

Lab 7

To Demonstrate the Working of a Digital Comparator

Note: You may draw all the logic diagrams with hand and paste the pictures here or on logicly software with your name, roll number & section mentioned in your workspace. Make sure that all of your connections are clearly visible and distinguishable. In logicly, use “text” label to point out/show all your inputs & outputs

Tasks

1. Construct a logic circuit for a 2 bit magnitude comparator Also write the Boolean expression for output(s). Simulate your circuit in logicly software.
Hint: Take 2 bits of each input i.e. A1A0 & B1B0

2-Bit Magnitude Comparator

- a) Truth Table

Input				Output		
A1	A0	B1	B0	A<B	A=B	A>B
0	0	0	0	0	1	0
0	0	0	1	1	0	0
0	0	1	0	1	0	0
0	0	1	1	1	0	0
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	1	0	0
0	1	1	1	1	0	0
1	0	0	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	0	1	0
1	0	1	1	1	0	0
1	1	0	0	0	0	1
1	1	0	1	0	0	1
1	1	1	0	0	0	1
1	1	1	1	0	1	0

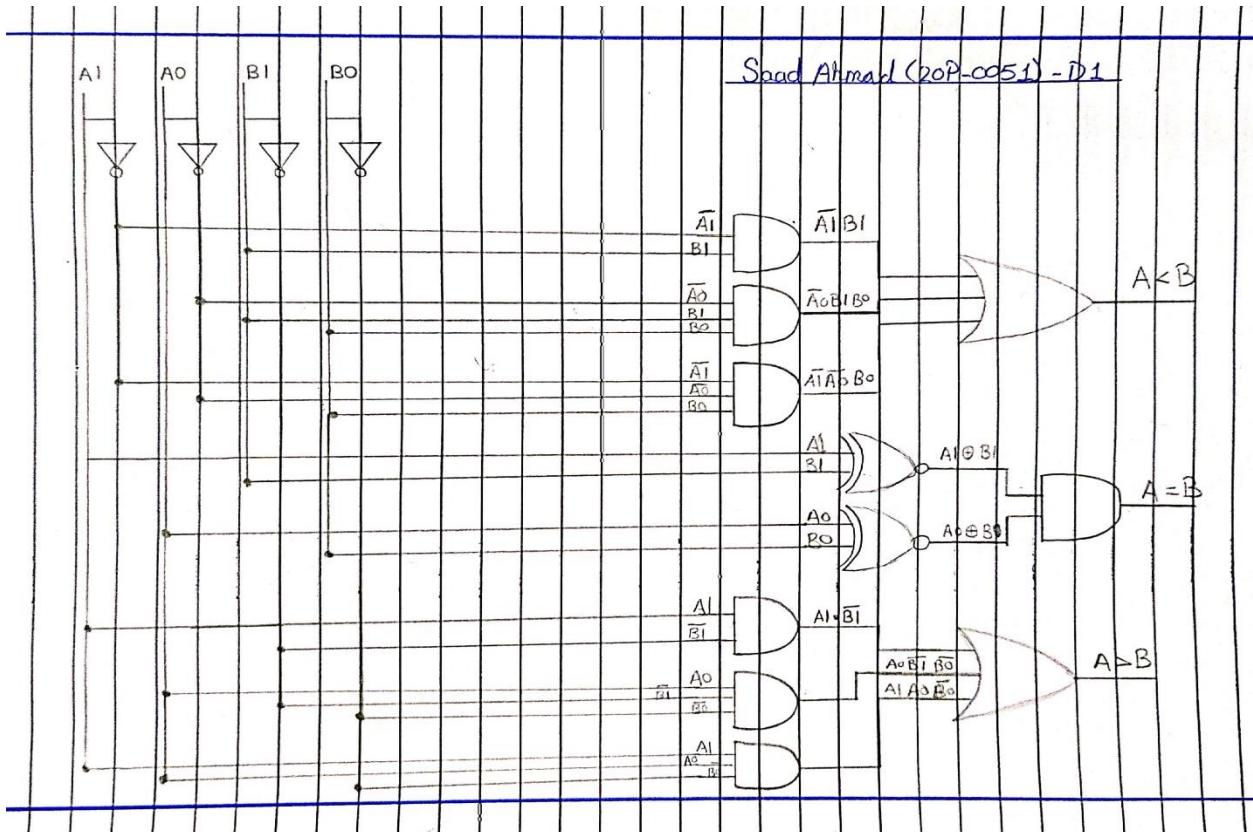
b) Boolean Expression (Simplified)

$$A < B = A_1' B_1 + A_0' B_1 B_0 + A_1' A_0' B_0$$

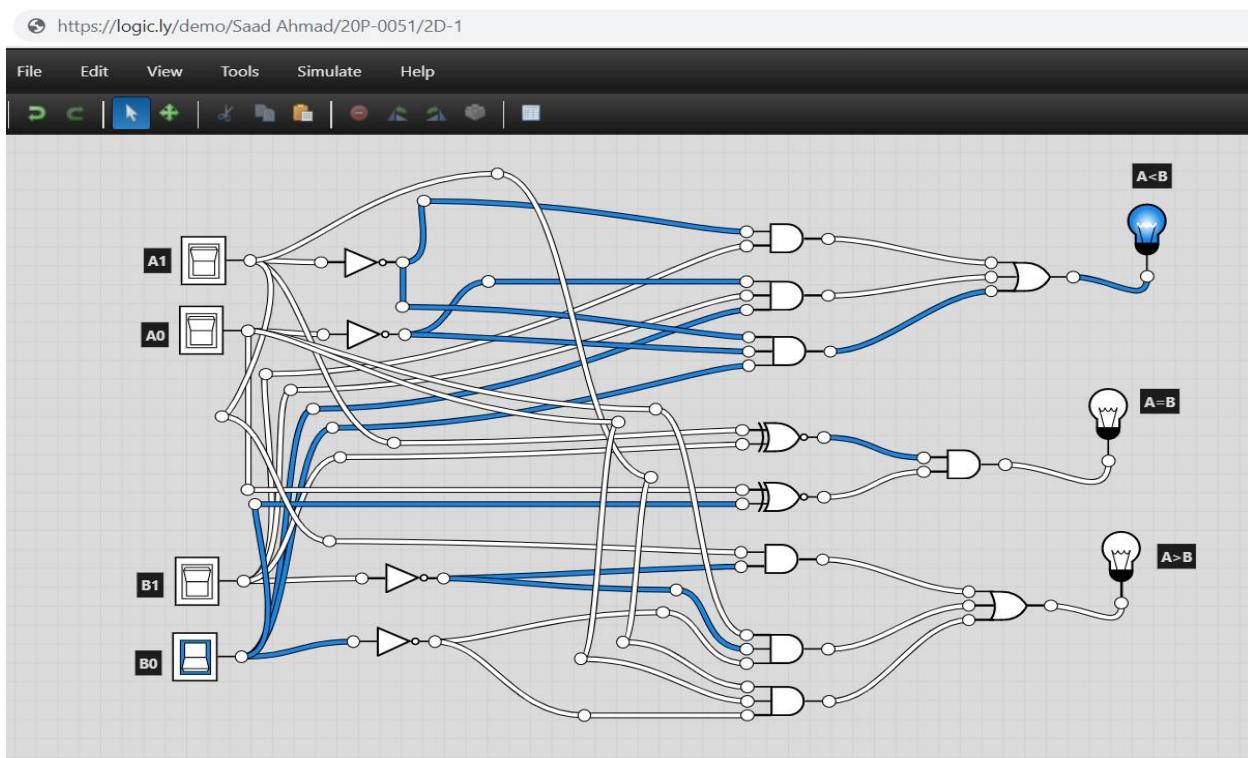
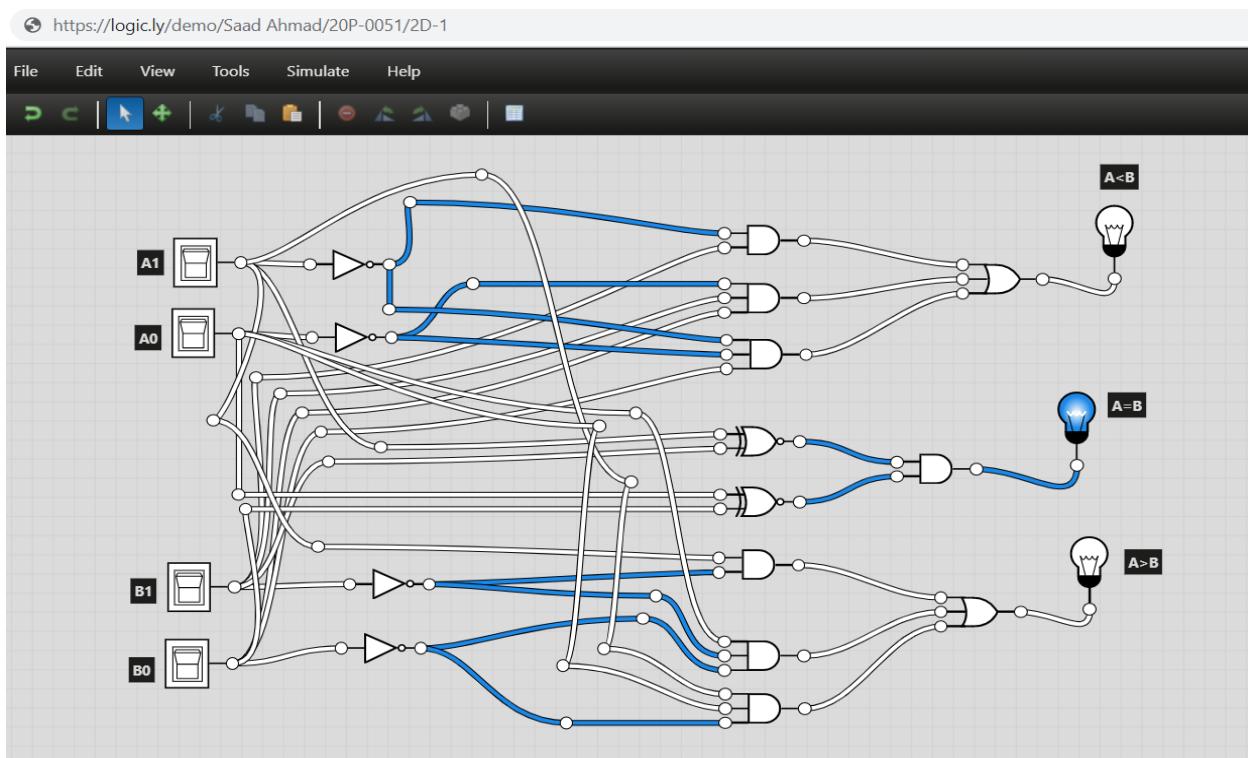
$$A = B = \text{NOT} [(A_0 \oplus B_0)] \cdot \text{NOT} [(A_1 \oplus B_1)]$$

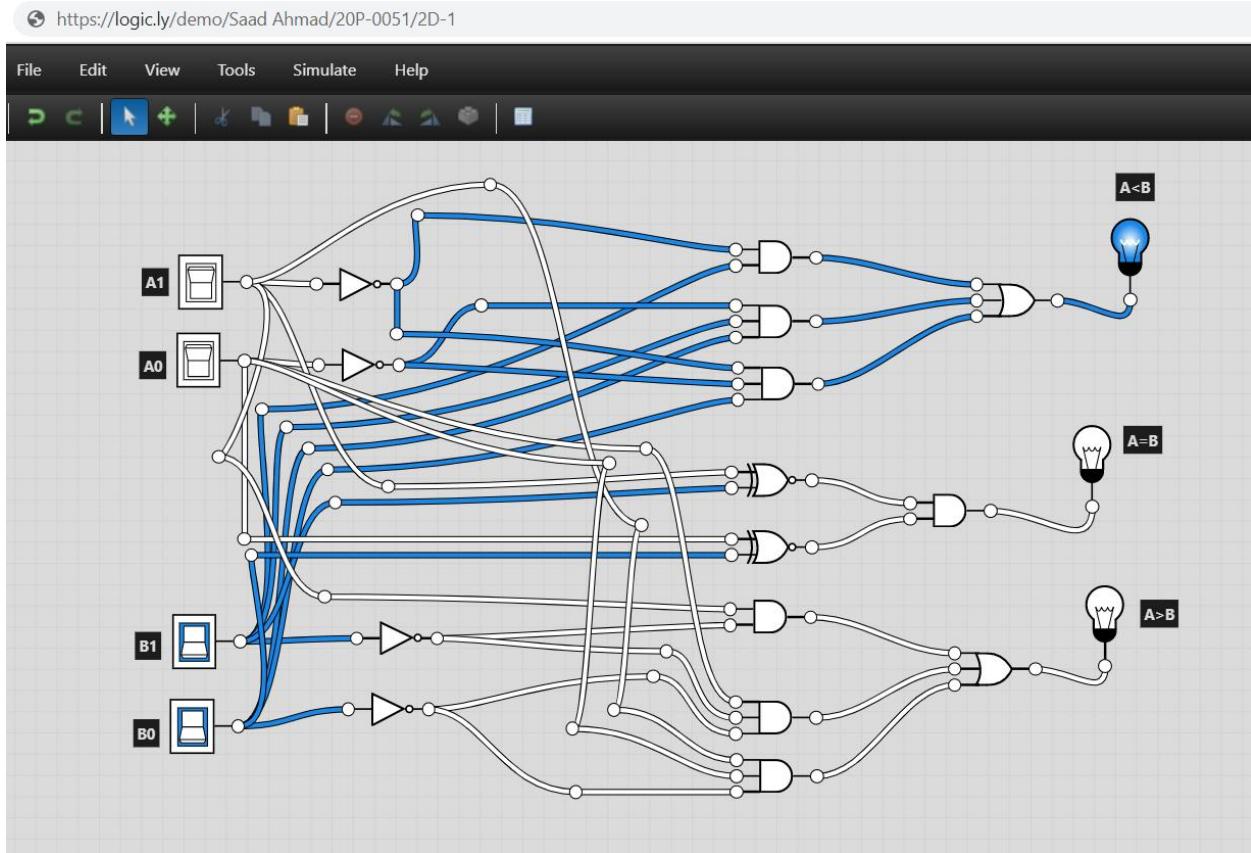
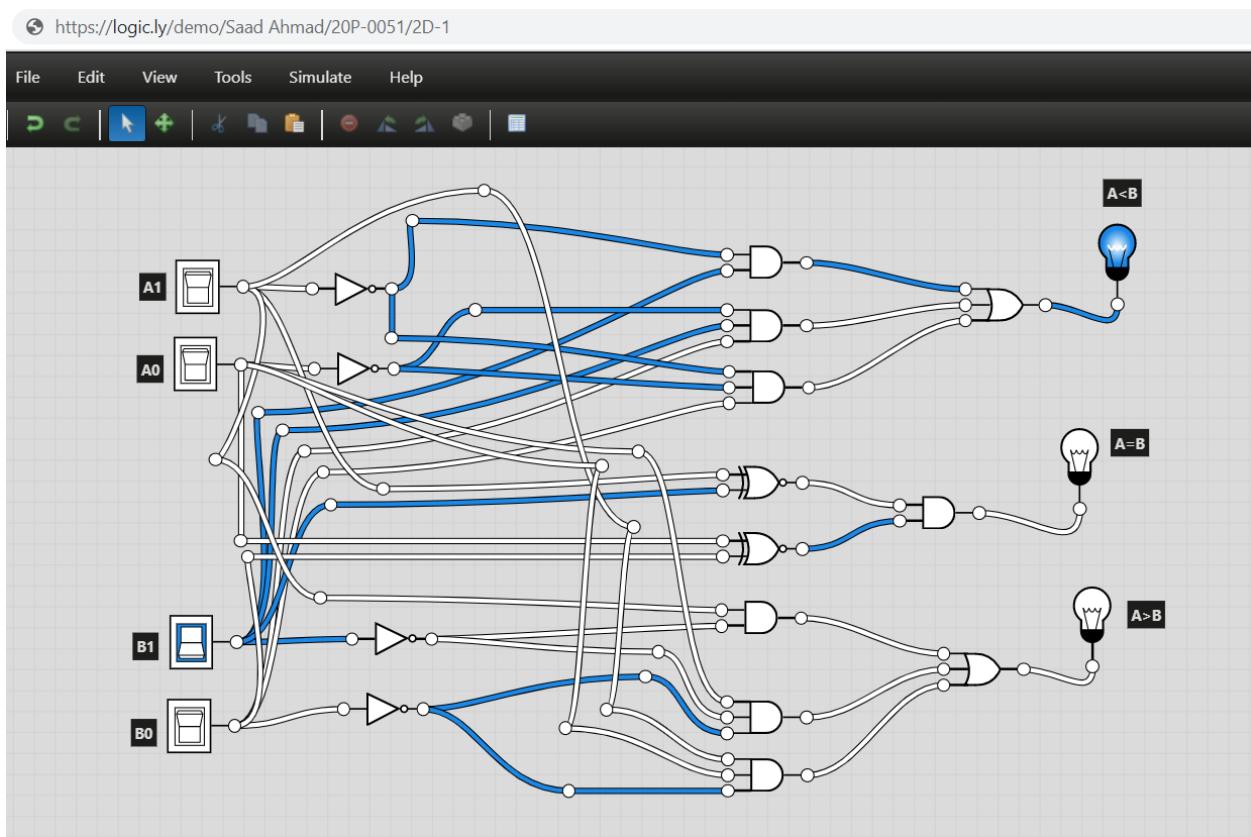
$$A > B = A_1 B_1' + A_0 B_1' B_0' + A_1 A_0 B_0'$$

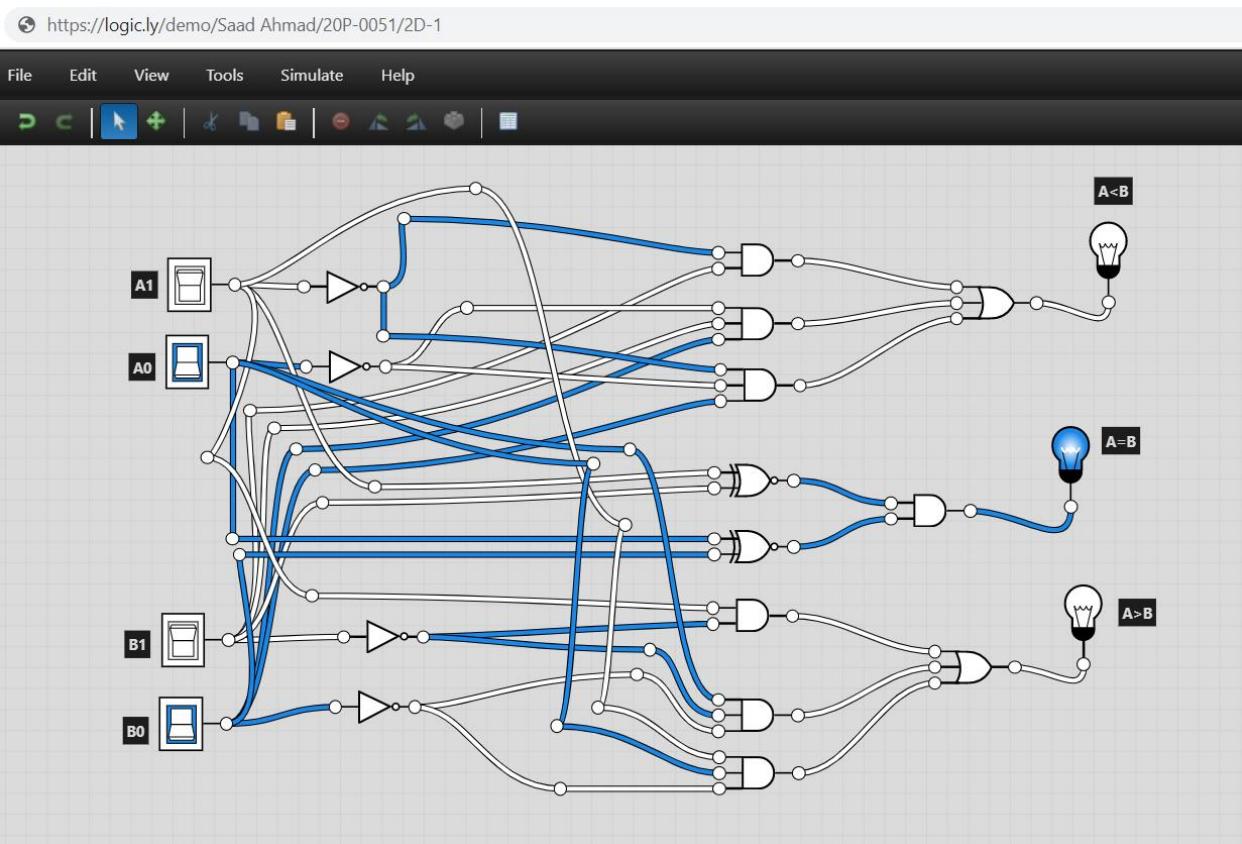
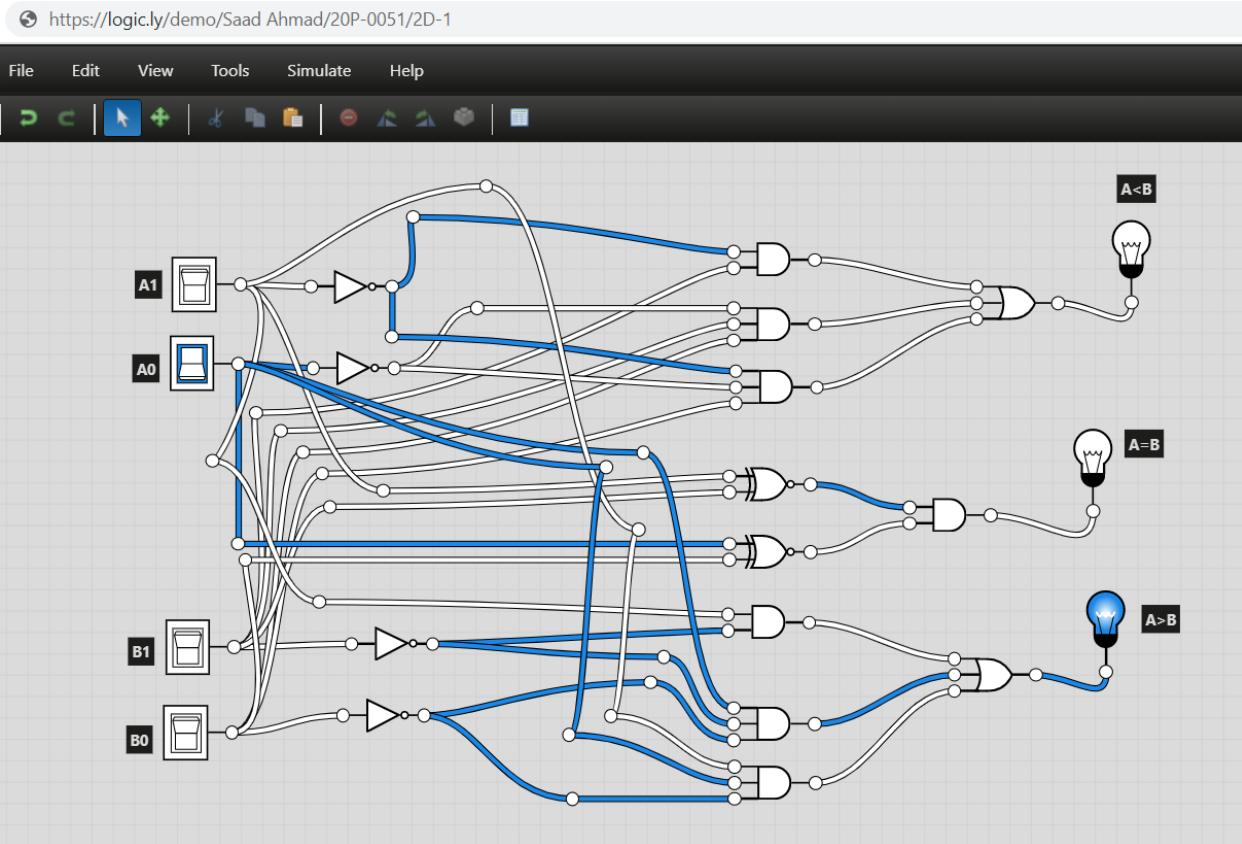
c) Logic Diagram

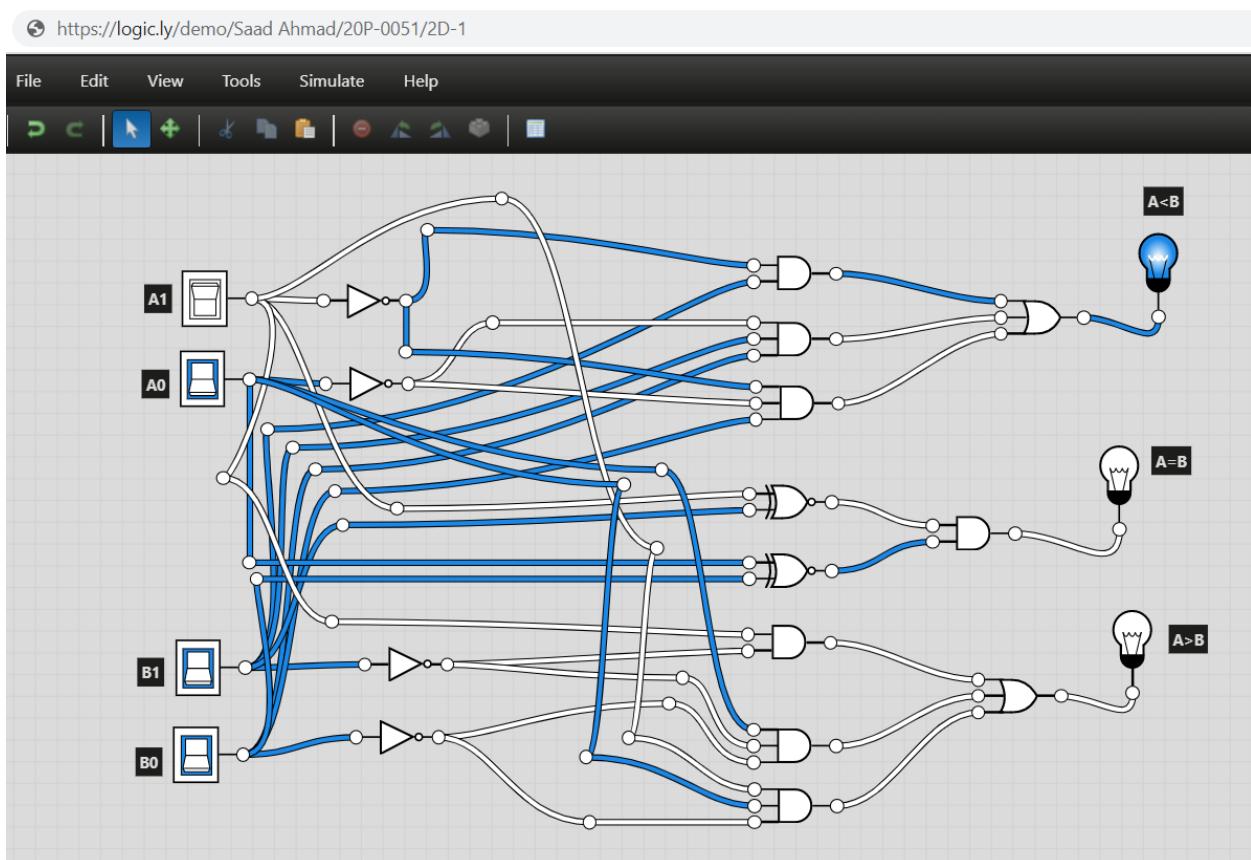
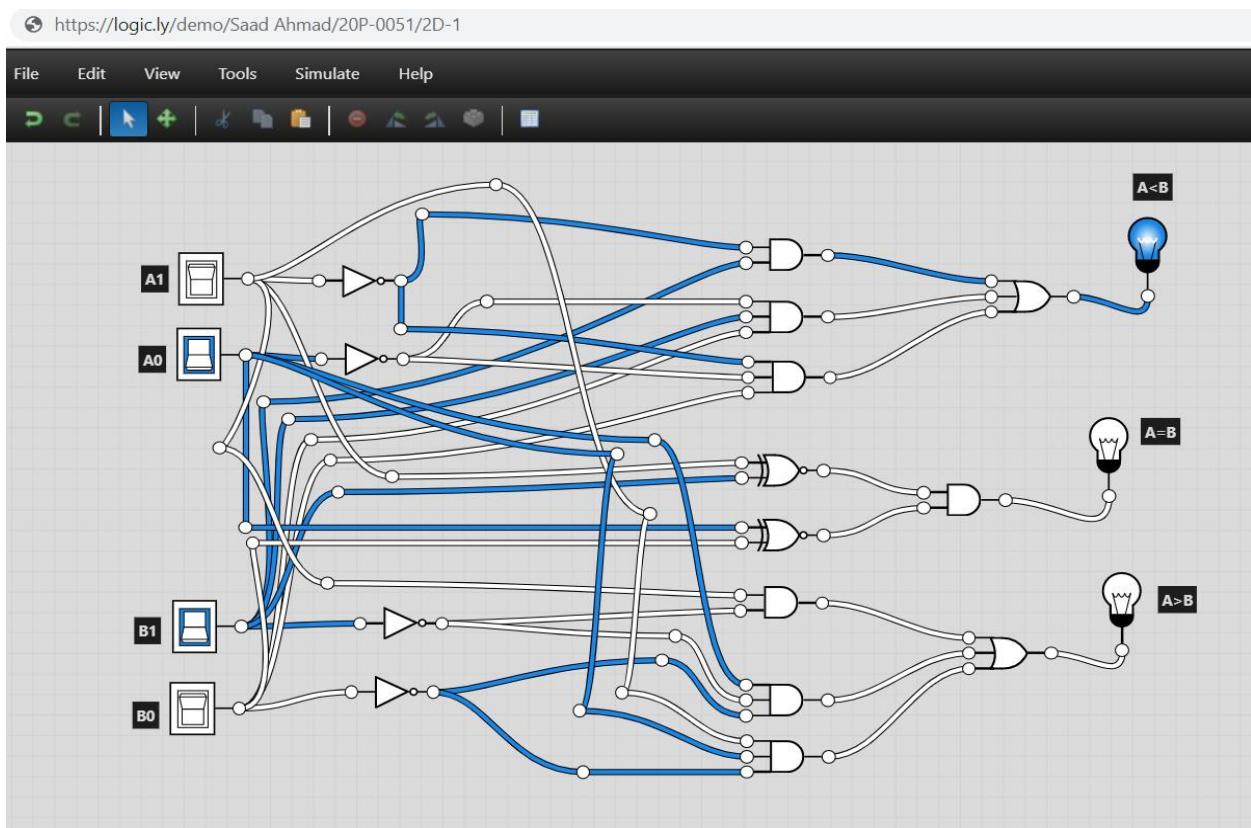


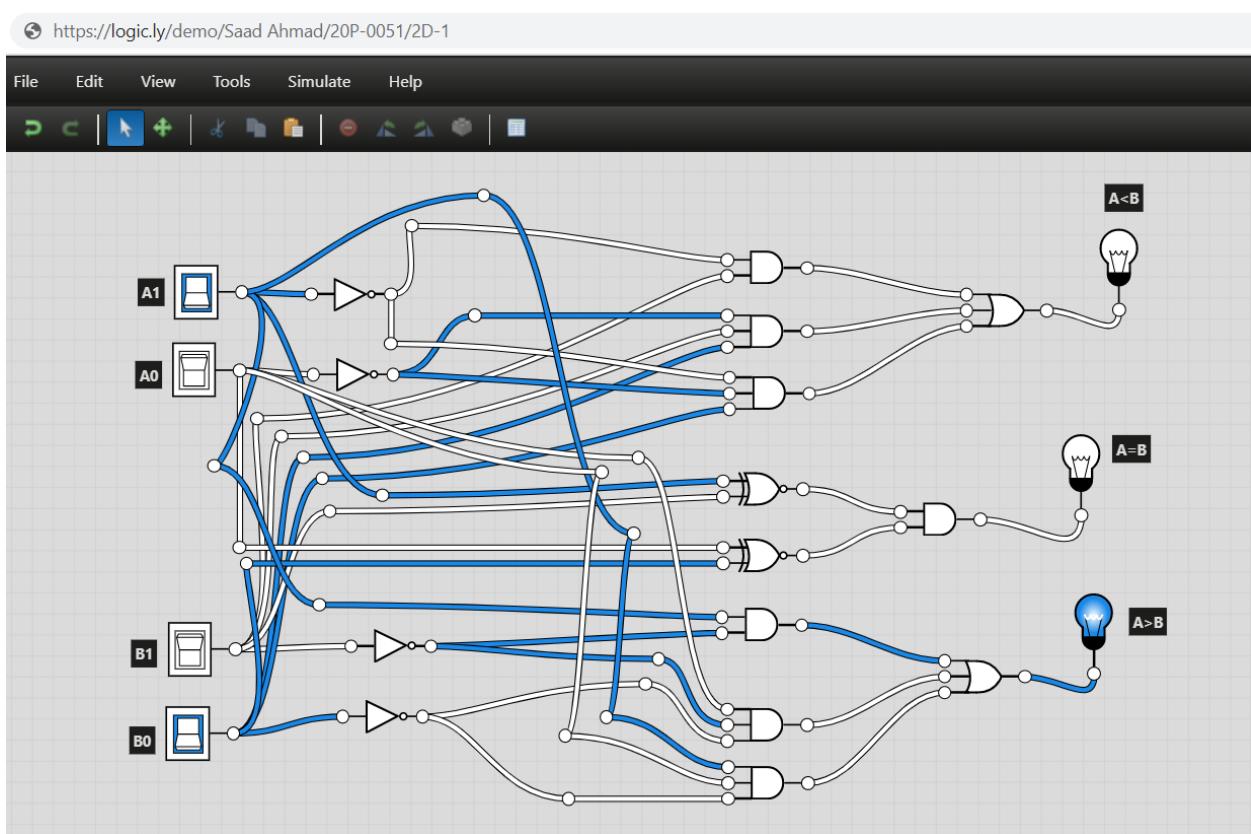
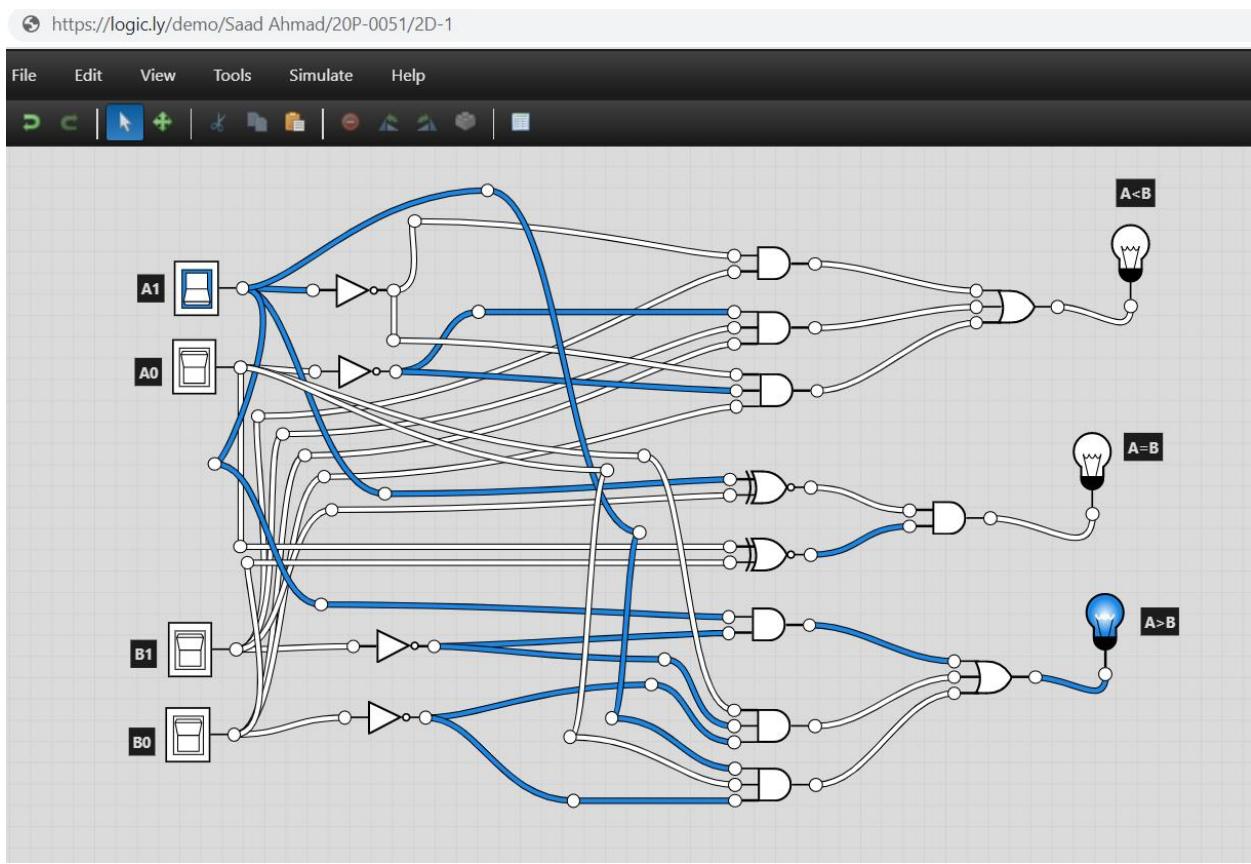
d) Software Simulation (Show here your results for each combination that gives a high output)

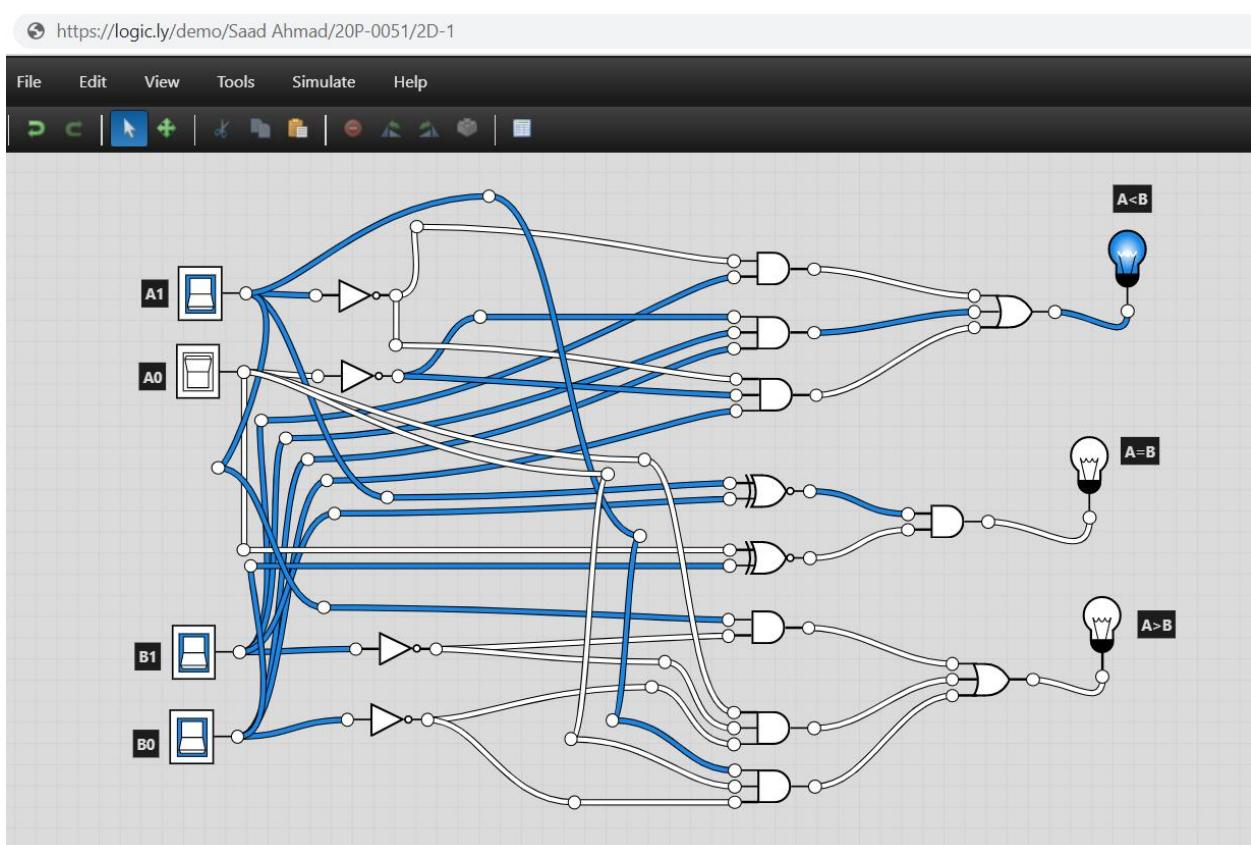
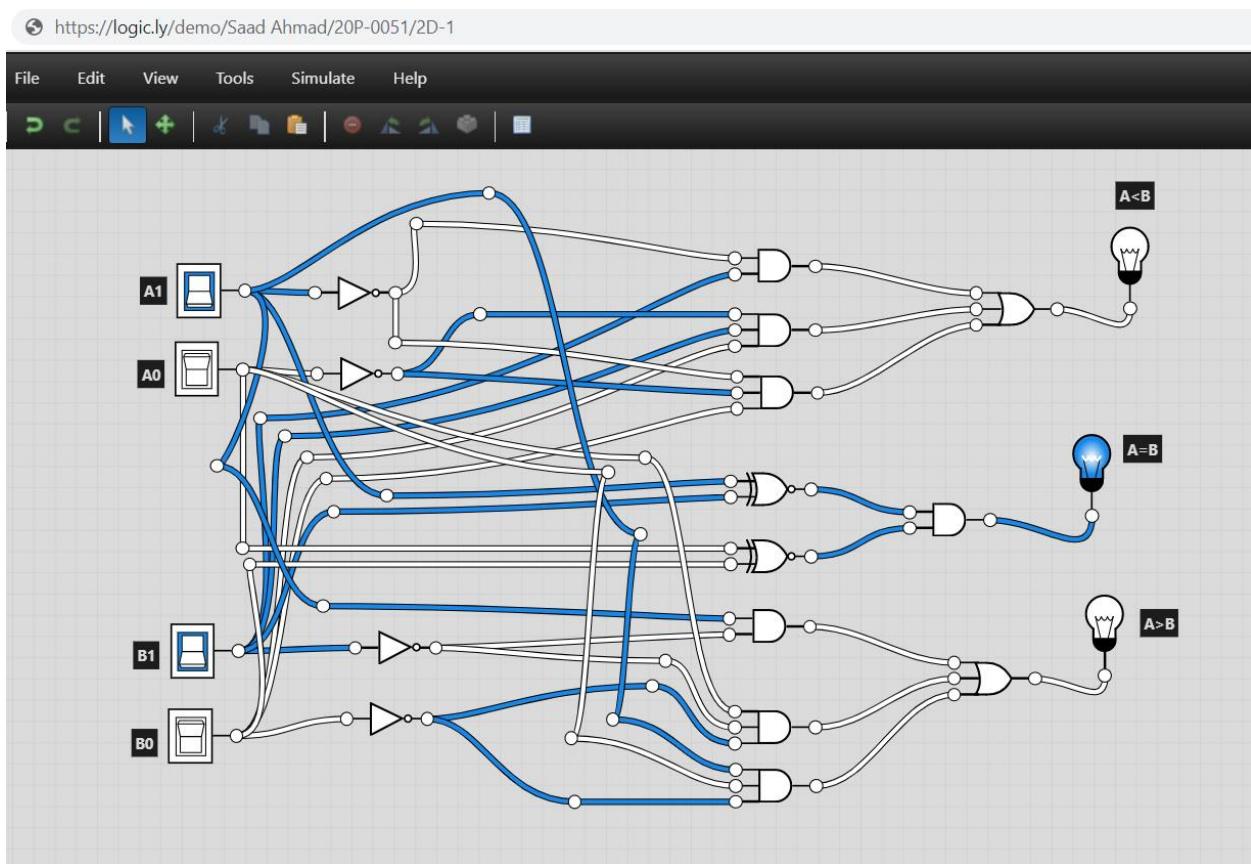


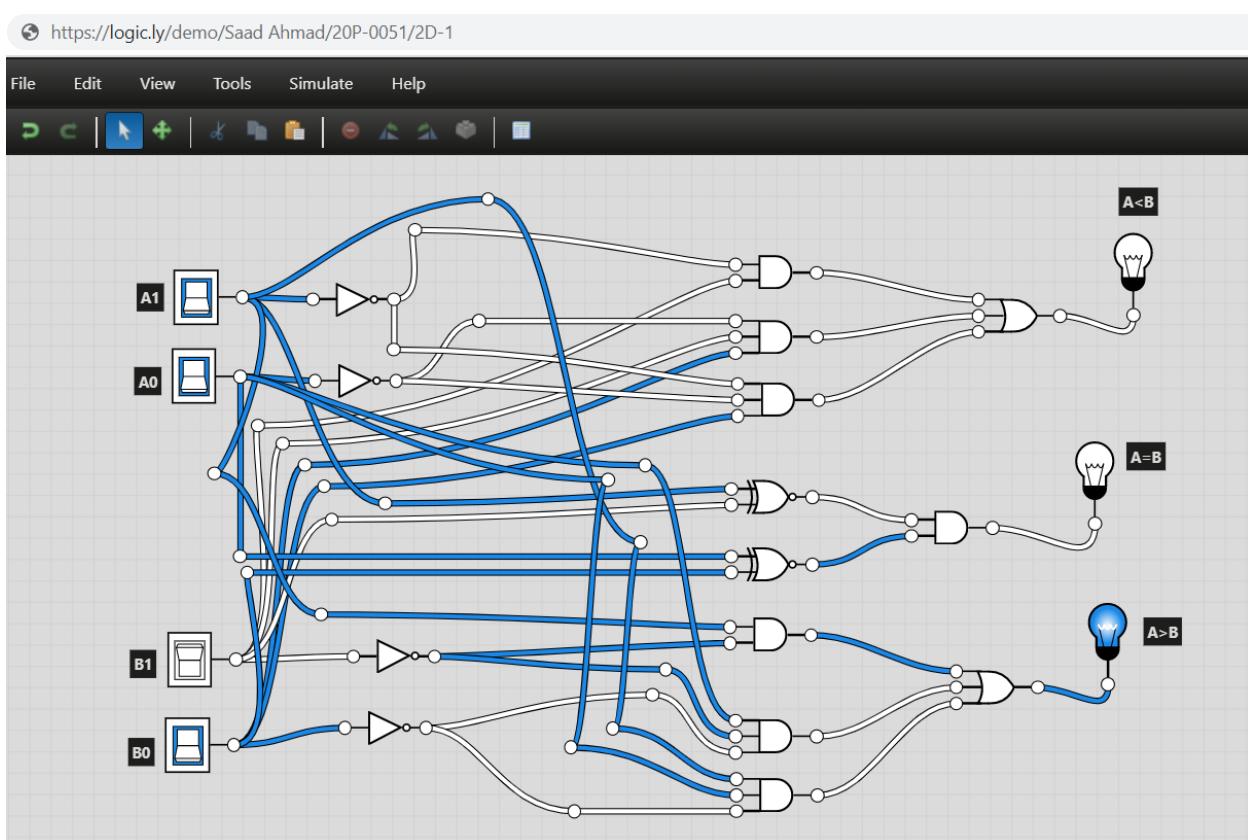
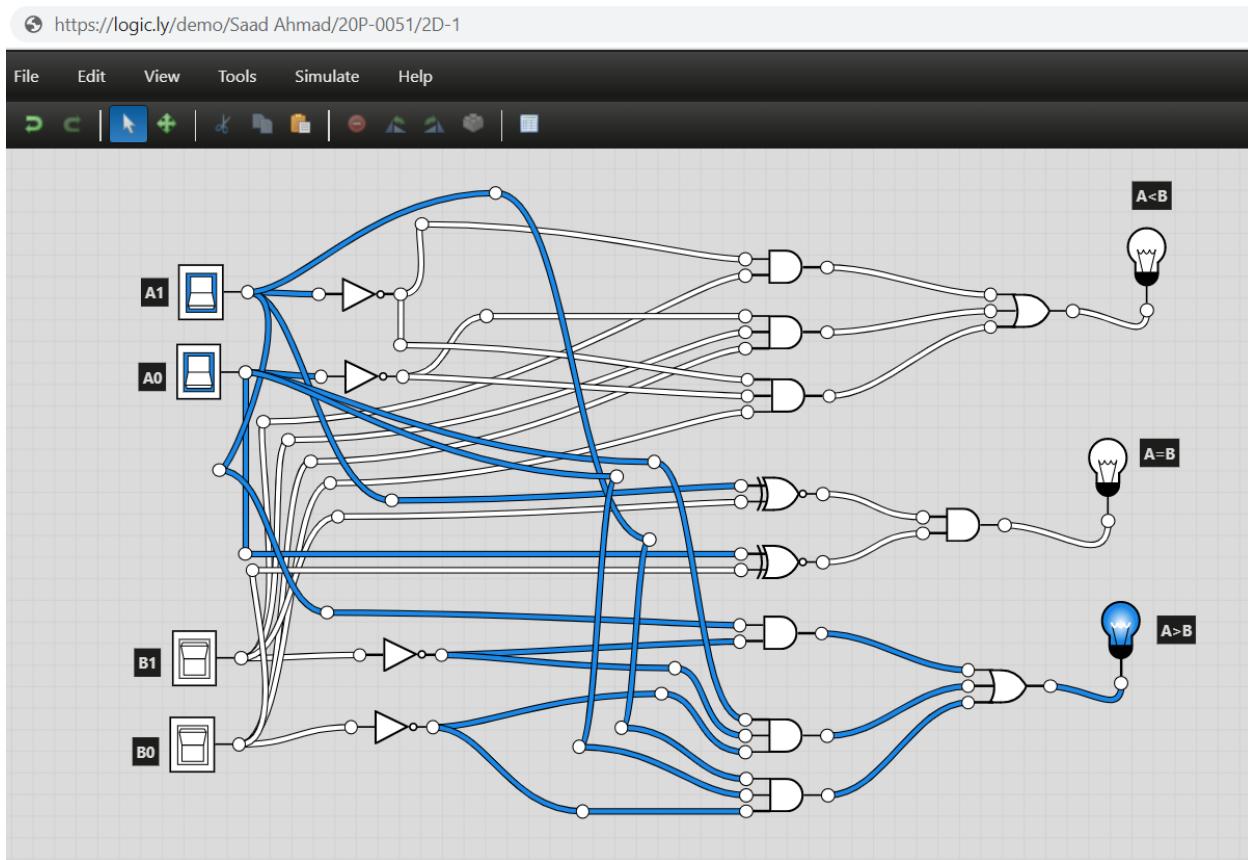


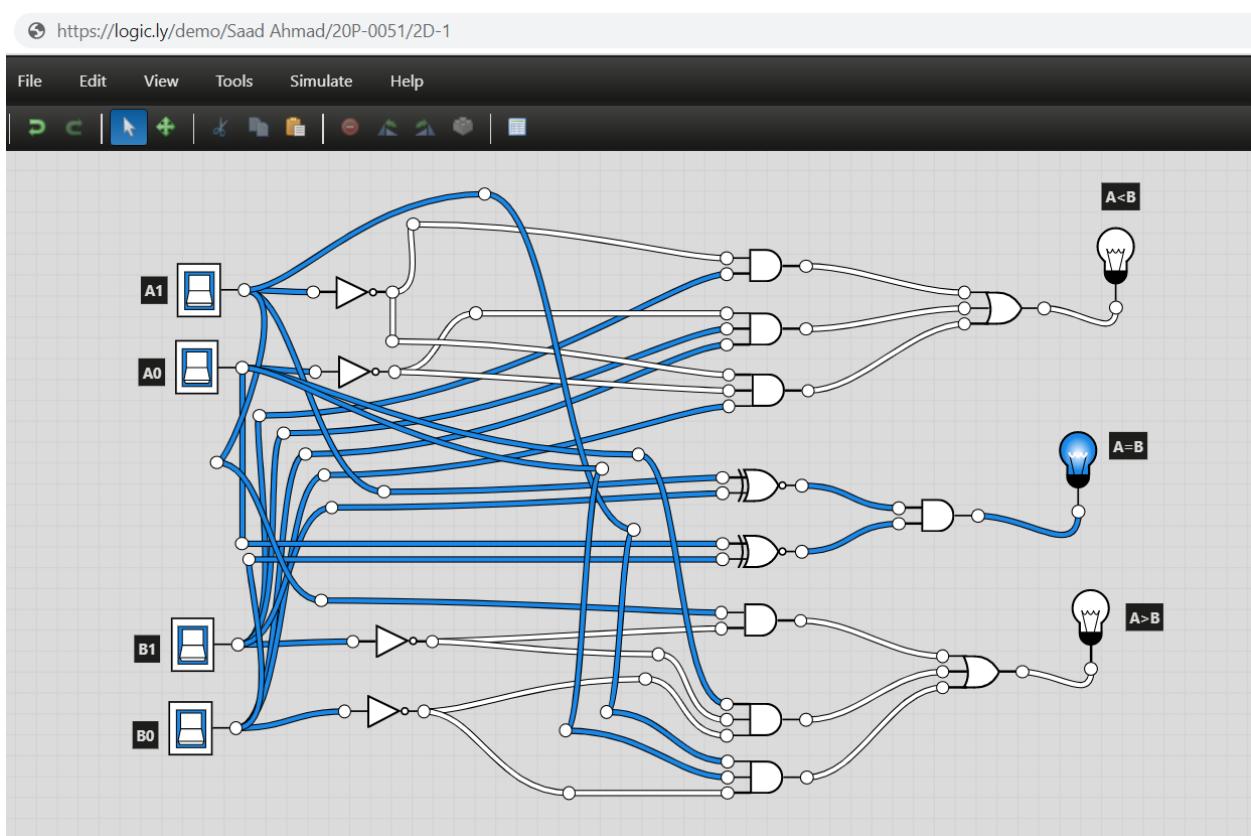
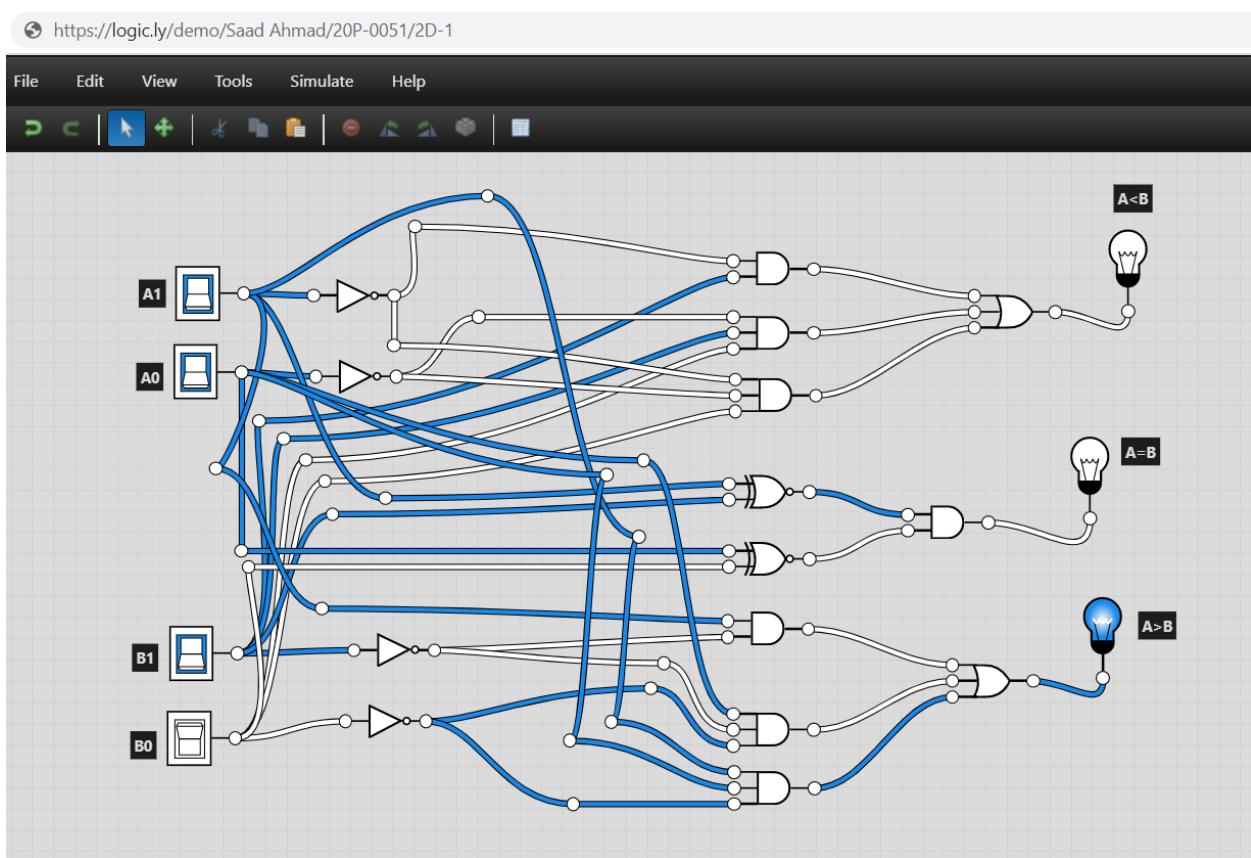












- 2) Construct a logic circuit for a 4-bit magnitude comparator Also write the Boolean expression for output(s). Simulate your circuit in logically software.

You may take help from the logic diagram available on the Internet and compare it with yours for better understanding.

The logic circuit should be hand drawn (neatly) with all necessary labels (inputs/outputs).

4-Bit Magnitude Comparator

- a) Truth Table

Input				Output		
A3B3	A2B2	A1B1	A0B0	A>B	A<B	A=B
A3>B3	x	x	x	1	0	0
A3<B3	x	x	x	0	1	0
A3=B3	A2>B2	x	x	1	0	0
A3=B3	A2<B2	x	x	0	1	0
A3=B3	A2=B2	A1>B1	x	1	0	0
A3=B3	A2=B2	A1<B1	x	0	1	0
A3=B3	A2=B2	A1=B1	A0>B0	1	0	0
A3=B3	A2=B2	A1=B1	A0<B0	0	1	0
A3=B3	A2=B2	A1=B1	A0=B0	0	0	1

- b) Boolean Expression

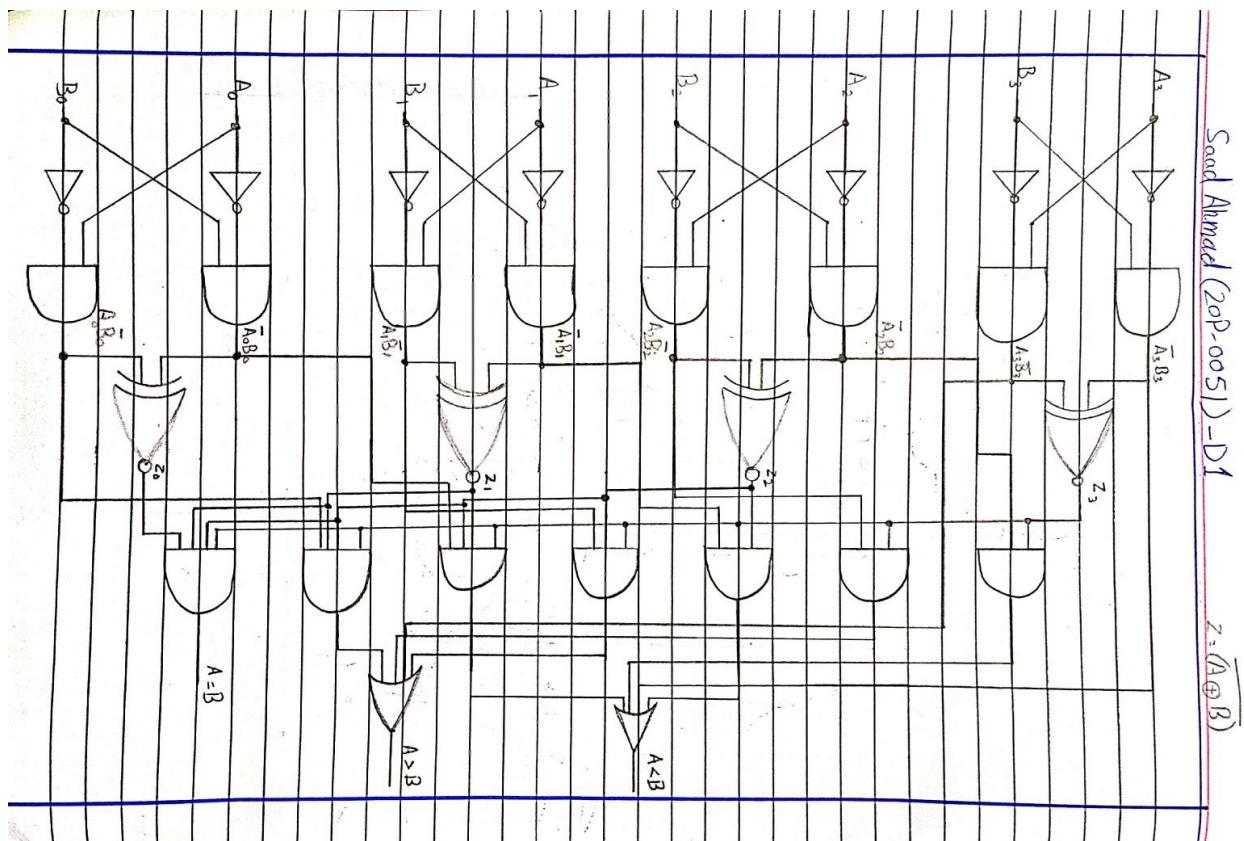
$$\text{Supposing } Z = \text{NOT}[(A \oplus B)]$$

$$A < B : A_3' \cdot B_3 + Z_3 \cdot A_2' \cdot B_2 + Z_3 \cdot Z_2 \cdot A_1' \cdot B_1 + Z_3 \cdot Z_2 \cdot Z_1 \cdot A_0' \cdot B_0$$

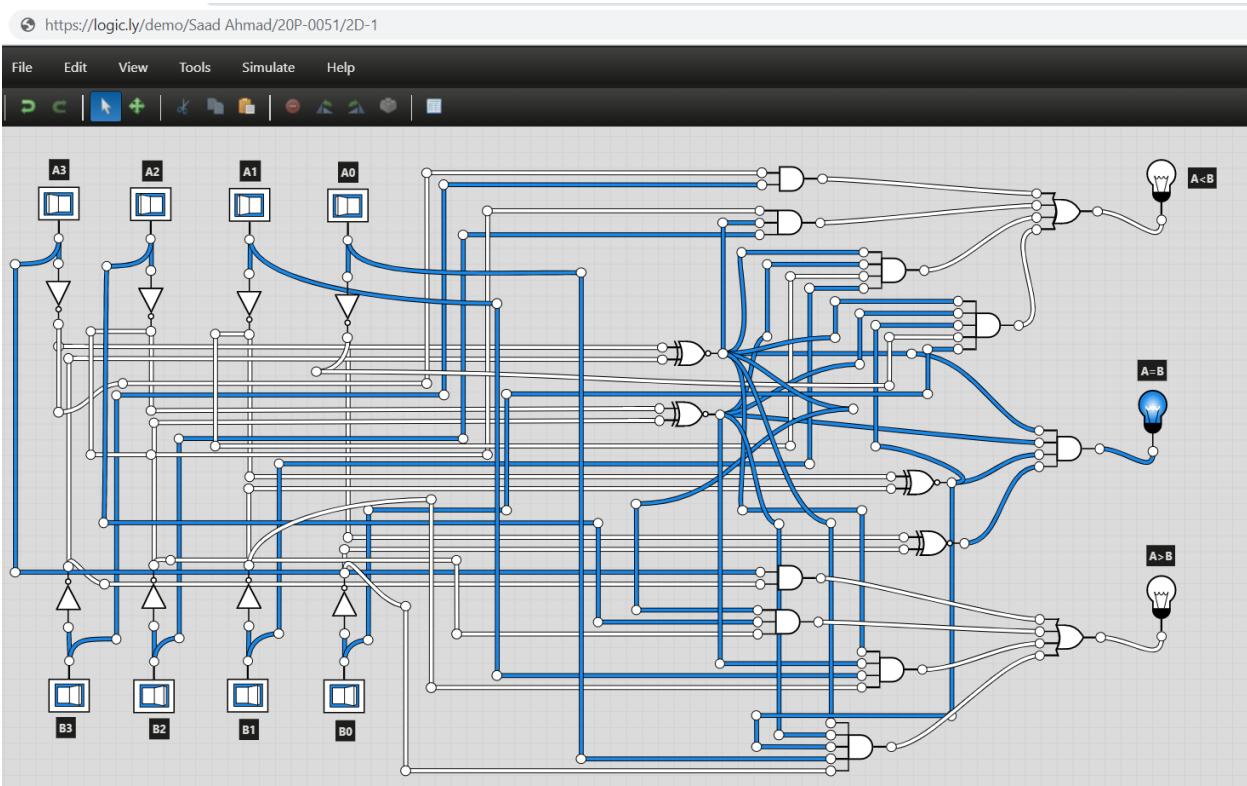
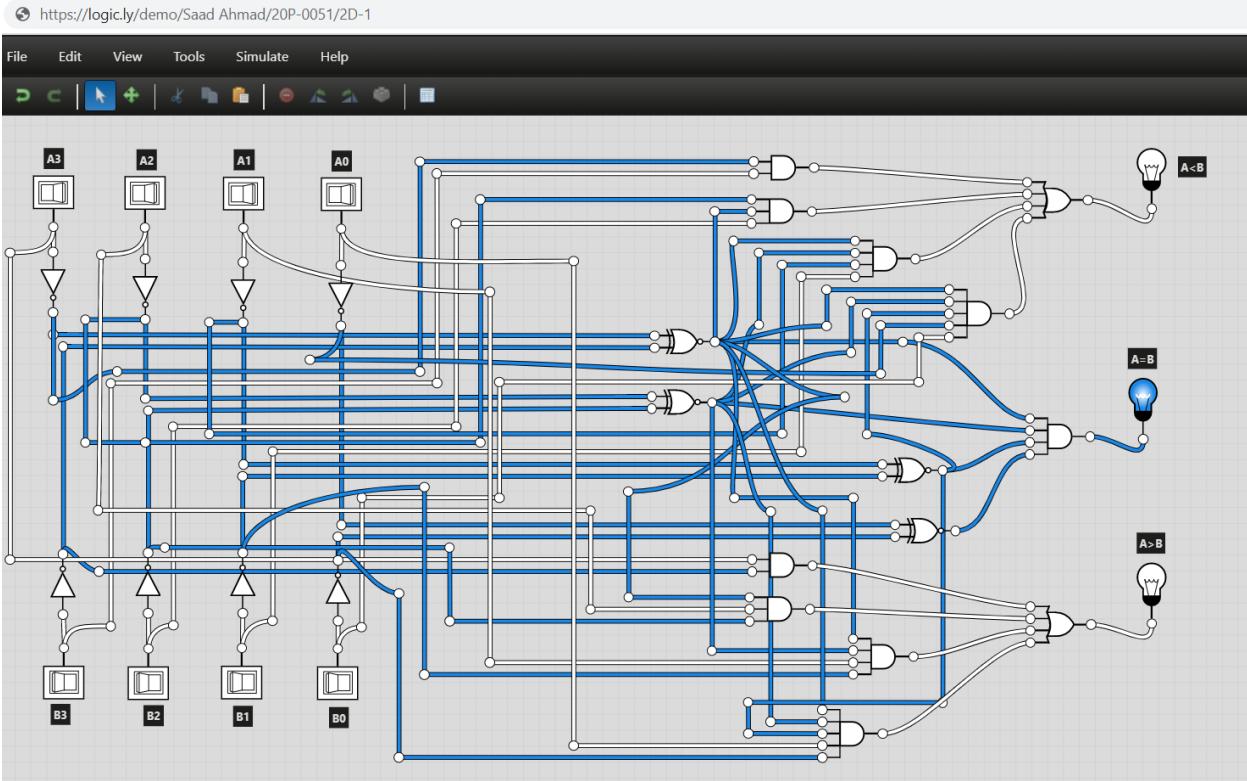
$$A = B : Z_3 \cdot Z_2 \cdot Z_1 \cdot Z_0$$

$$A > B : A_3 \cdot B_3' + Z_3 \cdot A_2 \cdot B_2' + Z_3 \cdot Z_2 \cdot A_1 \cdot B_1' + Z_3 \cdot Z_2 \cdot Z_1 \cdot A_0 \cdot B_0'$$

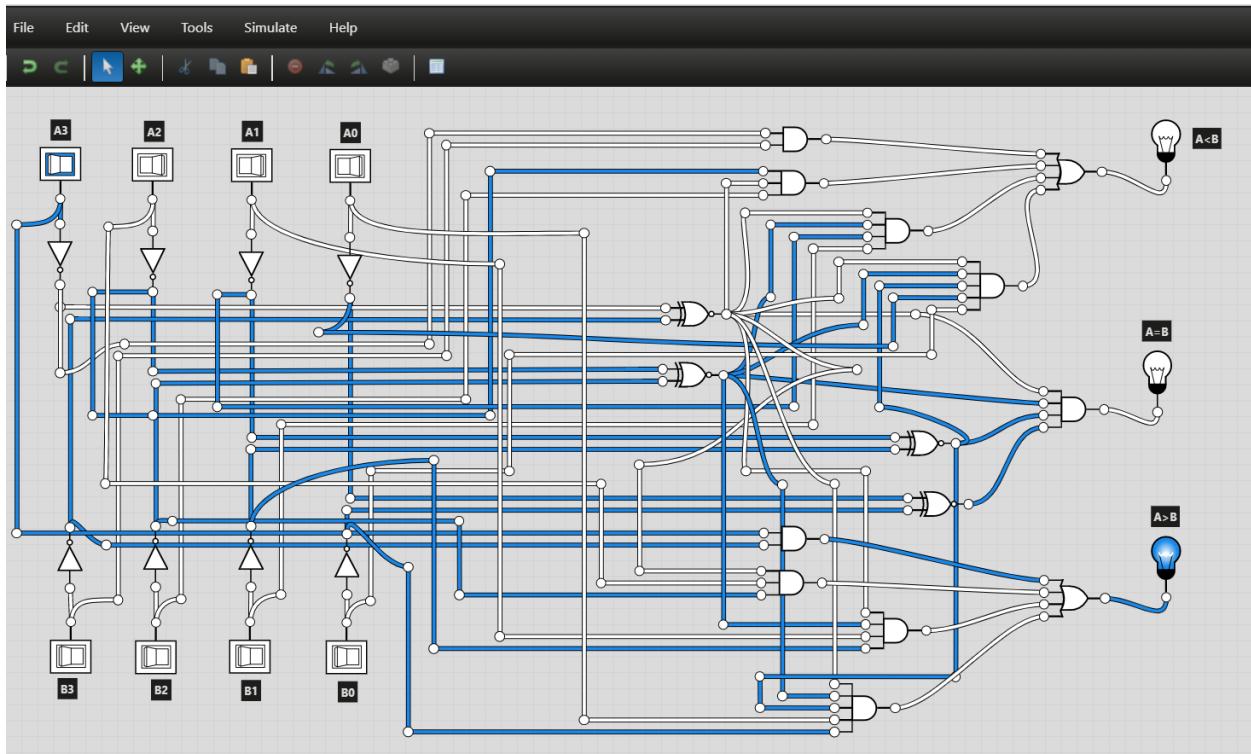
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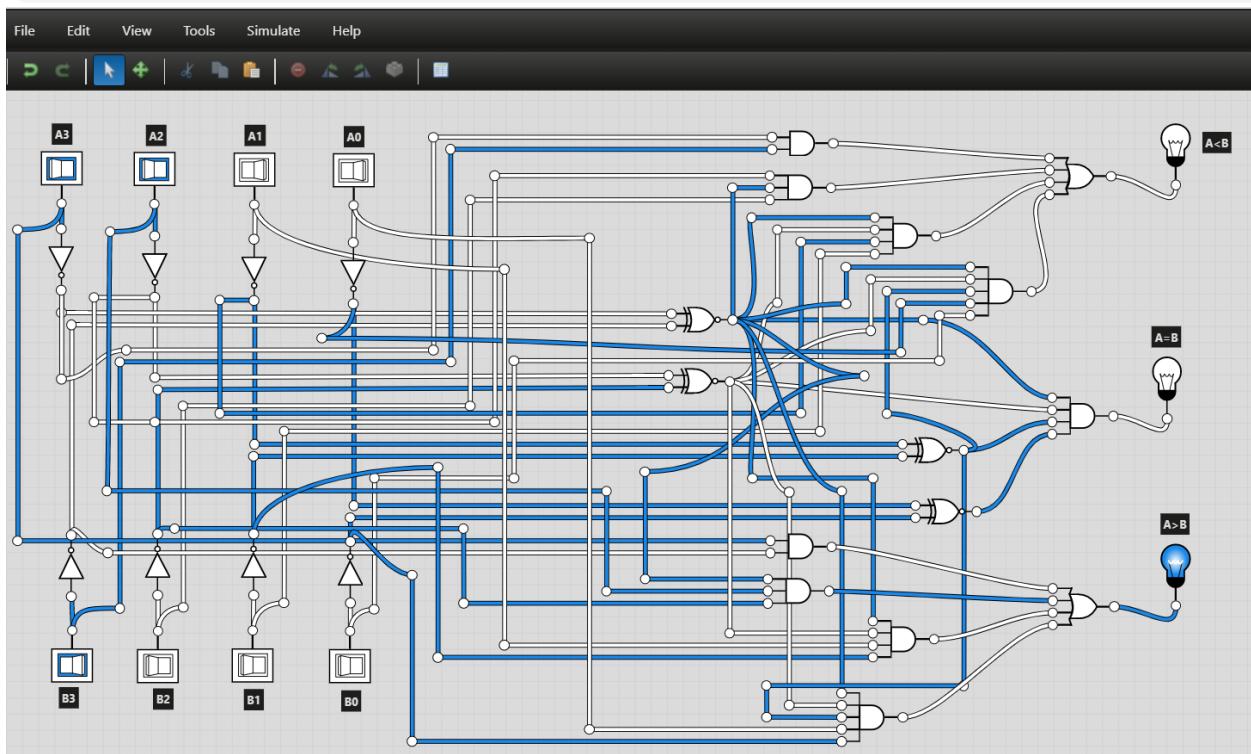
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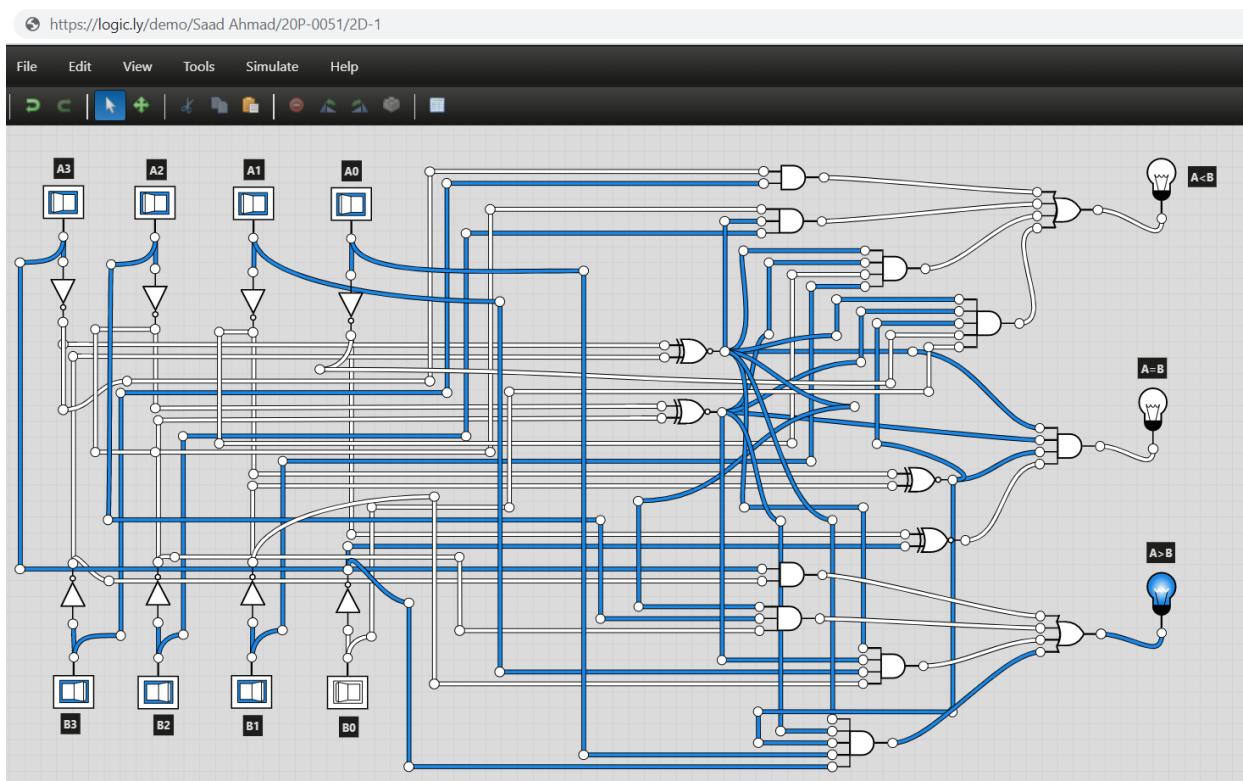
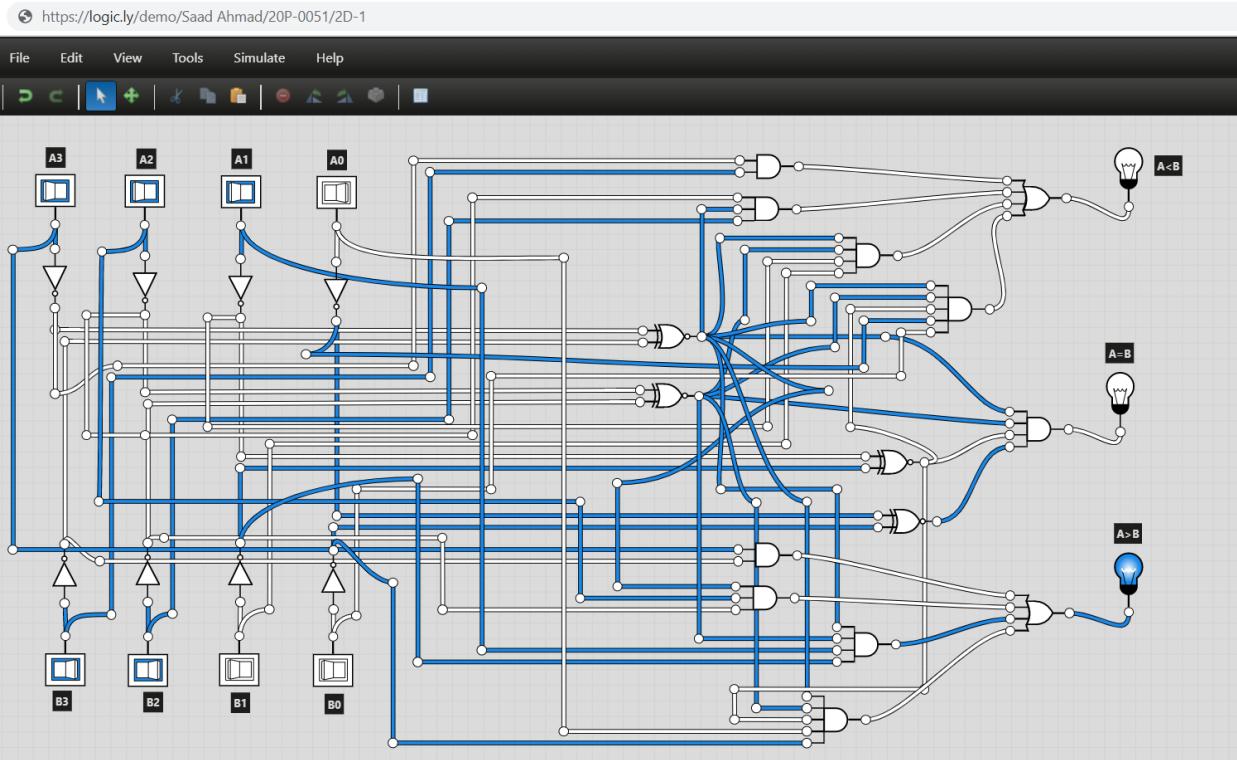


<https://logic.ly/demo/Saad Ahmad/20P-0051/2D-1>

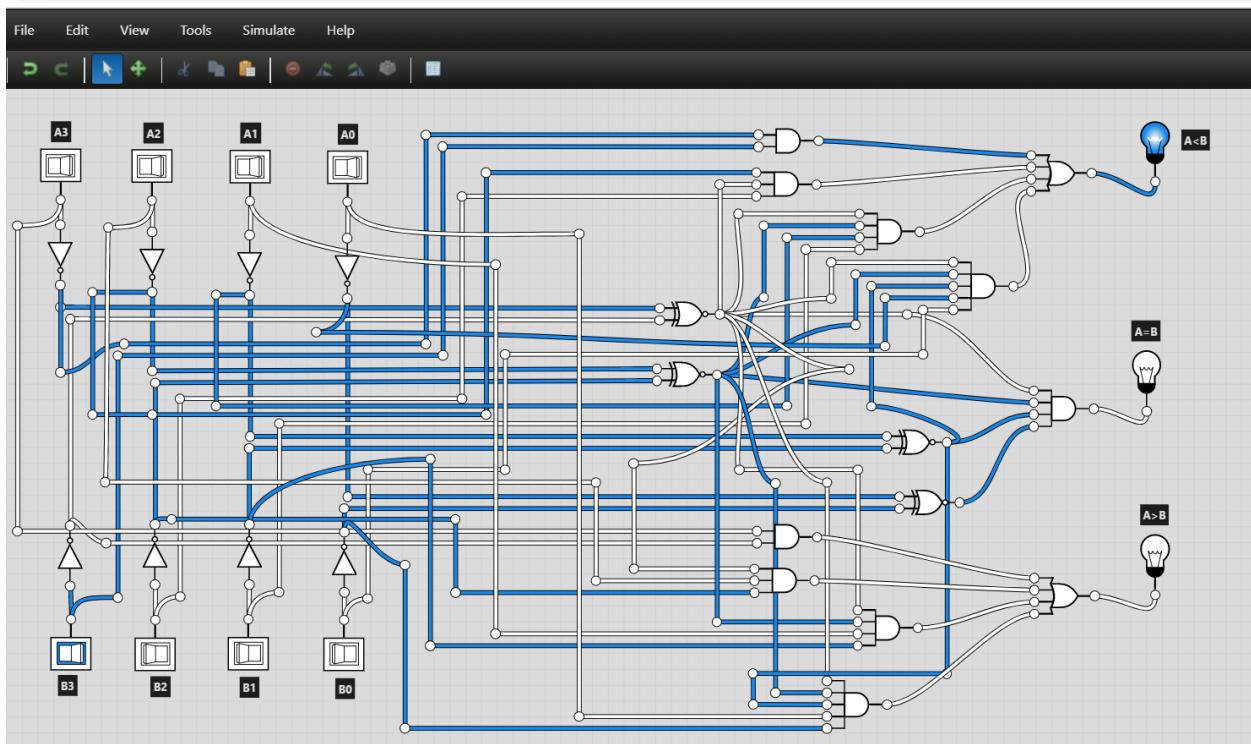


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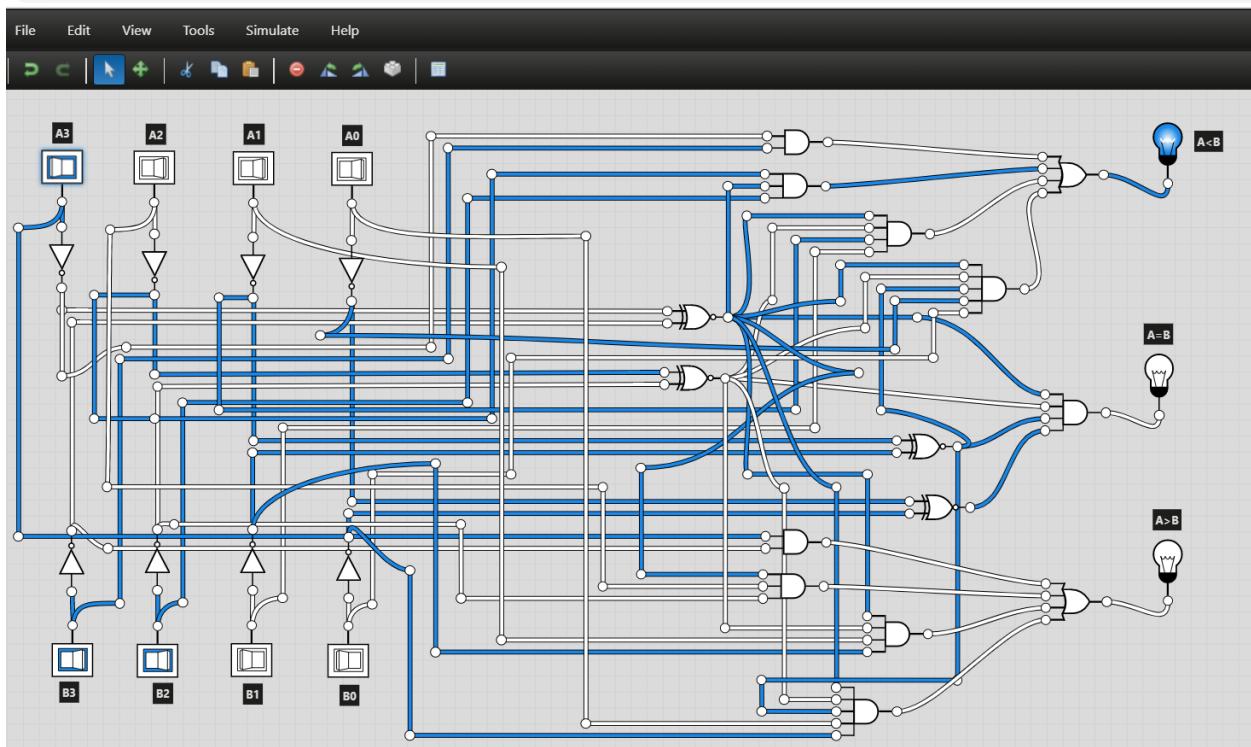




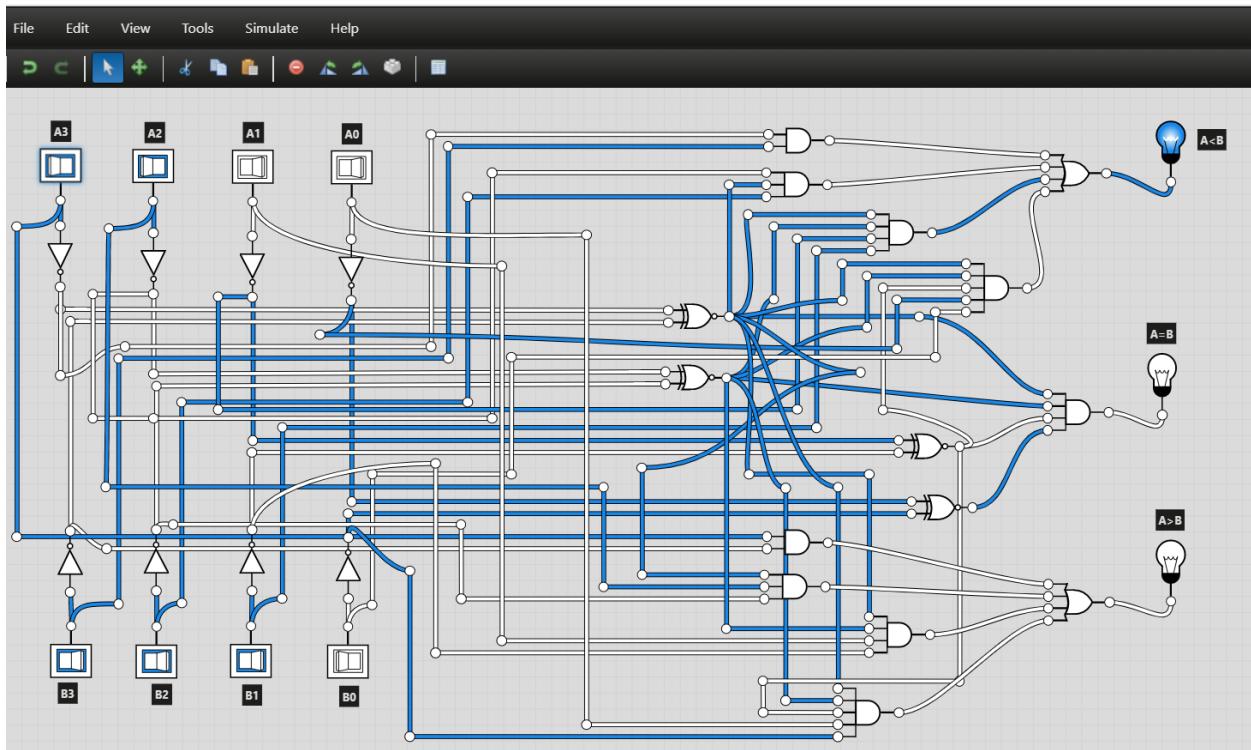
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