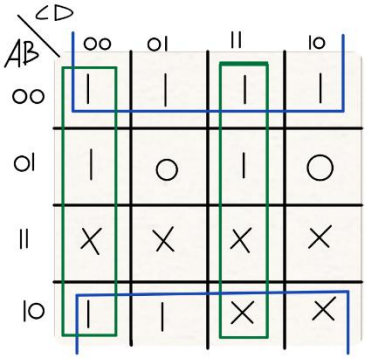
NOTE: (The decimal digits from 10 to 15 are don't care because we can't display them in the 7-segment display

Decimal Digit	**A**	**B**	**C**	**D**	**a**	**b**	**c**	**d**	**e**	**f**	**g**
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	0	0	1	1

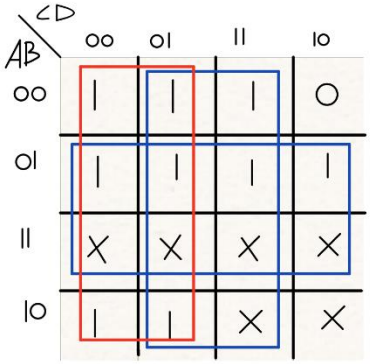
- **Second**, for each output we drew a 2^4 k-map and extracted an equation from each one by taking the biggest groups possible for better simplification:



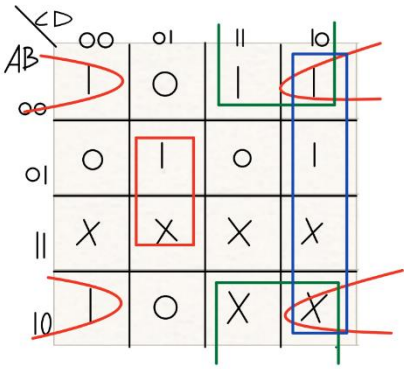
$a = A + C + BD + \overline{B}\overline{D}$



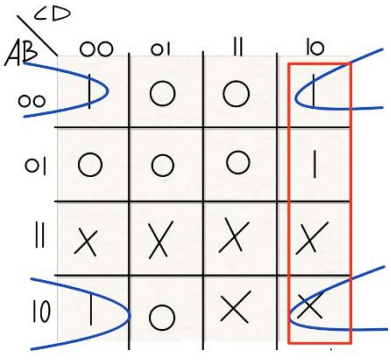
$b = \overline{B} + \overline{C\,D} + CD$



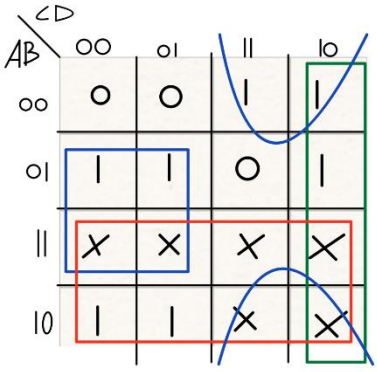
$c = B + \overline{C} + D$



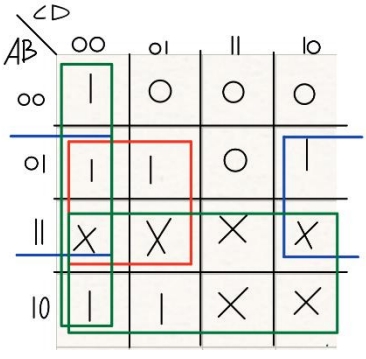
$d = \overline{B}\overline{D} + C\overline{D} + B\overline{C}D + \overline{B}C$



$e = \overline{B}\overline{D} + C\overline{D}$

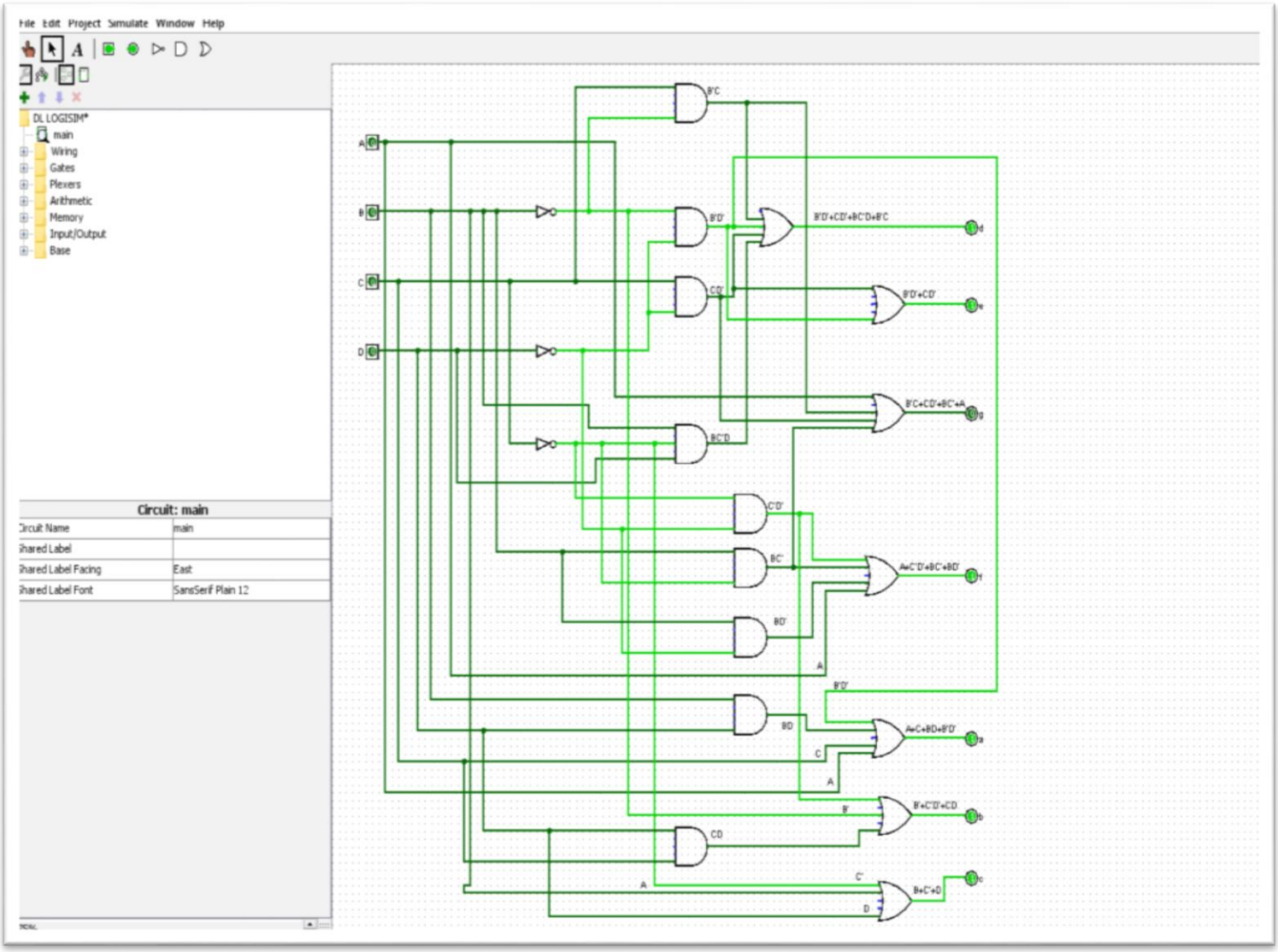


$g = \overline{B}C + C\overline{D} + B\overline{C} + A$



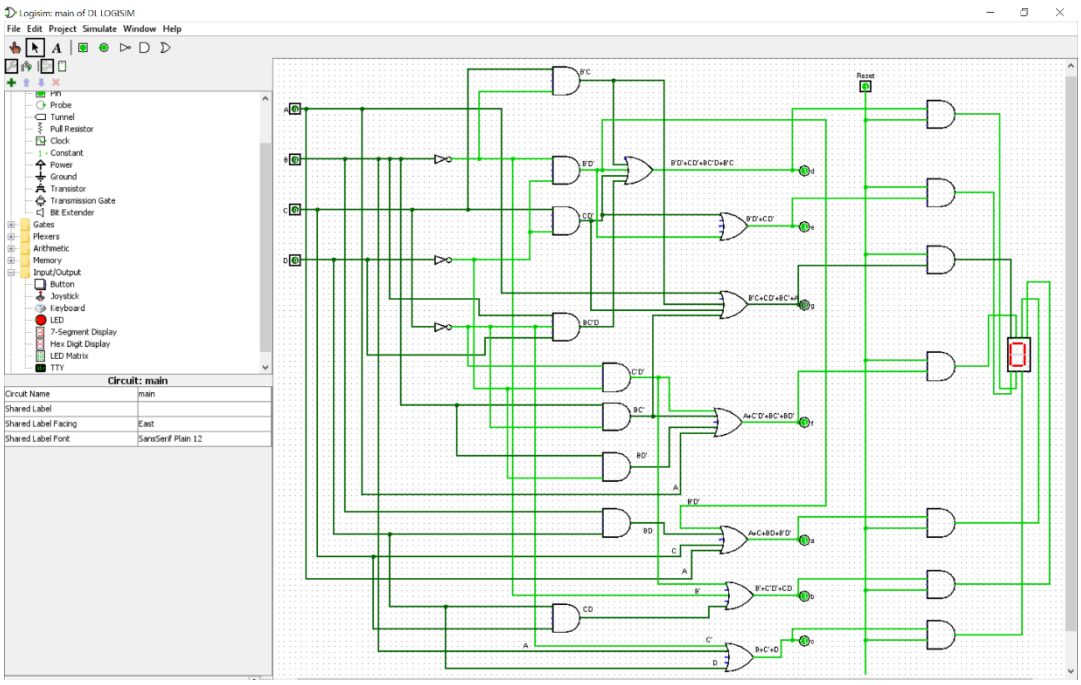
$f = A + \overline{C}\overline{D} + B\overline{C} + B\overline{D}$

-**Third**, we simulated each equation from the outputs and generated a circuit by using Logisim:

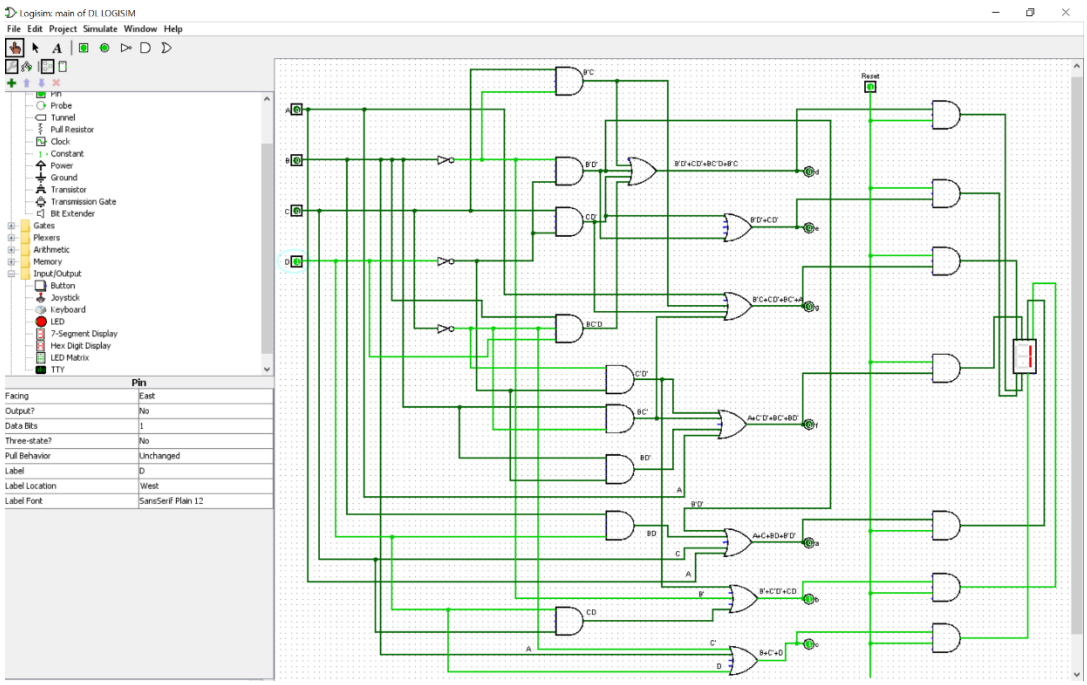


-**Lastly**, we dragged a 7-segment display to output each number from 0 to 9 by enabling or disabling the inputs and using a Reset:

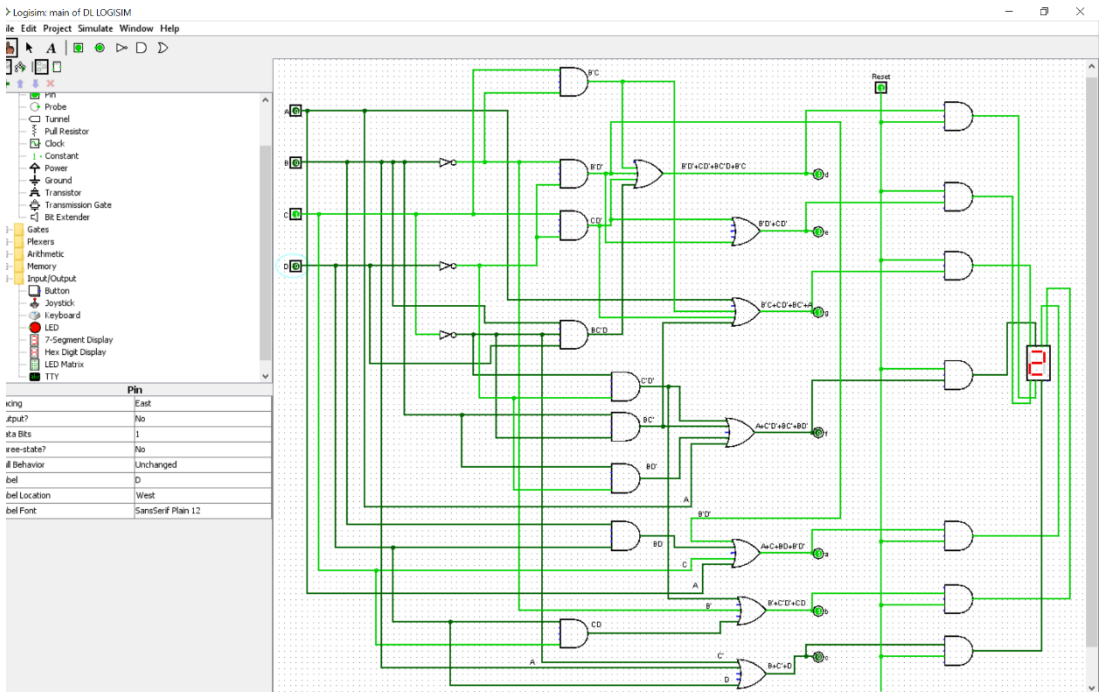
- when disabling all the segments we get 0



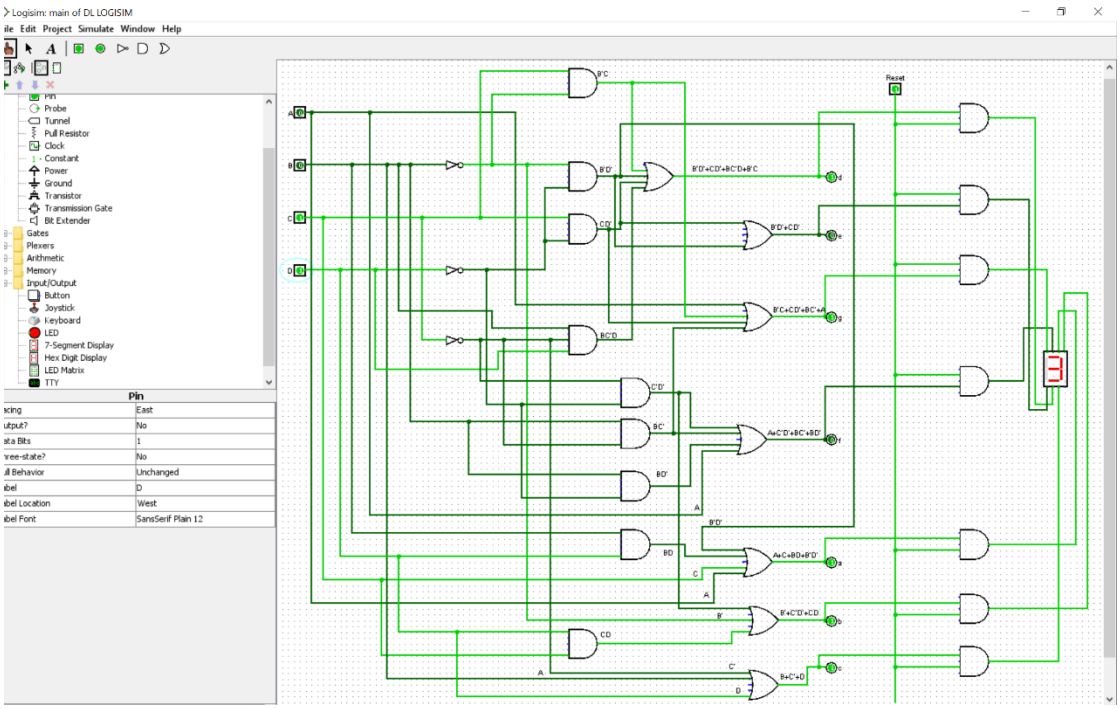
- Enabling just 'D' and disabling the rest we get 1



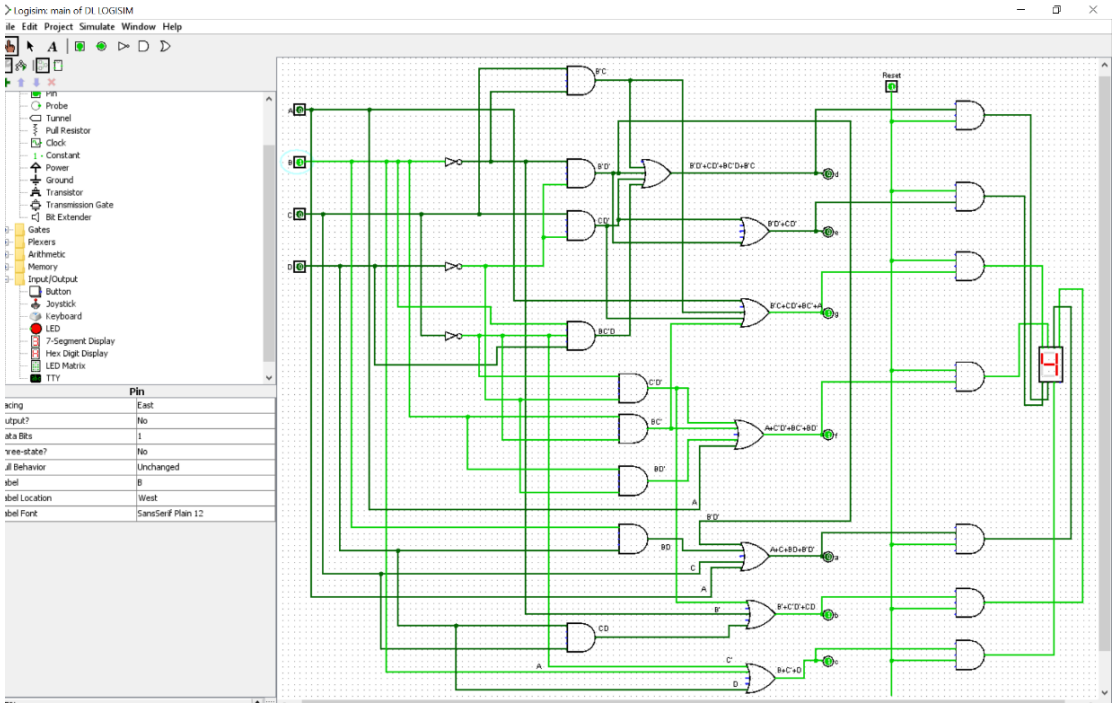
- Enabling just 'C' and disabling the rest will give us 2



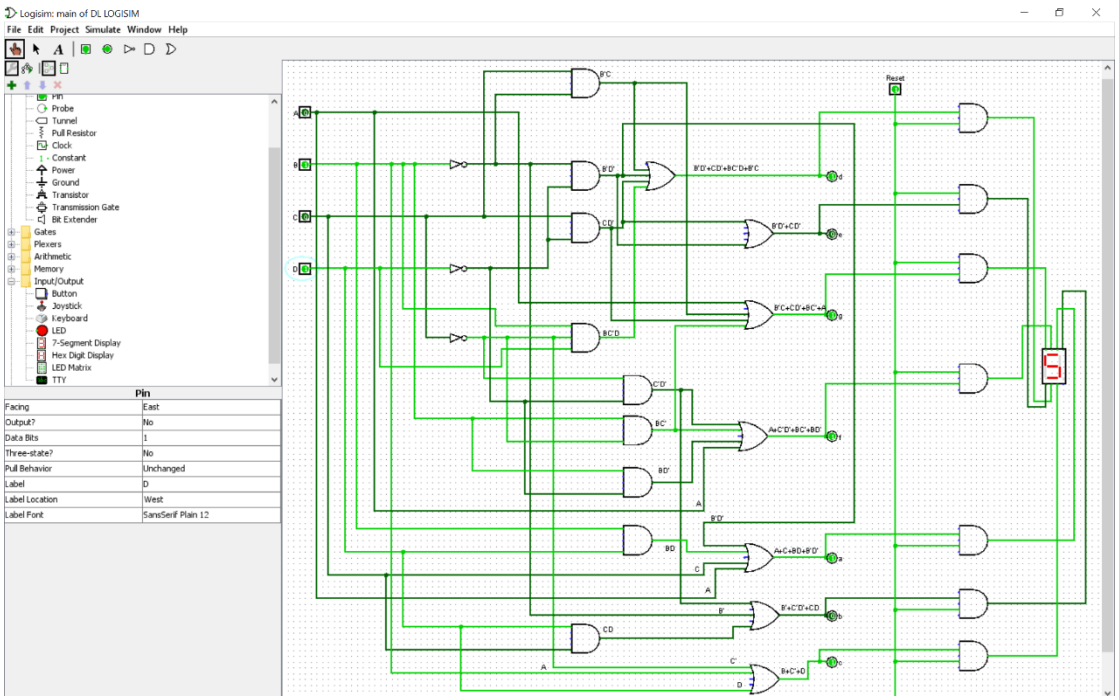
- Enabling 'D' & 'C' and disabling the rest will give us 3



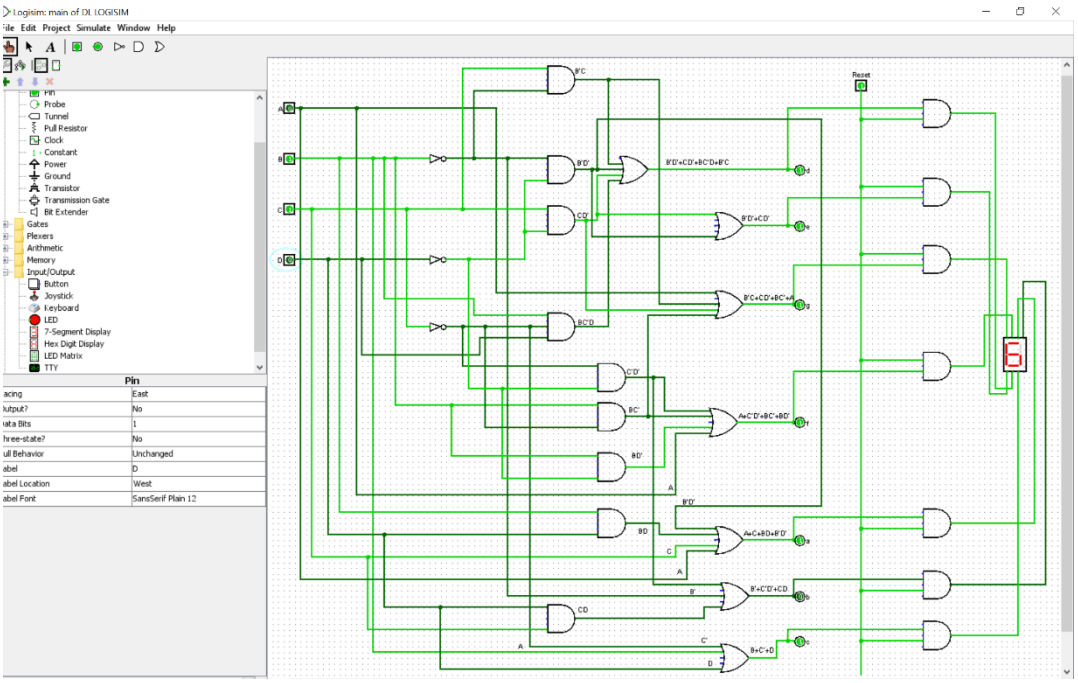
- Enabling just 'B' and disabling the rest will give us 4



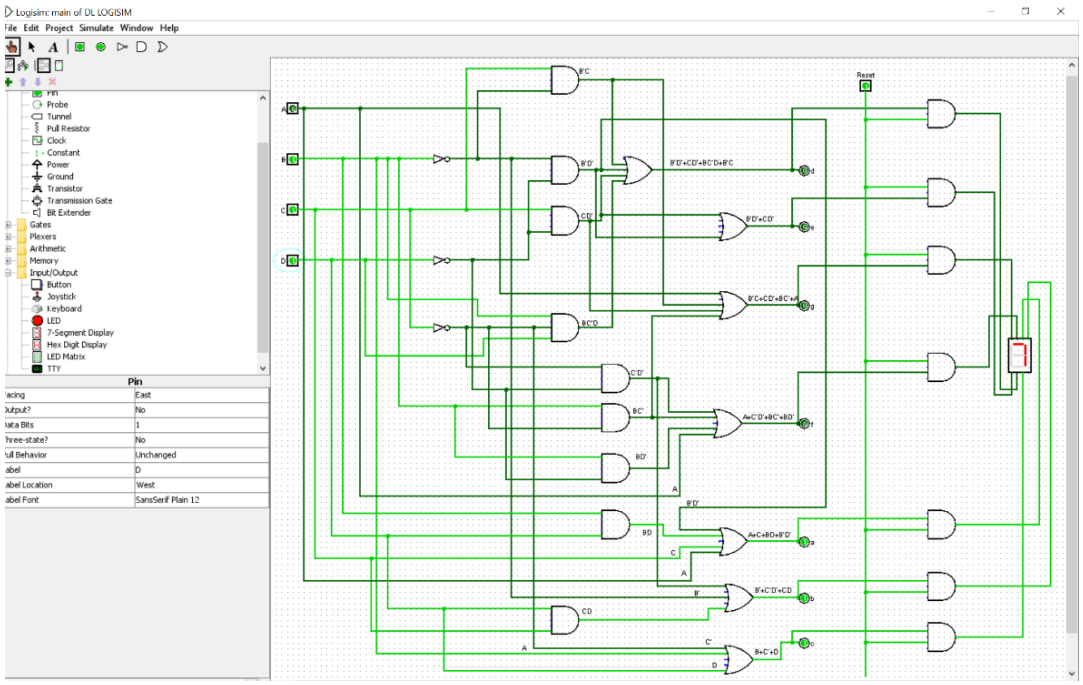
- Enabling 'B' & 'D' and disabling the rest will give us 5



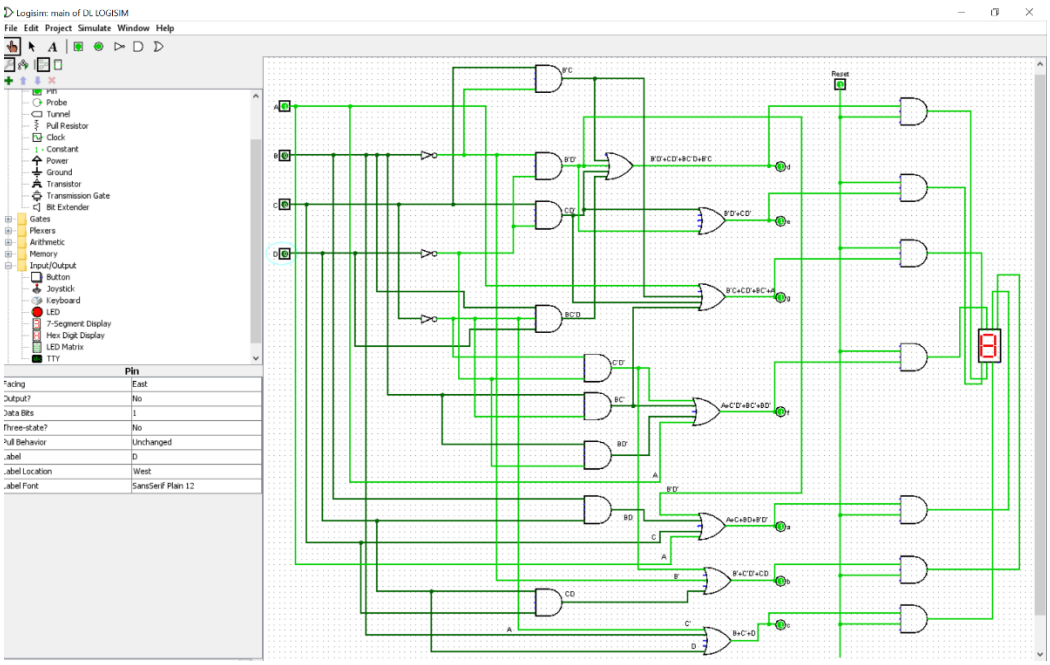
- Enabling 'B' & 'D' and disabling the rest will give us 6



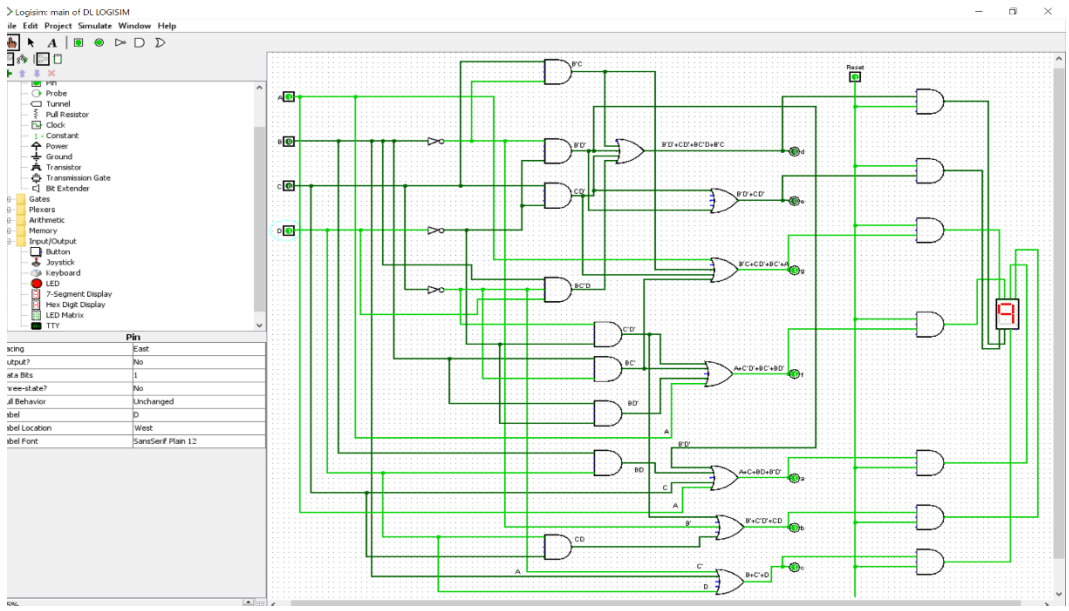
- Enabling 'B' & 'C' & 'D' and disabling just 'A' will give us 7



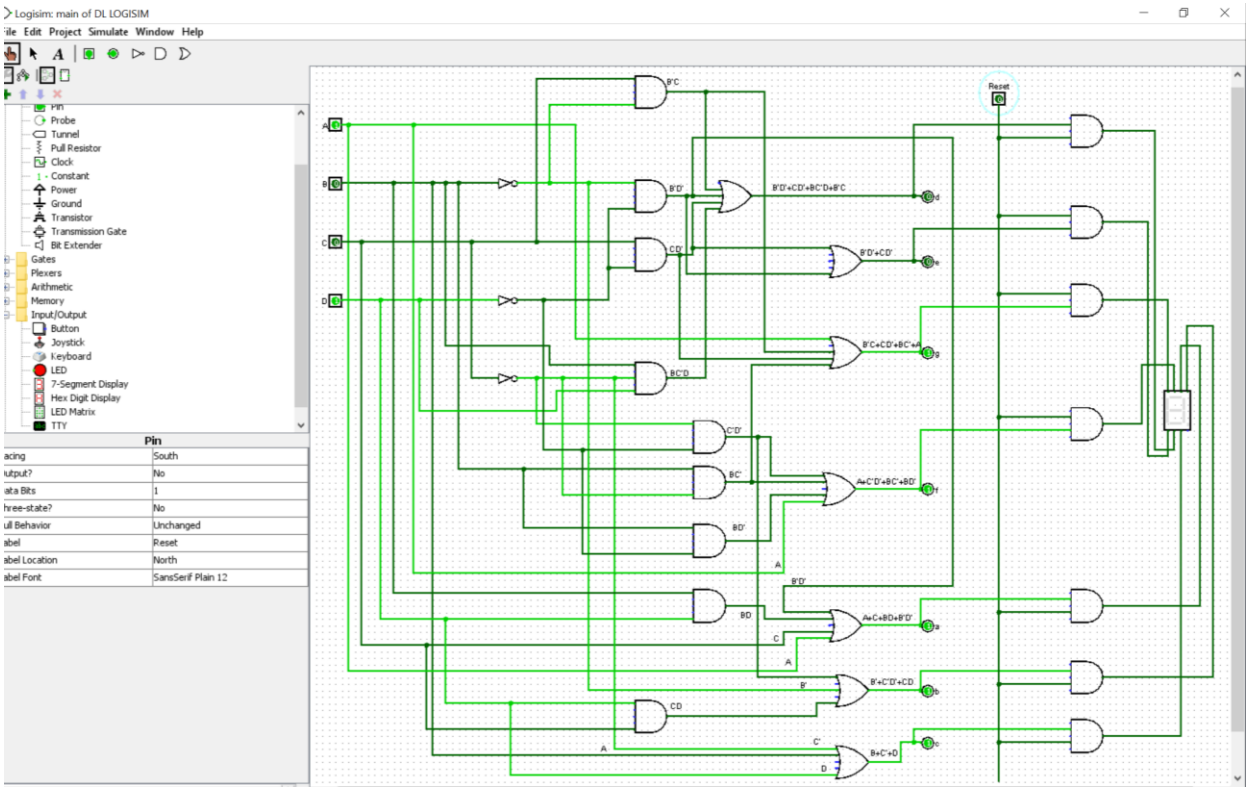
- Enabling just 'A' and disabling the rest will give us 8



- Enabling 'A' & 'D' and disabling the rest will give us 9



- when disabling the 'Reset' the entire circuit will stop working



- The block diagram with the 7-segment display on