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

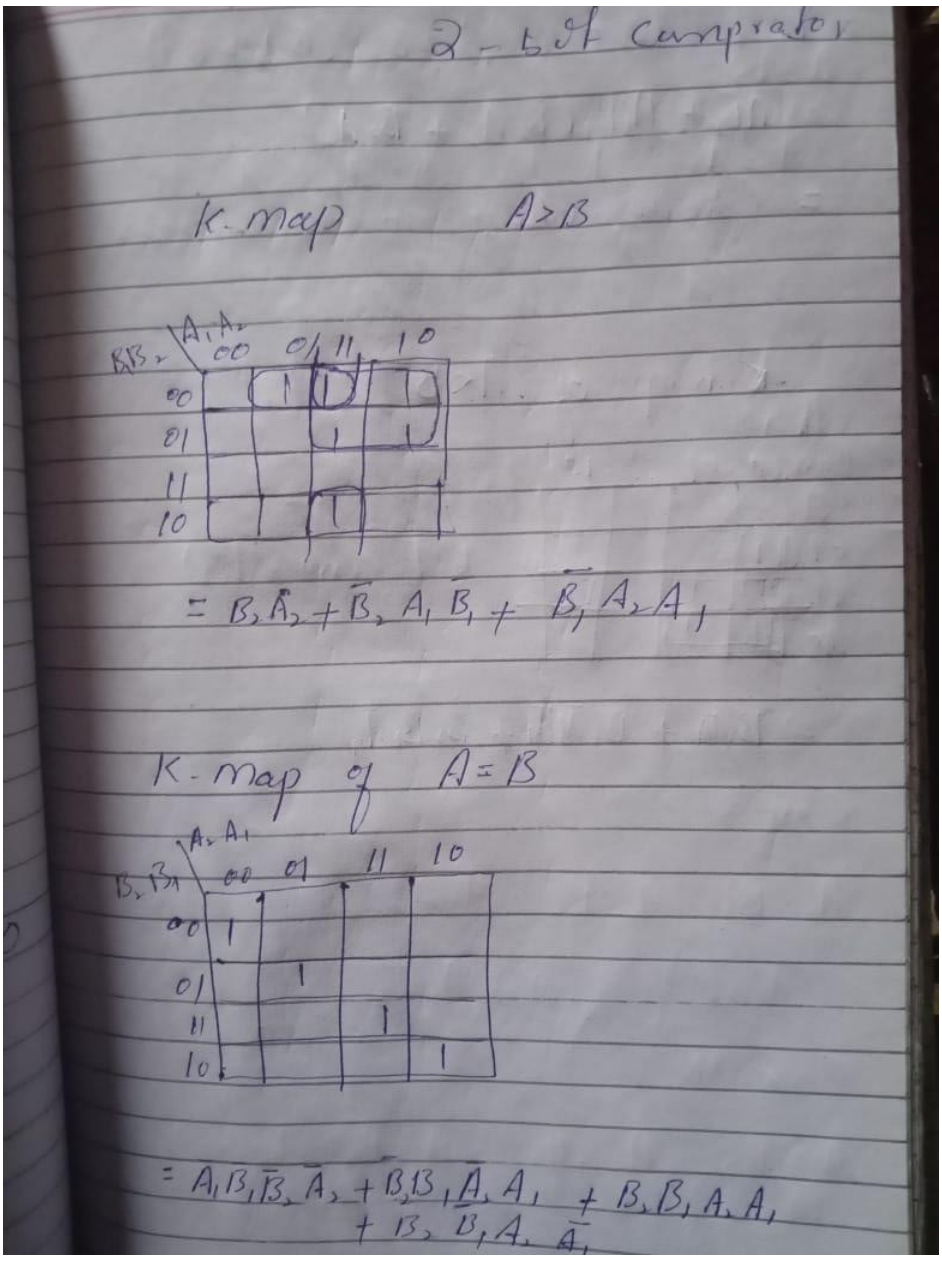
1. **Construct a logic circuit for a 2 bit magnitude comparator Also write the Boolean expression for output(s). Simulate your circuit in logicly software.**
   Hint: Take 2 bits of each input i.e. A1A0 & B1B0

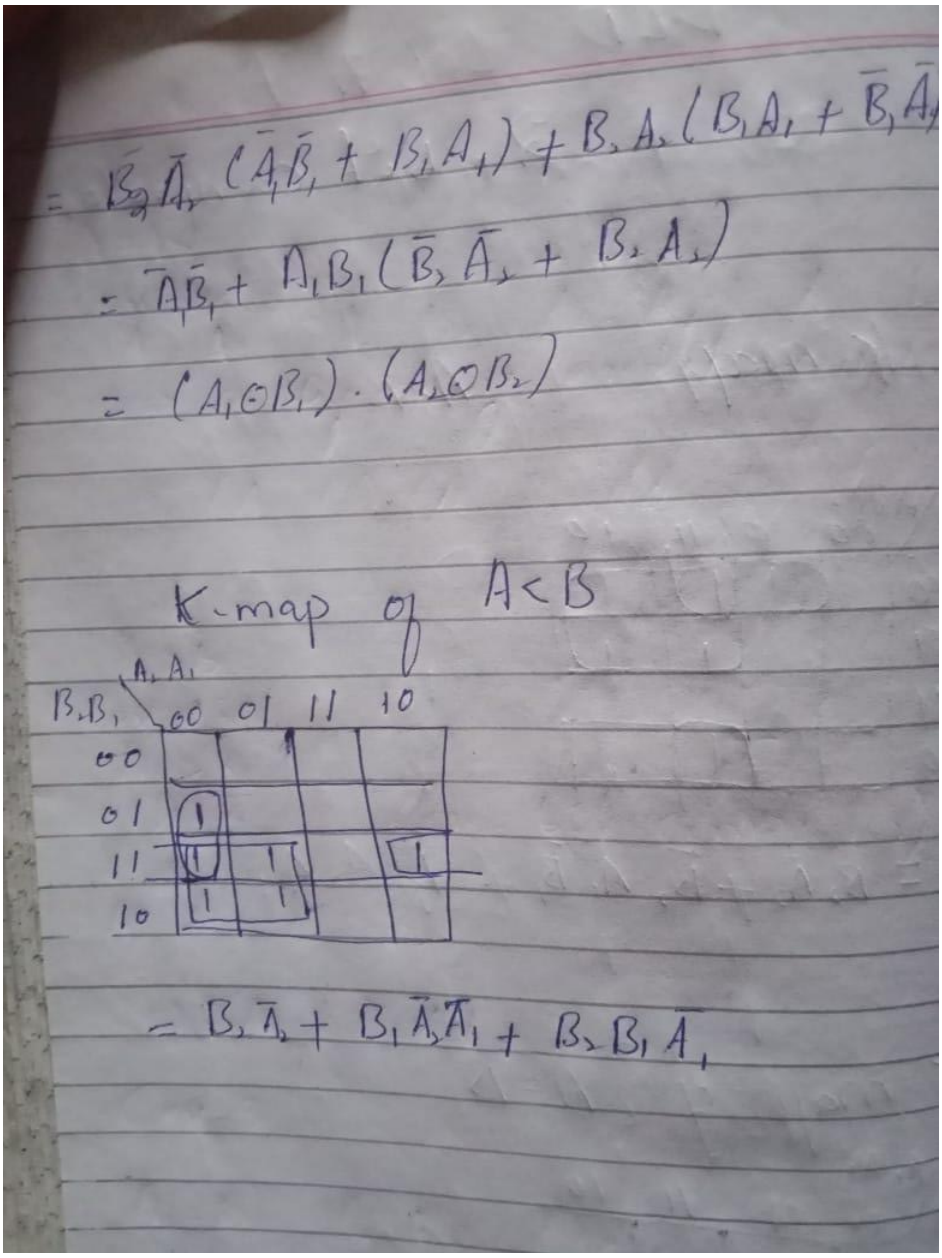
2-Bit Magnitude Comparator

a) Truth Table

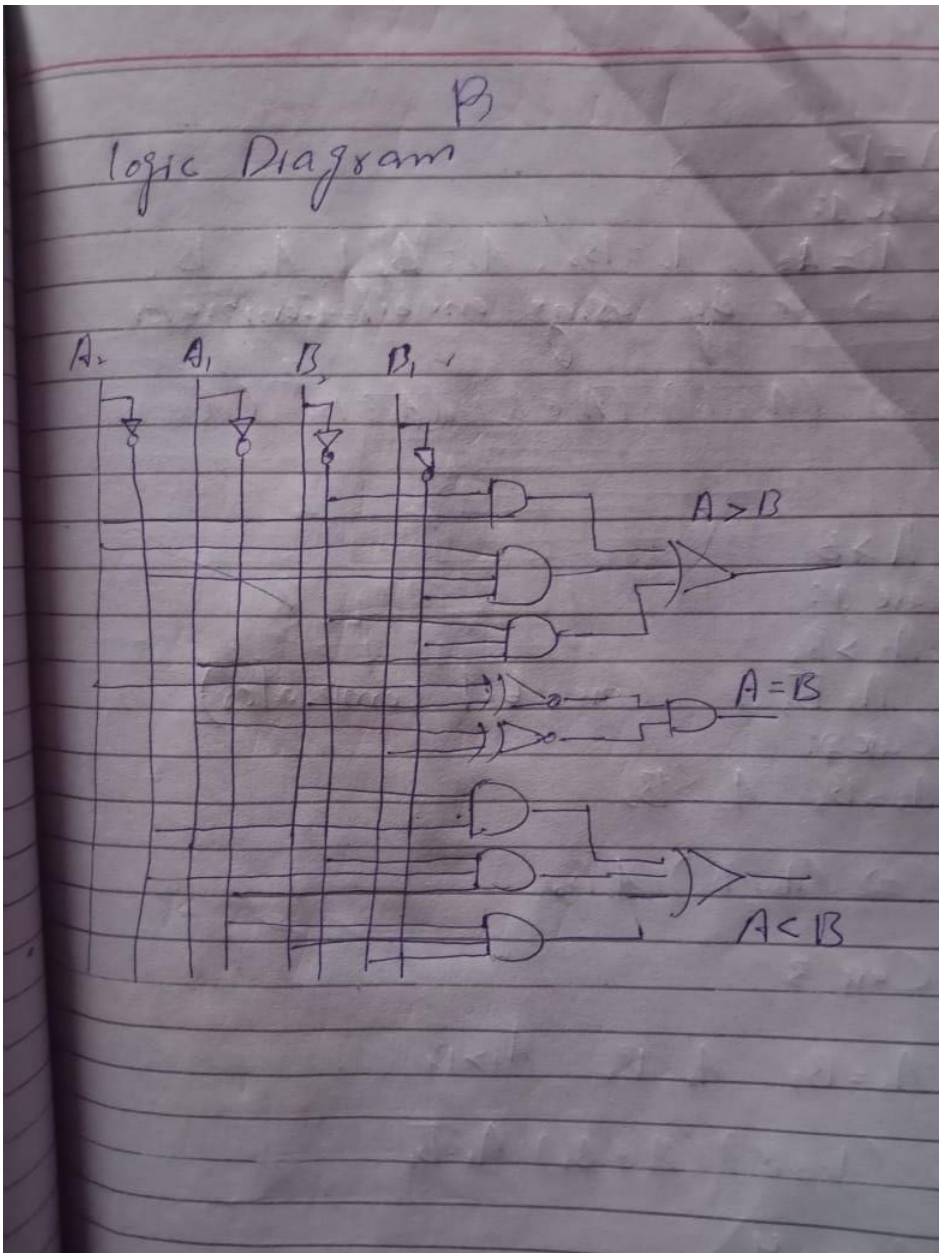
A2	A1	B2	B1	A>B	A=B	A<B
0	0	0	0	0	1	0
0	0	0	1	0	0	1
0	0	1	0	0	0	1
0	0	1	1	0	0	1
0	1	0	0	1	0	0
0	1	0	1	0	1	0
0	1	1	0	0	0	1
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	1	0
1	0	1	1	0	0	1
1	1	0	0	1	0	0
1	1	0	1	1	0	0
1	1	`	0	1	0	0
1	1	1	1	0	1	0

b) Boolean Expression (Simplified)

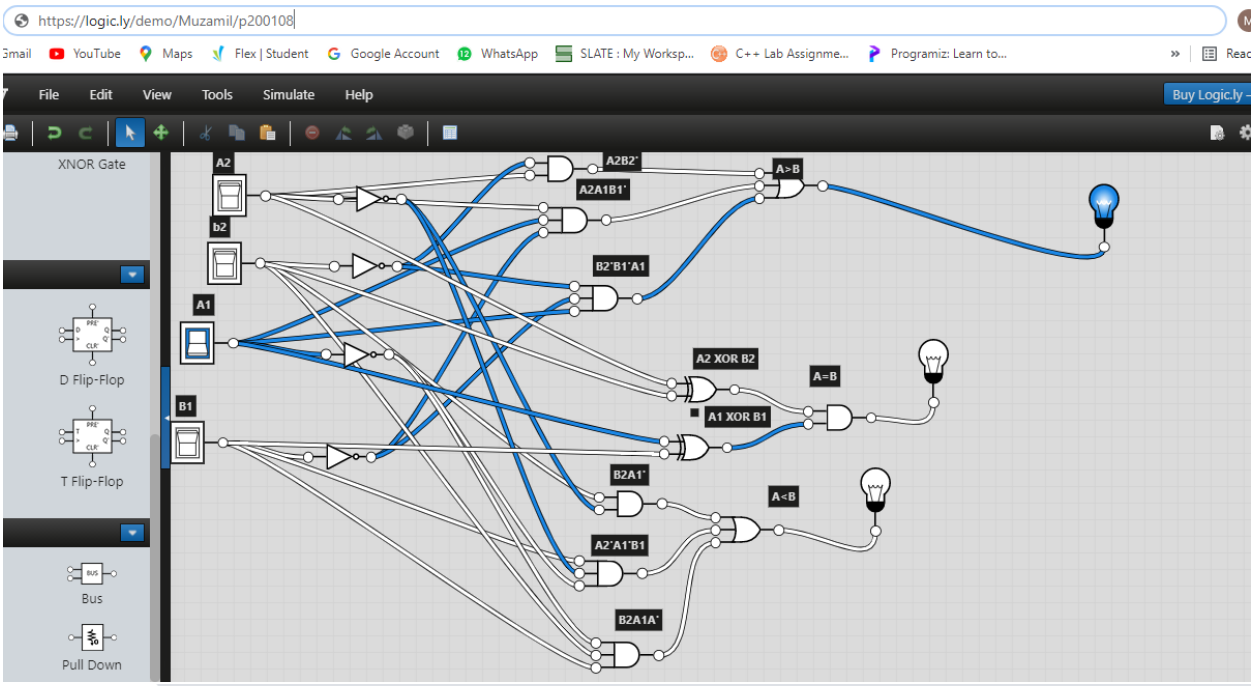




c) Logic Diagram



d) Software Simulation (Show here your results for each combination that gives a high output)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A1
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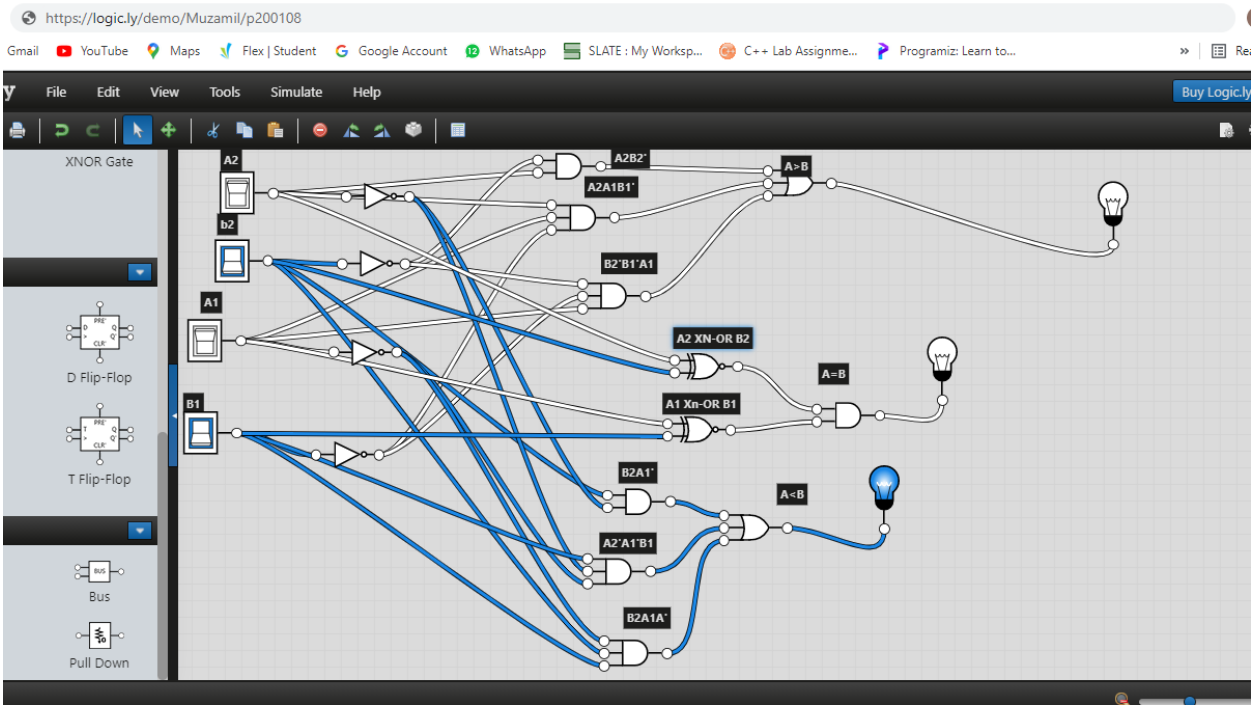
A2B2'
A2A1B1'
A>B
B2'B1'A1
A2 XOR B2
A=B
A1 XOR B1
B2A1'
A<B
A2'A1'B1
B2A1A'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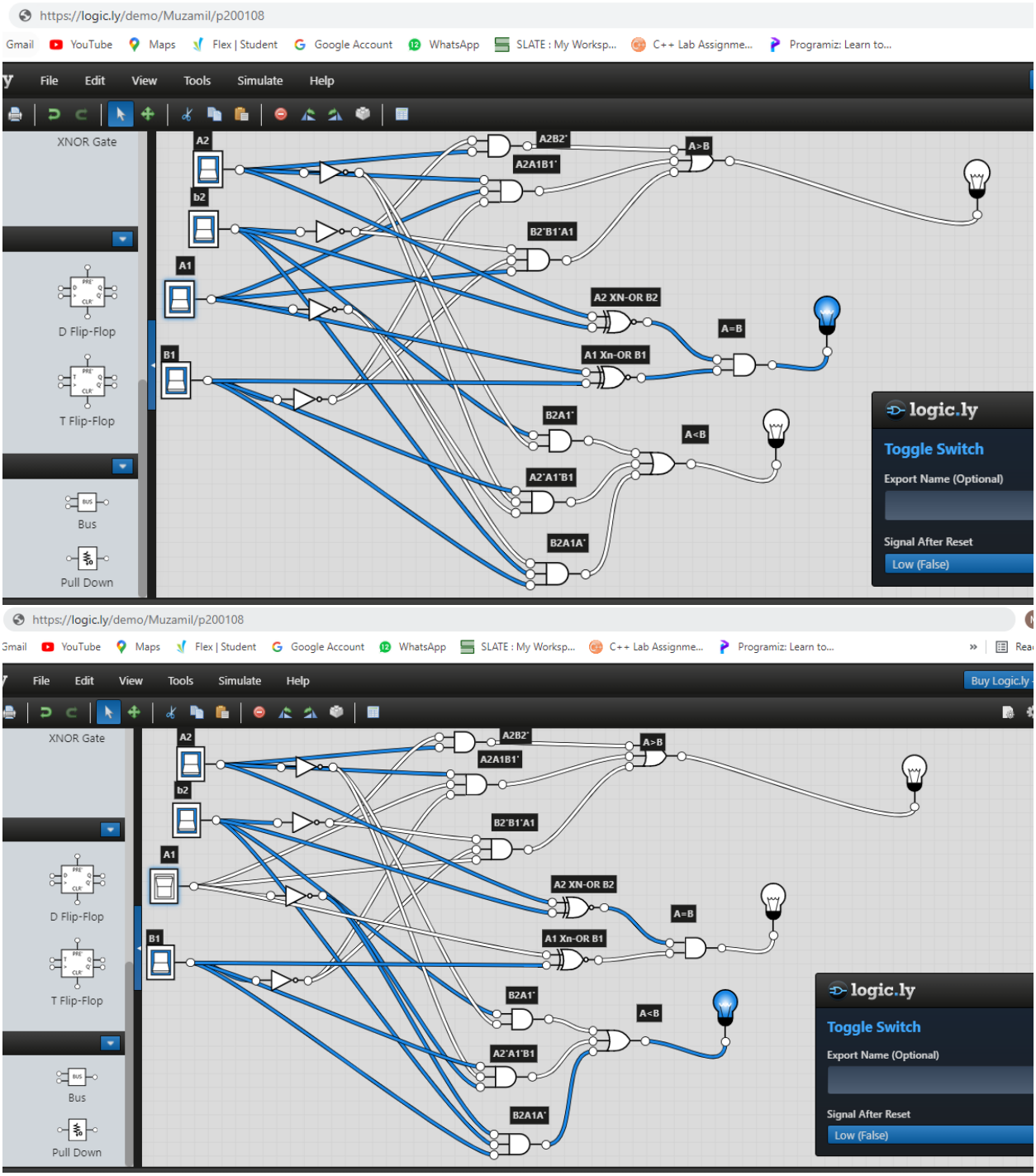
A2A1B1'
A>B
B2'B1'A1
A2 XN-OR B2
A=B
A1 Xn-OR B1
B2A1'
A<B
A2'A1'B1
B2A1A'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A2 XN-OR B2
A1 Xn-OR B1
B2A1'
A2'A1'B1
B2A1A'
A>B
A=B
A<B
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Toggle Switch
Export Name (Optional)
Signal After Reset
Low (False)
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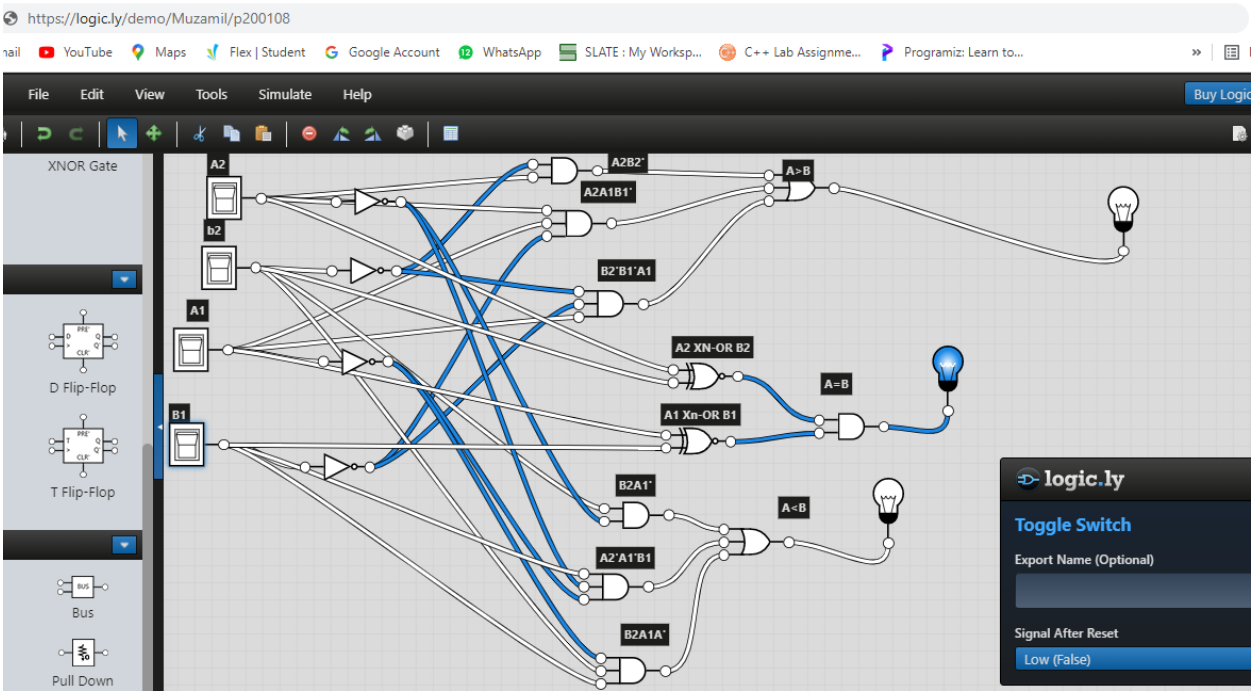


2) Construct a logic circuit for a 4-bit magnitude comparator Also write the Boolean expression for output(s). Simulate your circuit in logicaly software.

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).

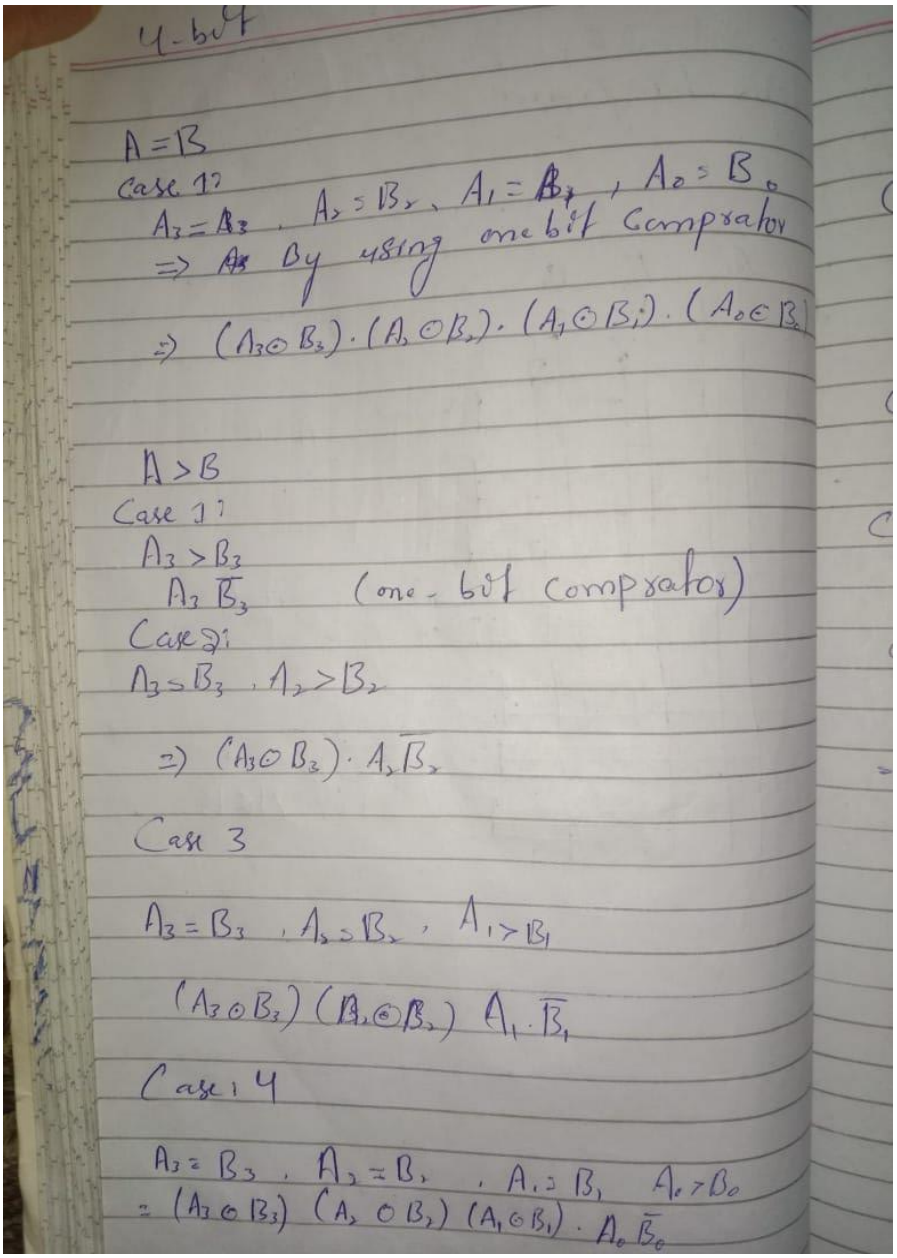
4-Bit Magnitude Comparator

a) Truth Table

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

b) Boolean Expression

c)



4-bit

A = B

Case 1:

$A_3 = B_3$, $A_2 = B_2$, $A_1 = B_1$, $A_0 = B_0$

⇒ By using one bit comprator

⇒ $(A_3 \odot B_3) \cdot (A_2 \odot B_2) \cdot (A_1 \odot B_1) \cdot (A_0 \odot B_0)$

A > B

Case 1:

$A_3 > B_3$

$A_3 \overline{B_3}$ (one bit comprator)

Case 2:

$A_3 = B_3$, $A_2 > B_2$

⇒ $(A_3 \odot B_3) \cdot A_2 \overline{B_2}$

Case 3

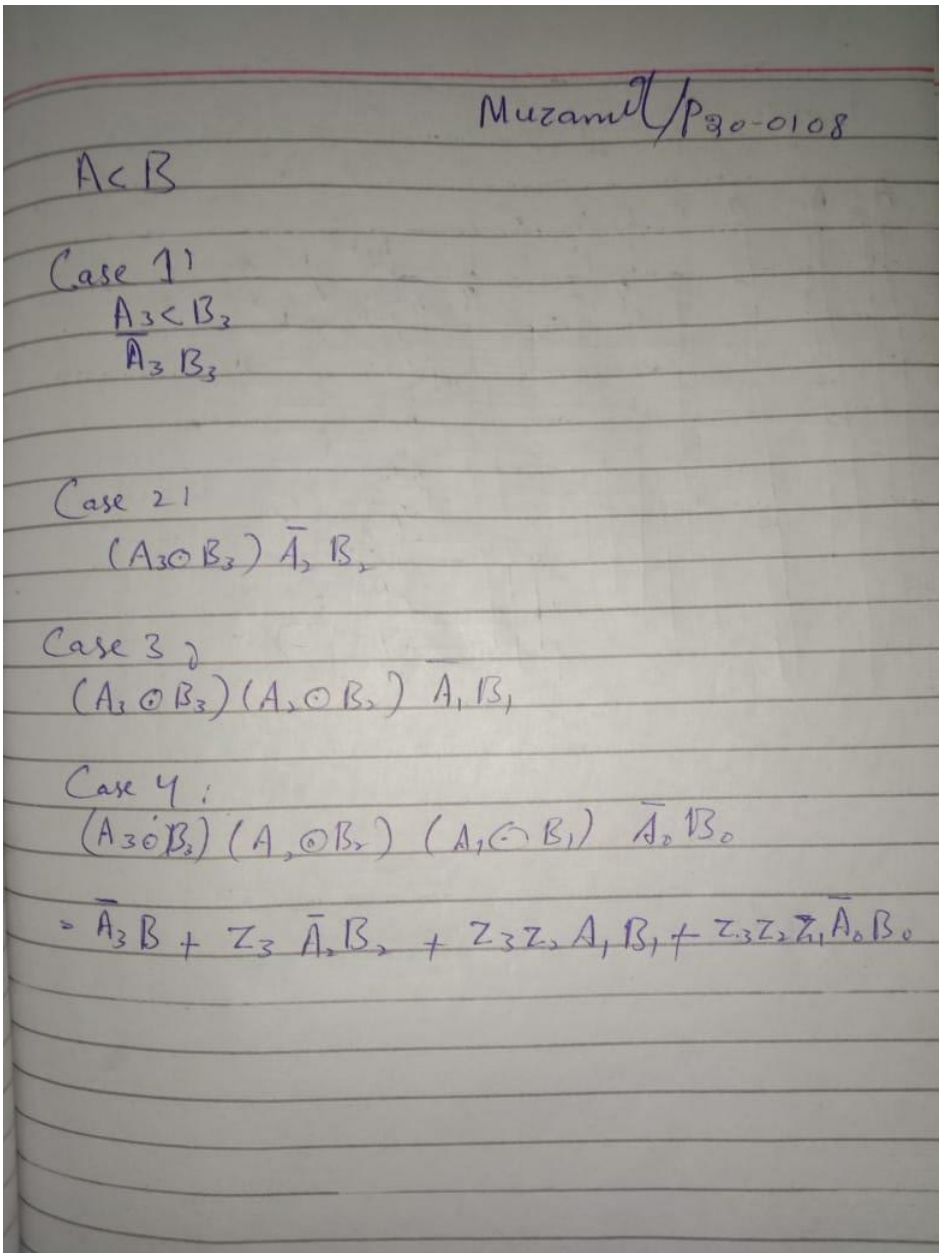
$A_3 = B_3$, $A_2 = B_2$, $A_1 > B_1$

$(A_3 \odot B_3)(A_2 \odot B_2) A_1 \cdot \overline{B_1}$

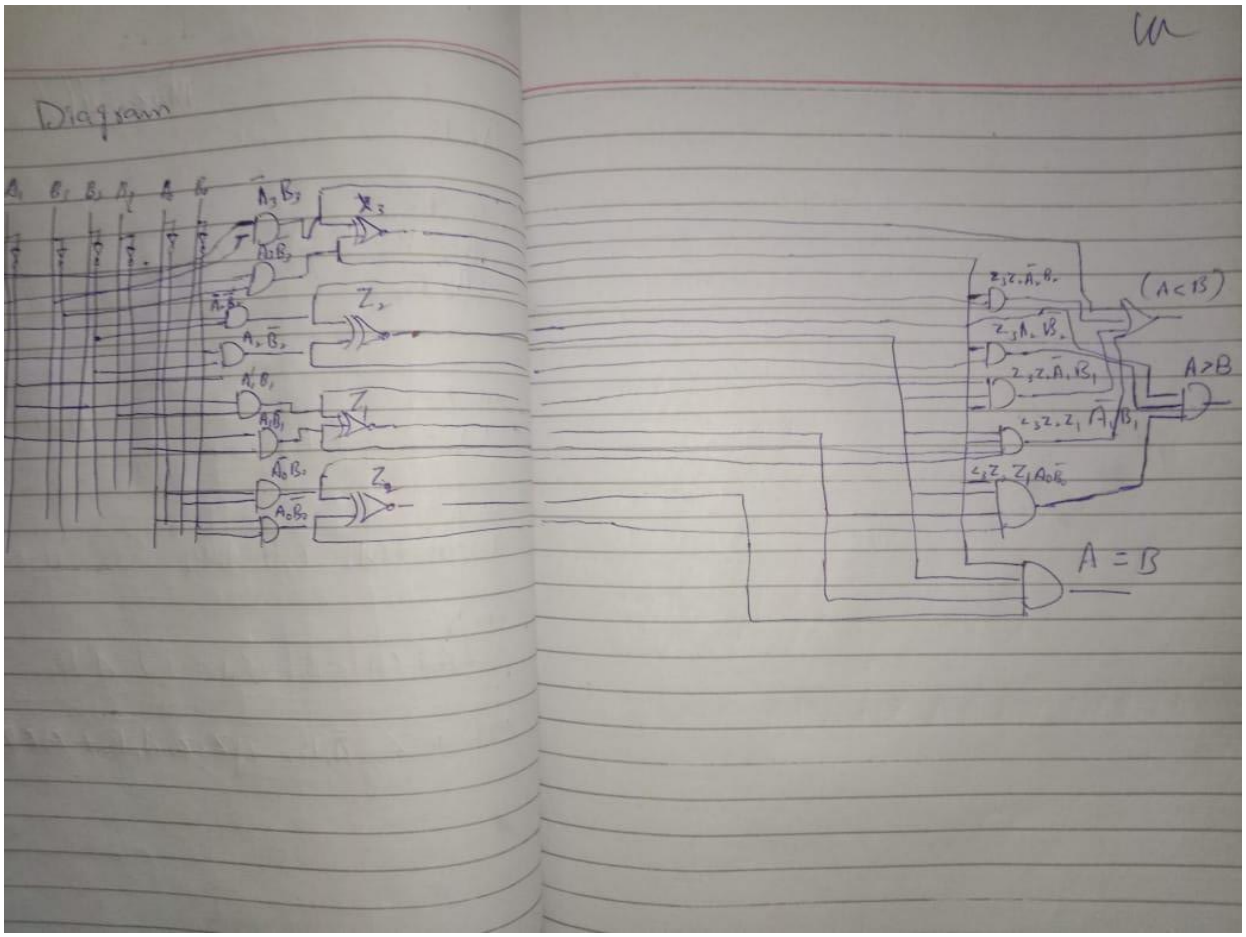
Case 4

$A_3 = B_3$, $A_2 = B_2$, $A_1 = B_1$ $A_0 > B_0$

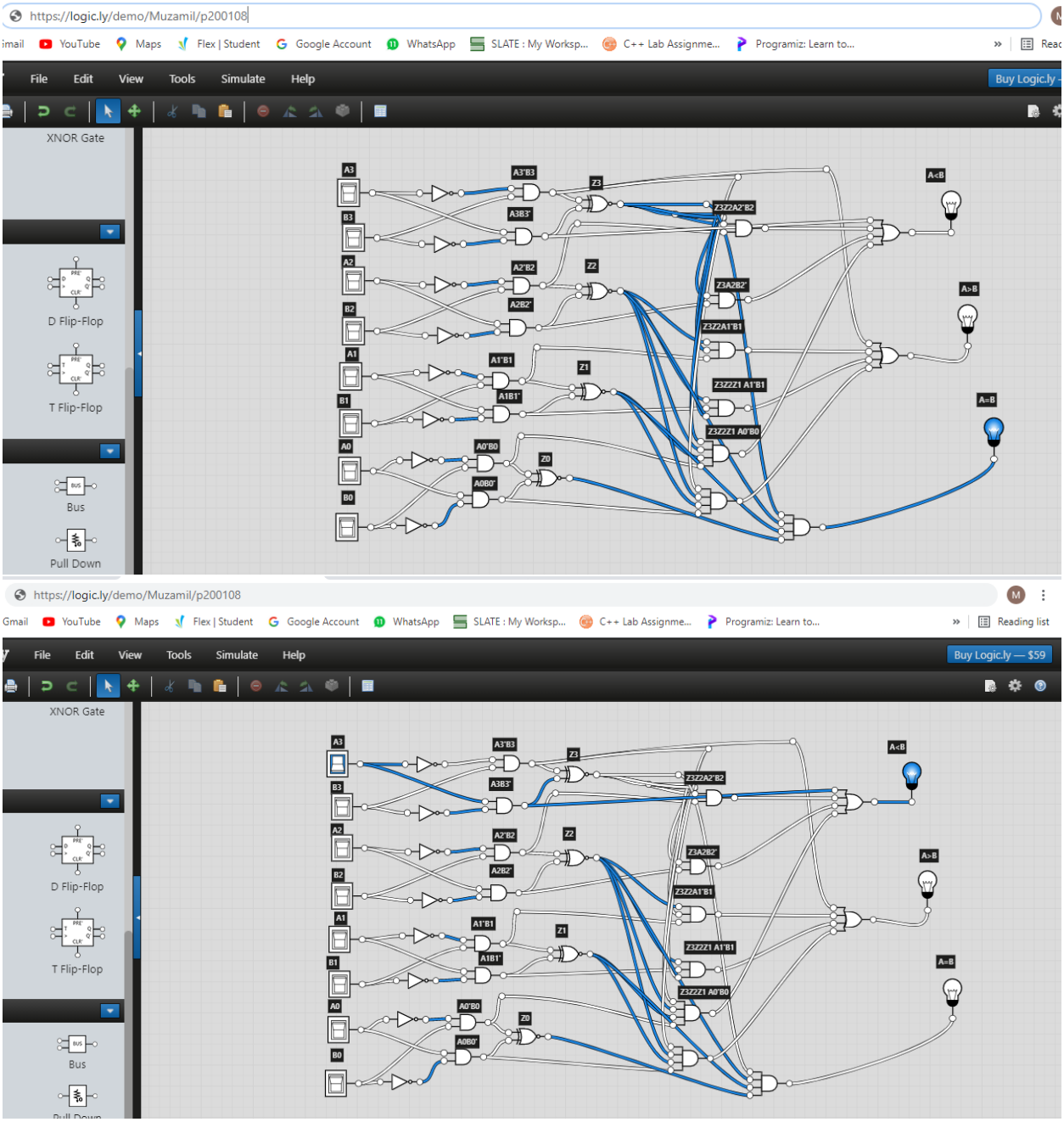
$= (A_3 \odot B_3)(A_2 \odot B_2)(A_1 \odot B_1) \cdot A_0 \overline{B_0}$



d) Logic Diagram

e) 

f) Software Simulation (Show here your results for each combination that gives a high output)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A1B1'
A0'B0
A0B0'
Z3
Z2
Z1
Z0
Z3Z2A2'B2
Z3A2B2'
Z3Z2A1'B1
Z3Z2Z1 A1'B1
Z3Z2Z1 A0'B0
A<B
A>B
A=B
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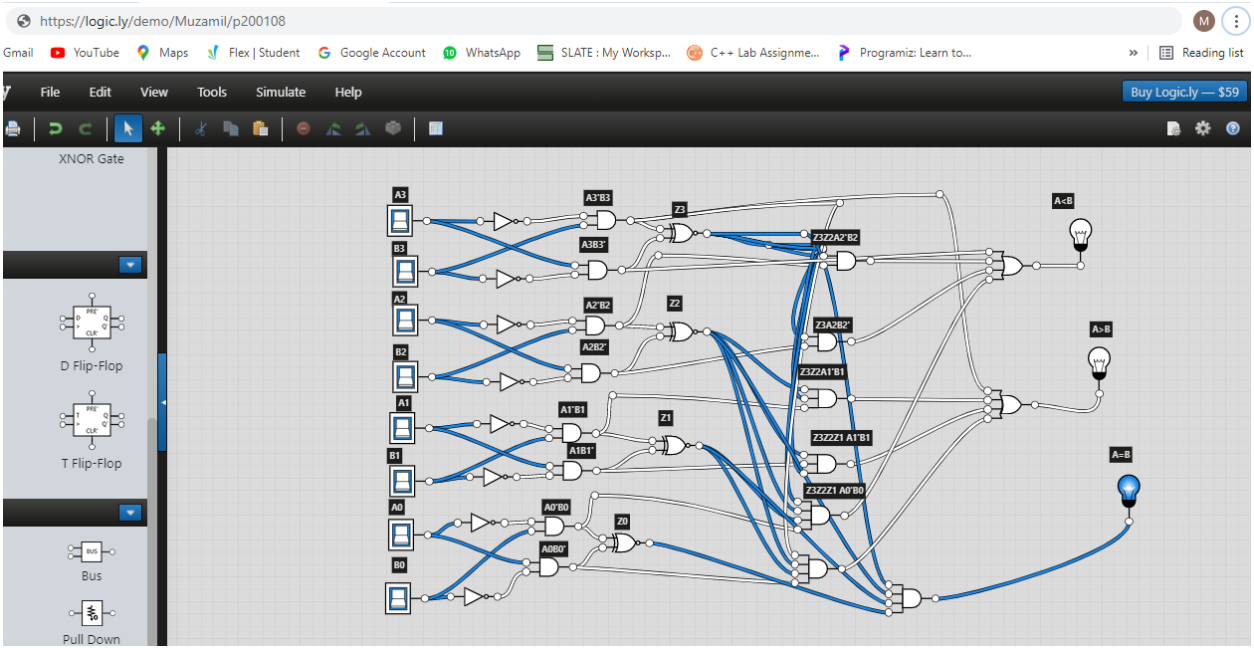
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Z3Z2A2'B2
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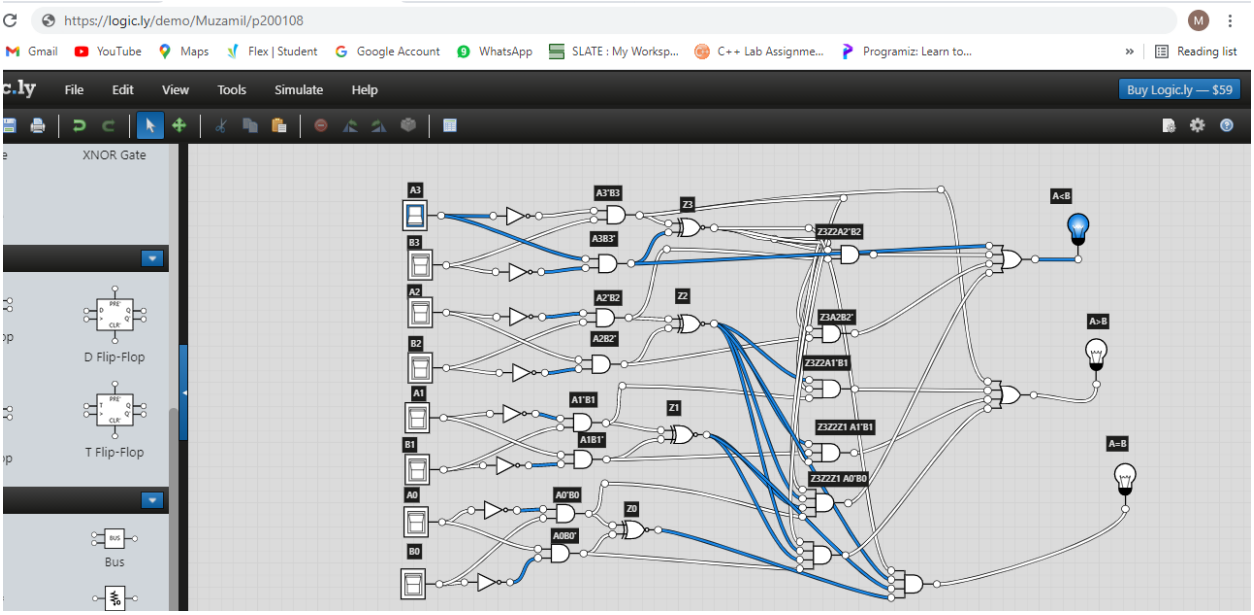
Z3Z2A1'B1
Z3ZZ1 A1'B1
Z3ZZ1 A0'B0
A<B
A>B
A=B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