D.Y. PATIL INTERNATIONAL UNIVERSITY
B.TECH CSE FY SEM-2
A.Y. 2022-2023

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SUBJECT: DIGITAL LOGIC AND DESIGN
BATCH: A1

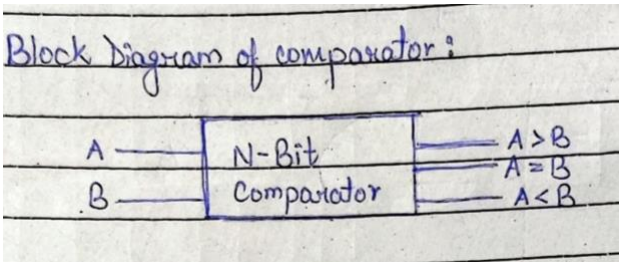
EXPERIMENT-5

Aim:
Realization of one/two-bit comparator & study of 7485 magnitude Comparator.

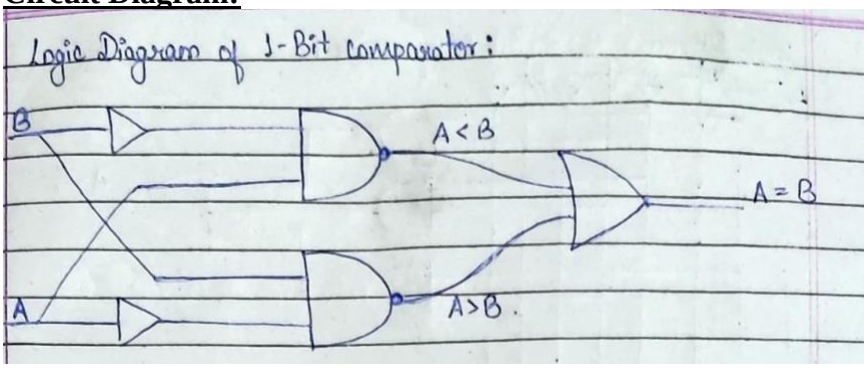
Requirements:

- **For 1-Bit Comparator**
  1. NOT Gate
  2. AND Gate
  3. NOR Gate
- **For 2-Bit Comparator**
  1. NOT Gate
  2. AND Gate
  3. OR Gate
  4. Ex-NOR

Theory:
A magnitude digital comparator is a combinational circuit that compares two digital or binary numbers in order to find out whether one binary number is equal, less than or greater than the other binary number. We logically design a circuit for which we will have two inputs one for A and other for B and have three output terminals, one for A > B condition, one for A = B condition and one for A < B condition.



Circuit Diagram:



Truth Table of 1-Bit comparator:

A	B	A<B	A=B	A>B
0	0	0	1	0
0	1	1	0	0
1	0	0	0	1
1	1	0	1	0

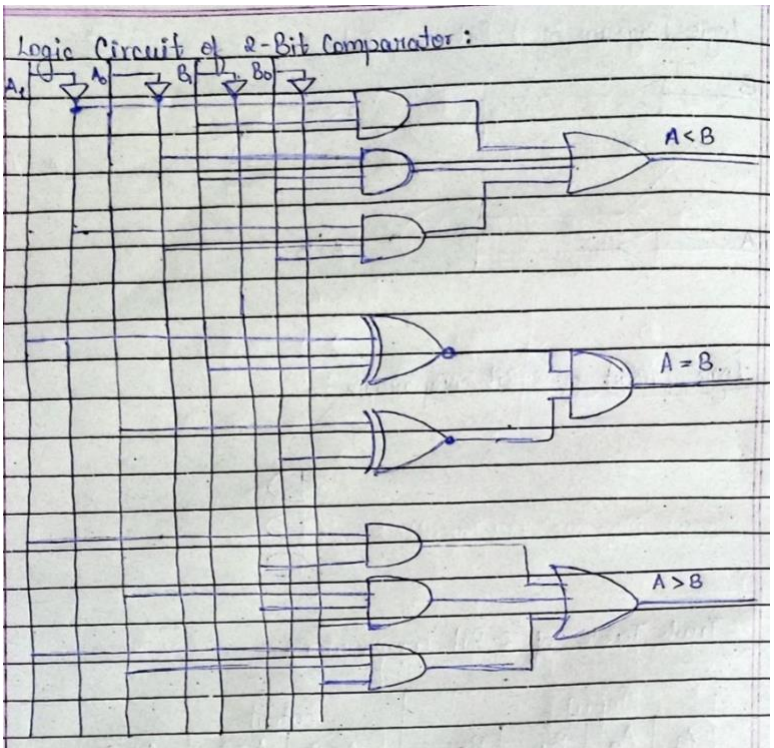
Mathematical Expression:

A>B : AB'

A<B : A'B

A=B : A'B' + AB

Logic Circuit of 2-Bit Comparator :



Mathematical Expression :

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

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

: $A_1' B_1' (A_0' B_0' + A_0 B_0) + A_1 B_1 (A_0 B_0 + A_0' B_0')$

: $(A_0 B_0 + A_0' B_0')(A_1 B_1 + A_1' B_1')$

: $(A_0 \text{ Ex-Nor } B_0)(A_1 \text{ Ex-Nor } B_1)$

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

Truth Table of 2-Bit comparator :

Input				output		
A_1	A_0	B_1	B_0	$A<B$	$A=B$	$A>B$
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

Observation Table:

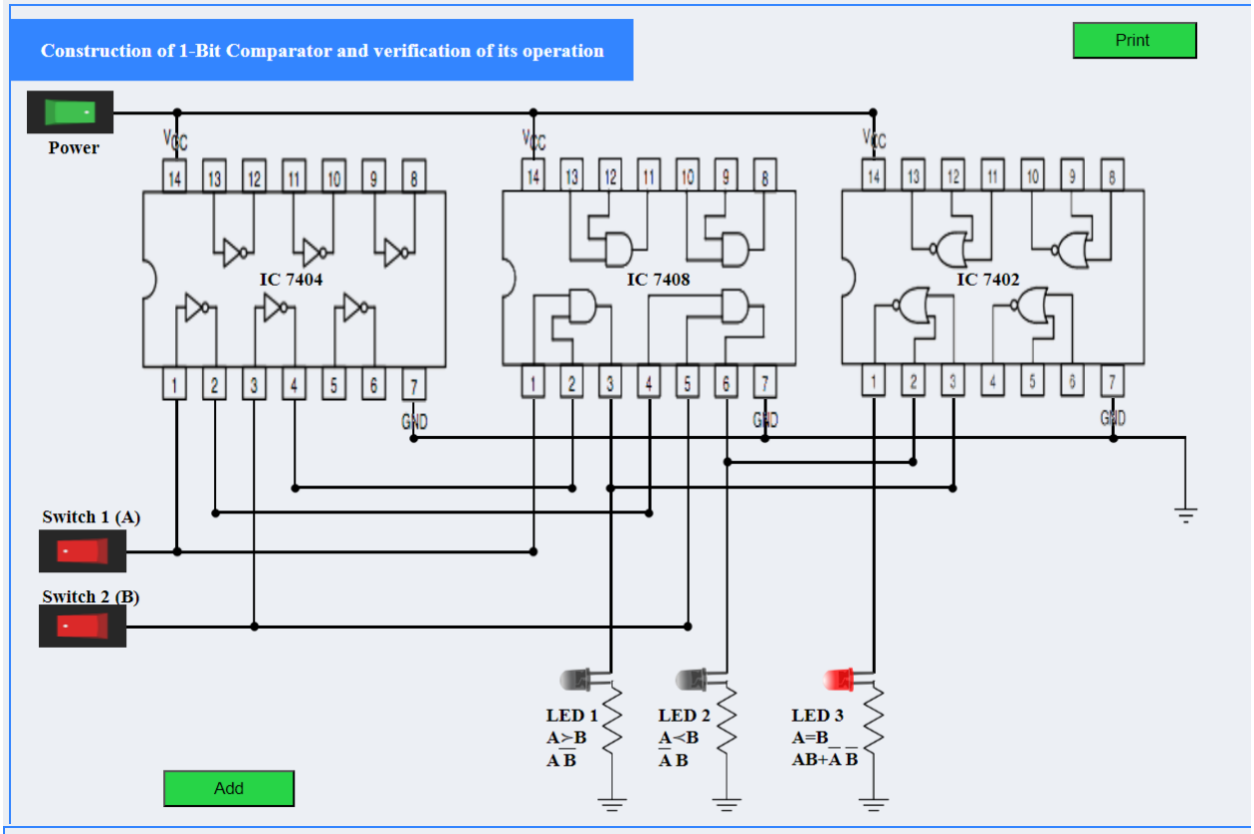
A) One-bit Comparator

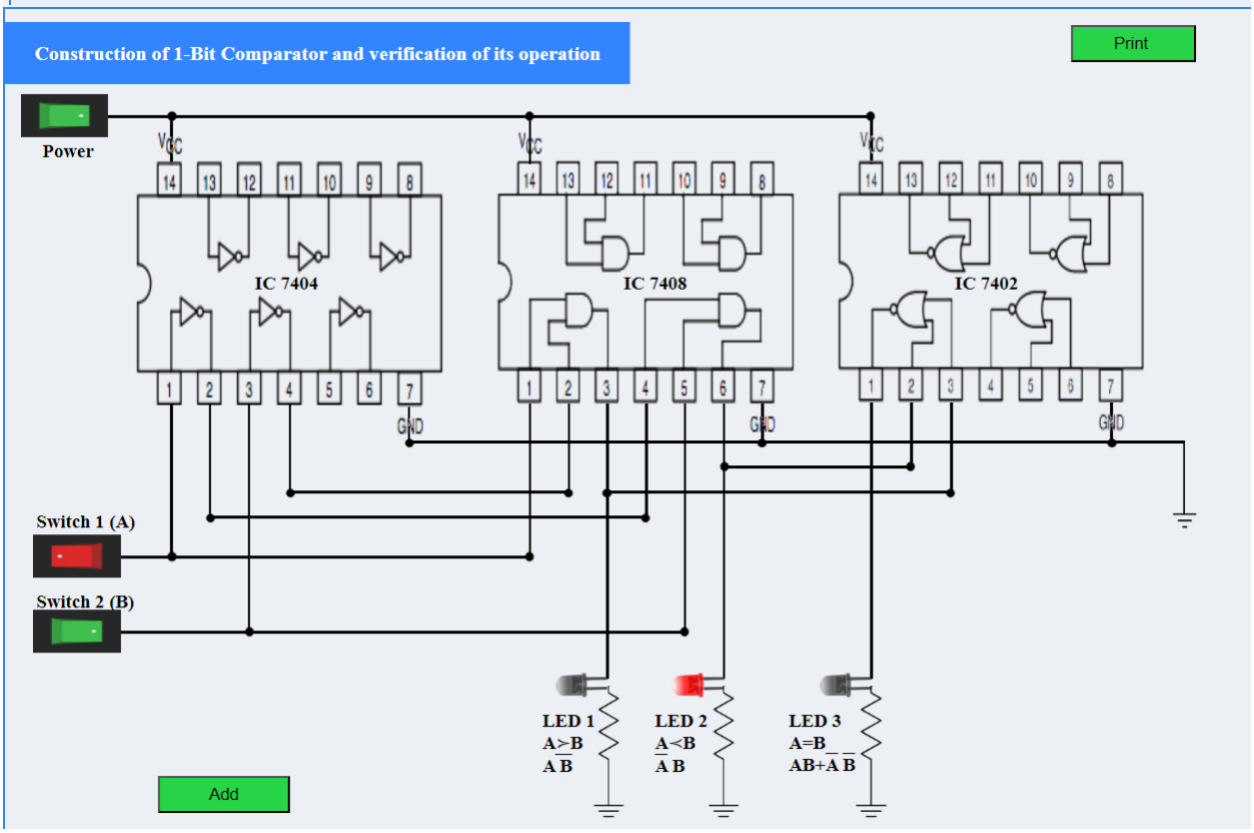
Input		Output		
A	**B**	**A>B**	**A=B**	**A<B**
0	0	0	1	0
0	1	0	0	1
1	0	1	0	0
1	1	0	1	0

B) Two-bit Comparator

Input				Output		
A1	**A0**	**B1**	**B0**	**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	1	0	1	0	0
1	1	1	1	0	1	0

Output:


Construction of 1-Bit Comparator and verification of its operation
Print
Power
IC 7404
IC 7408
IC 7402
Switch 1 (A)
Switch 2 (B)
LED 1
A>B
A B
LED 2
A<B
A B
LED 3
A=B
AB+A B
Add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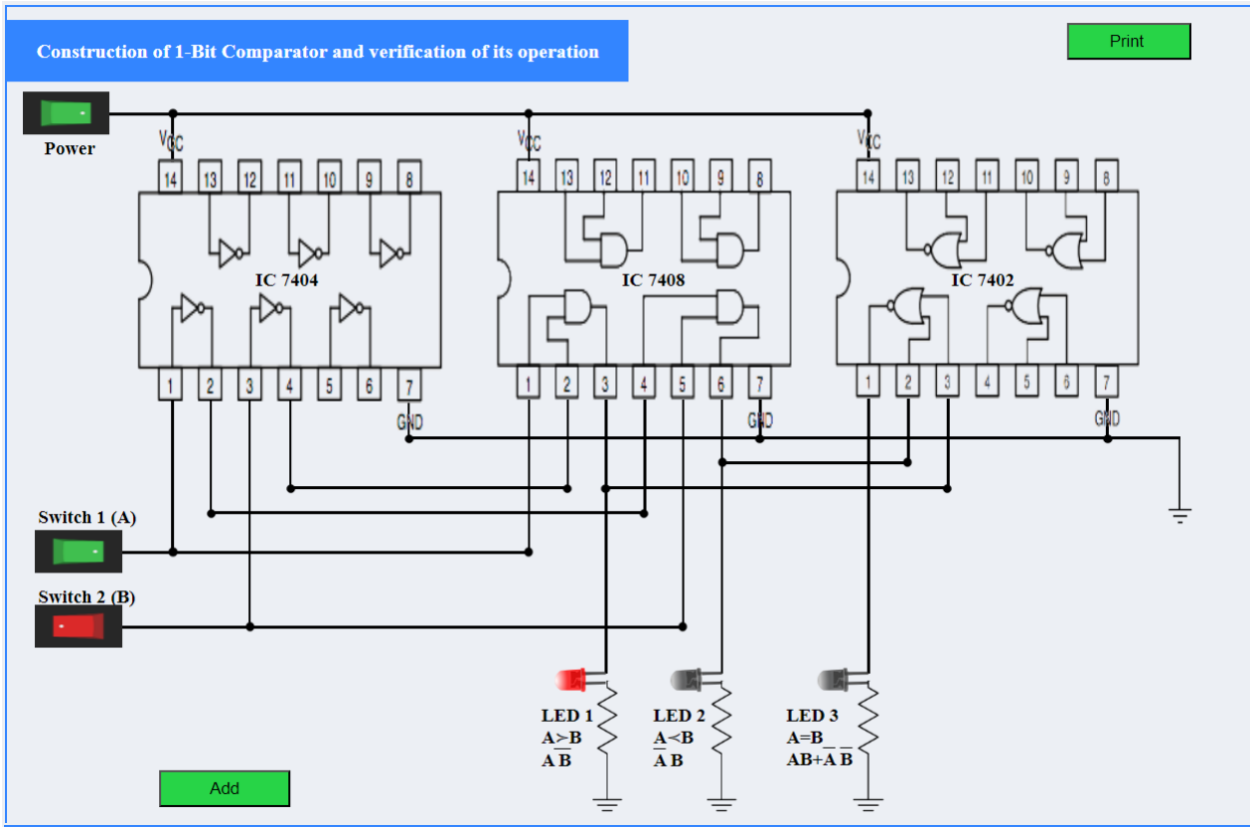
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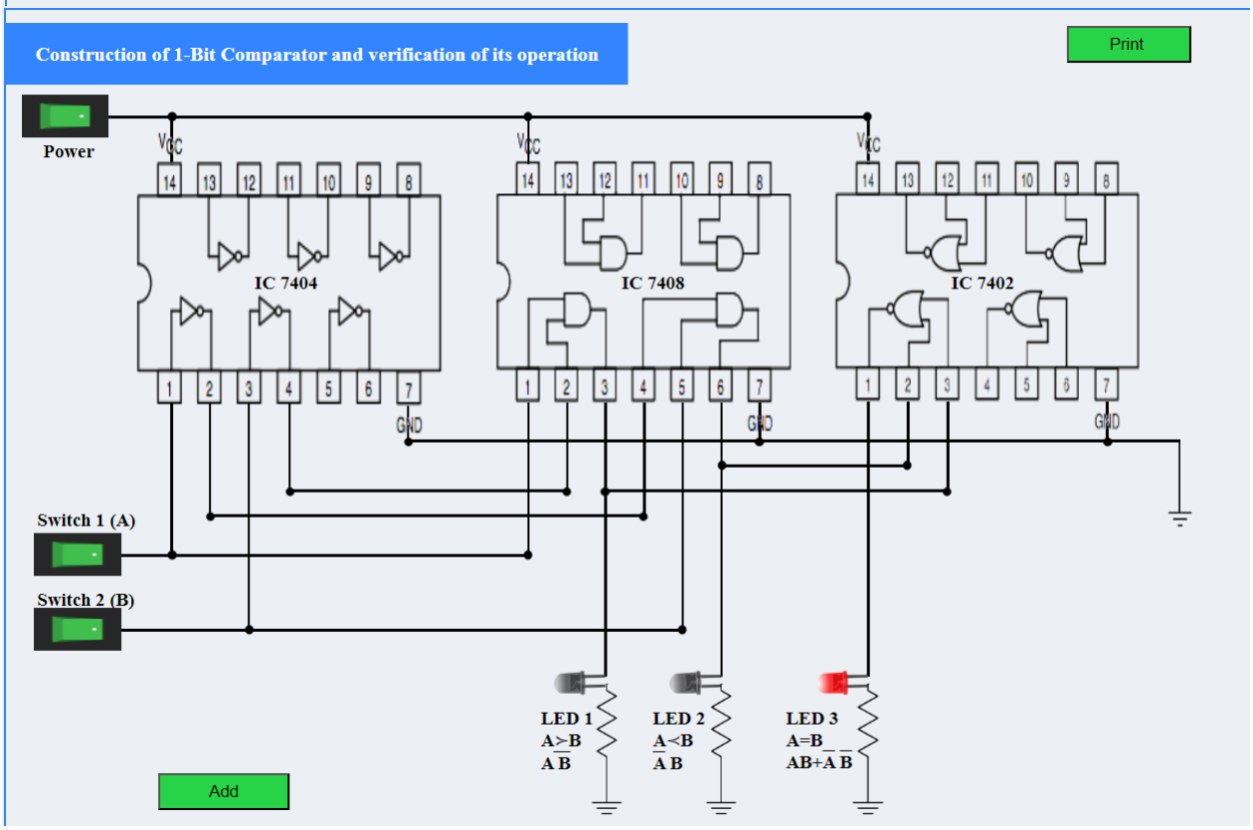
LED 2
A<B
A B
LED 3
A=B
AB+A B
Add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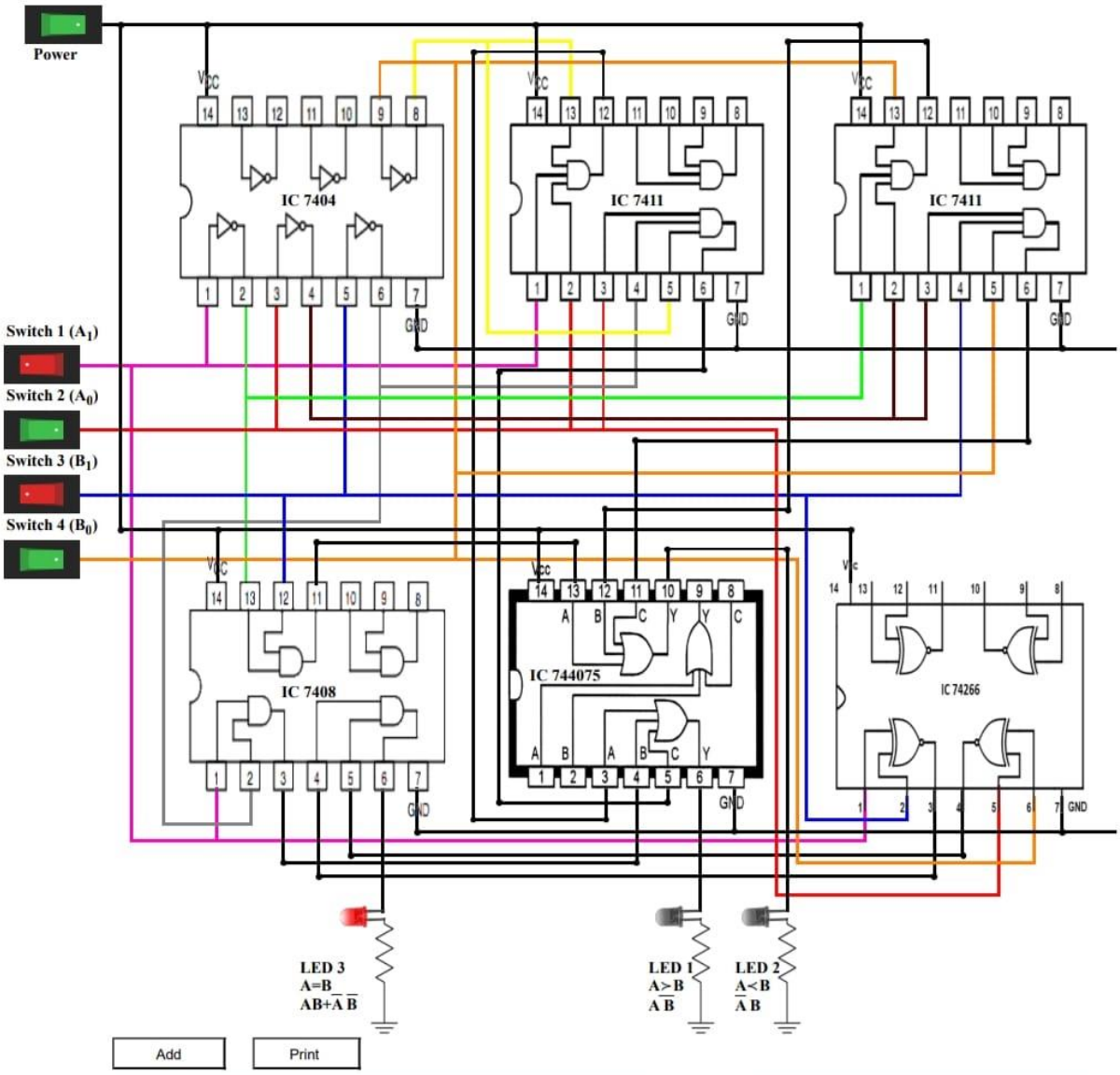
Power
IC 7404
IC 7408
IC 7402
Switch 1 (A)
Switch 2 (B)
LED 1
A>B
A B
LED 2
A<B
A B
LED 3
A=B
AB+A B
Add

Construction of 2-Bit Comparator and verification of its operation



TRUTH TABLE

Serial No.	A_1	A_0	B_1	B_0	A>B	A<B	A=B
1	0	0	0	0	0	0	1
2	0	0	1	0	0	1	0
3	0	1	0	0	1	0	0
4	1	1	1	1	0	0	1
5	1	0	1	0	0	0	1
6	0	1	0	1	0	0	1

COLOR OF INPUTS

Color	Inputs
	A_1
	A_1'
	A_0
	A_0'
	B_1
	B_1'
	B_0
	B_0'

Result:

The implementation of one-bit and two-bit comparators is done using logic gates and also with IC 7485.