ECE111|Digital Circuits
Dr. Vish Visweswaran

Lab_2:

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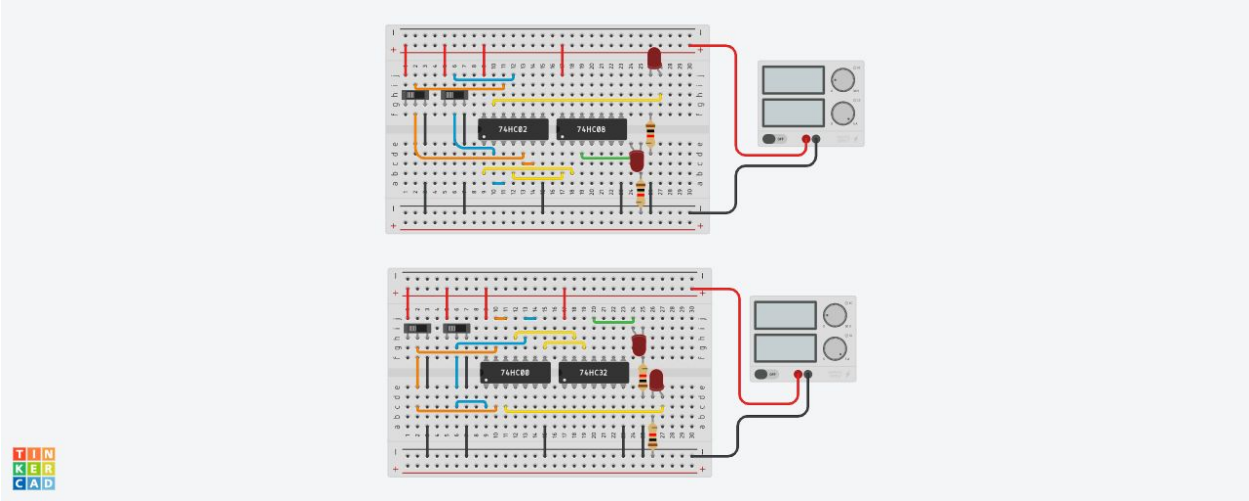
Aim 1: Verify De morgan's theorem

Components/ICs Use: 1 Quad NAND gate, 1 Quad NOR gate, 2 power supply, 4 slide switches, 4 resistors (1kohm), 4 LED, 1 Quad AND gate , 1 Quad OR gate

Circuit Diagram:



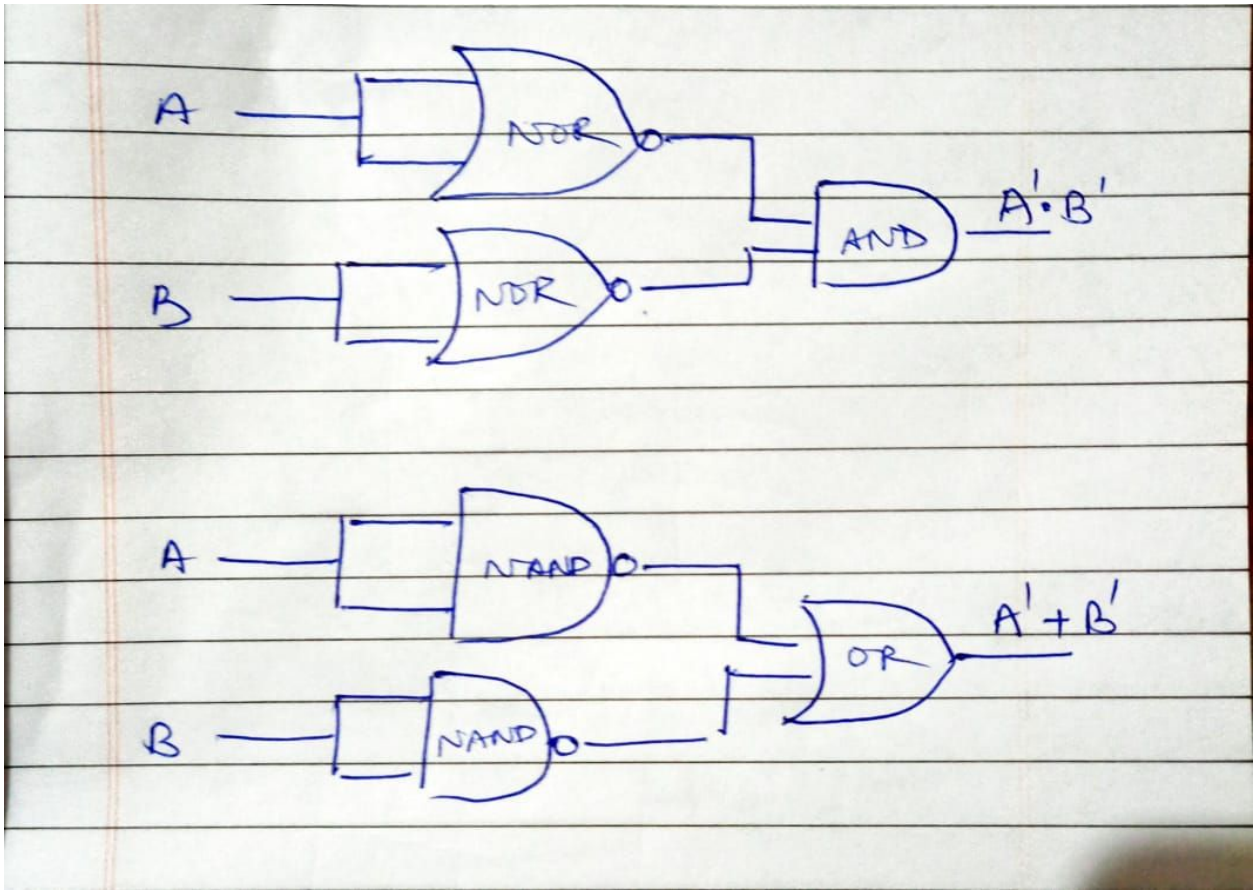
Link of TINKERCAD Workspace:

https://www.tinkercad.com/things/cgmaDlilMky-lab2a/editel?sharecode=UNiucXSVm2O-EO9G5cBxqD9VKbORVPp6jpp6msKCRww

Truth Table:

A	B	A’	B’	(A+B)’	A’.B’	(A.B)’	A’+B’
0	0	1	1	1	1	1	1
0	1	1	0	0	0	1	1
1	0	0	1	0	0	1	1
1	1	0	0	0	0	0	0

Logic circuit diagram:



Observations/Results:

From the above experiment we can show that (A + B)’ = A’ B’ and (A B)’ = A’ + B’ , thus

Verifying De Morgan’s Theorem.

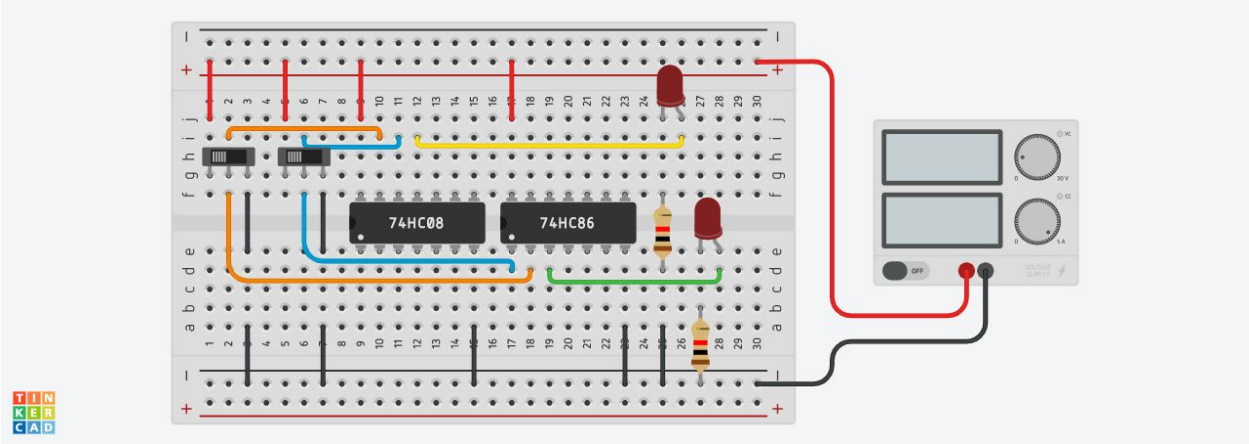
Applications of the experiment

1. De Morgan’s Theorem is used in solving boolean expressions.
2. It is used to make circuits using only 1 type of universal gates
3. It is used to implement operations of NAND and NOR gate.

Aim 2: Create a half adder circuit

Components/ICs Use: 1 power supply, 2 slide switches, 2 resistors (1kohm), 2 LED, 1 Quad AND gate , 1 Quad XOR gate

Circuit Diagram:



Link of TINKERCAD Workspace:

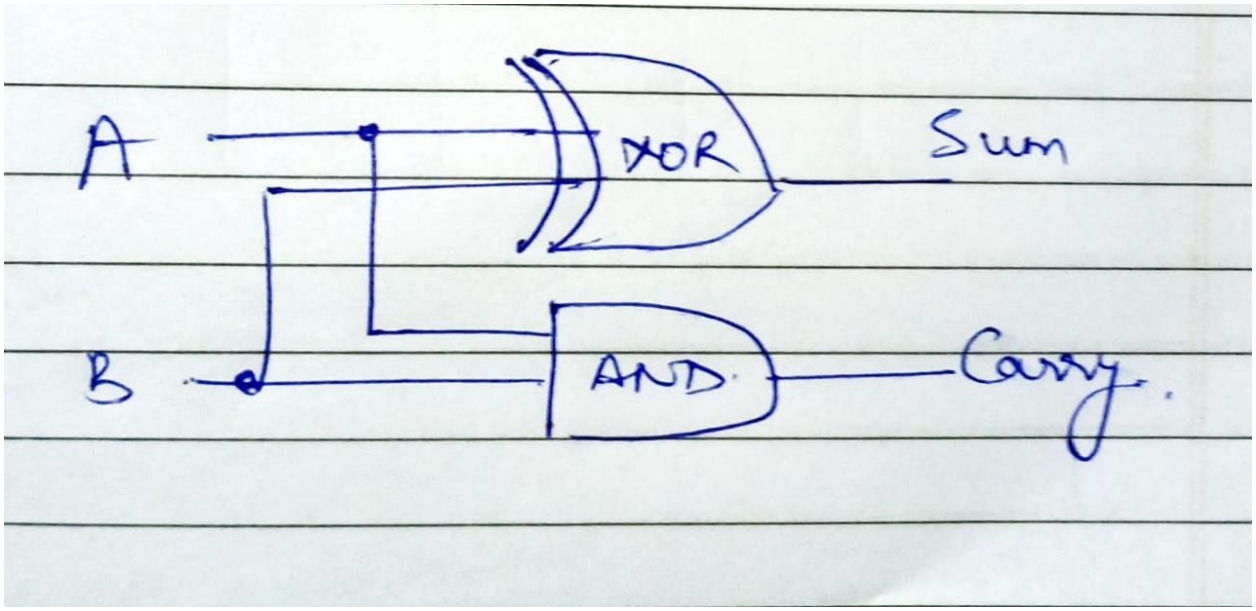
https://www.tinkercad.com/things/2o5V8RtMxqi-lab2b-half-adder/editel?sharecode=fHltJLkkVvoVl2ItuR9yc3MZxD6wf9AY0scqXJG3dBU

Truth Table:

A	B	Sum(A ⊕ B)	Carry(A.B)

0	**0**	**0**	**0**
0	**1**	**1**	**0**
1	**0**	**1**	**0**
1	**1**	**0**	**1**

Logic circuit diagram:



Observations/Results:

From the above experiment we can show that the sum A+B is given by **A ⊕ B** and the carry is given by A.B

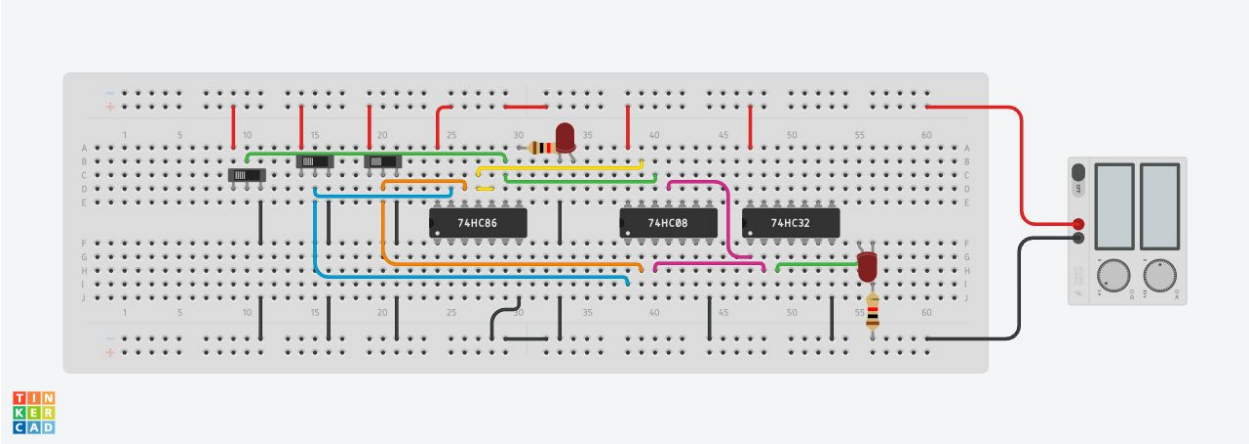
Applications of the experiment

1. It is used to add 2, 1 bit digits.
2. Combinations of half adder circuits forms full adder circuits
3. It is used to perform arithmetic addition

Aim 3: Create a full adder circuit

Components/ICs Use: 1 power supply, 3 slide switches, 2 resistors (1kohm), 2 LED, 1 Quad AND gate , 1 Quad XOR gate, 1 Quad OR gate

Circuit Diagram:



Link of TINKERCAD Workspace:

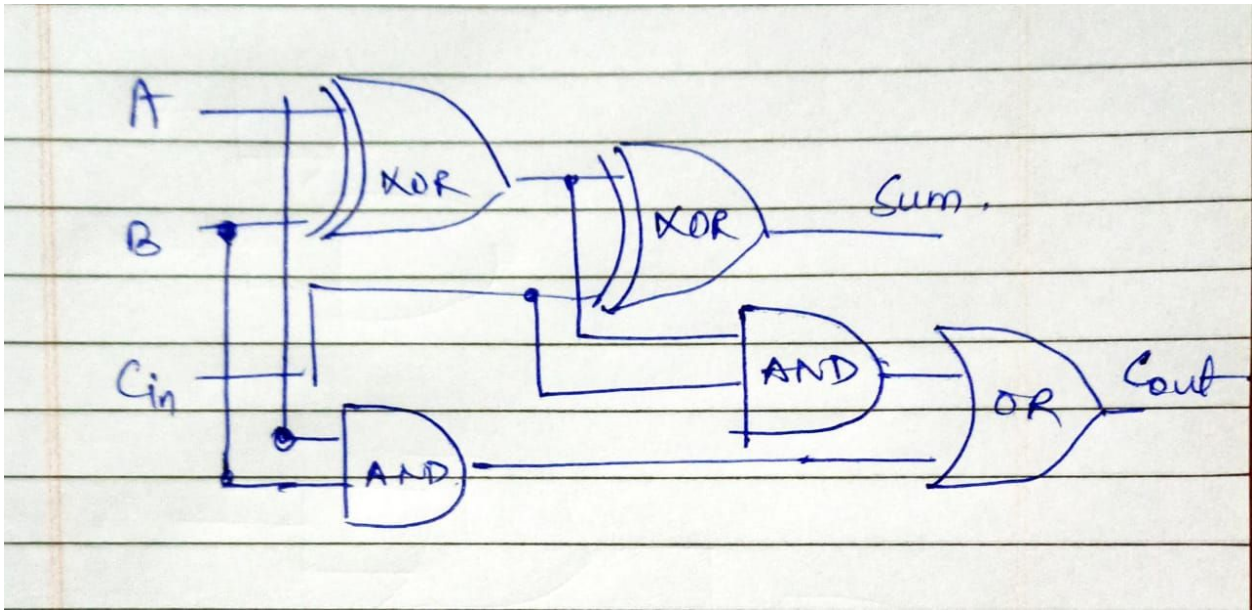
https://www.tinkercad.com/things/ePNHSI5MBwf-mighty-uusam-inari/editel?sharecode=HZ4CLetljv_6VXfIC_87FKL3aGBQ12i-zib03N-sdVA

Truth Table:

C in	A	B	SUM	C out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1

1	**0**	**0**	**1**	**0**
1	**0**	**1**	**0**	**1**
1	**1**	**0**	**0**	**1**
1	**1**	**1**	**1**	**1**

Logic circuit diagram:



Observations/Results:

From the above experiment we can show that the sum is given by (**A ⊕ B)⊕Cin** and the carry(C out) is given by A . B + Cin.(**A ⊕ B**)

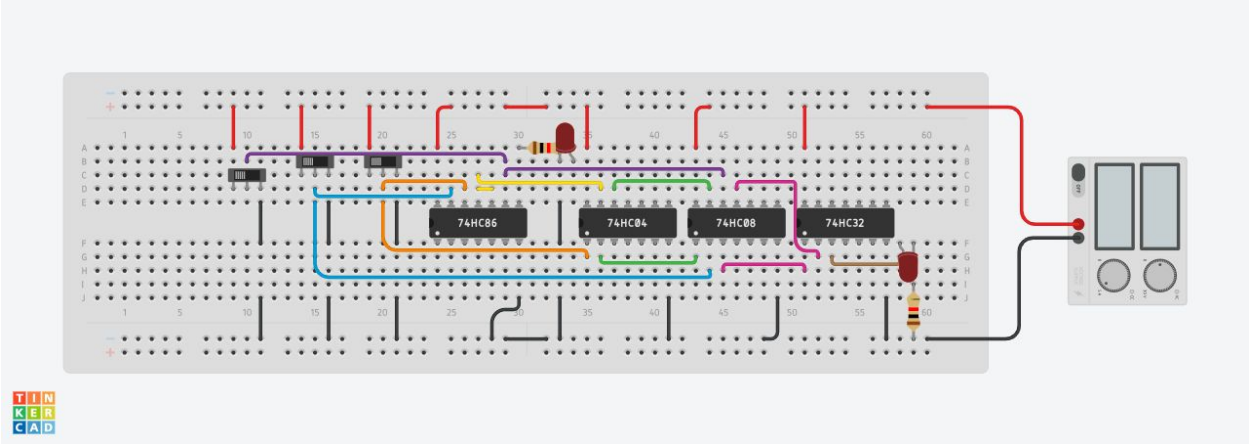
Applications of the experiment

1. It is used to add n-bits at a time
2. It is used in digital devices
3. It can be used to carry out multiplication

Aim 4: Create a binary full subtractor circuit

Components/ICs Use: 1 power supply, 3 slide switches, 2 resistors (1kohm), 2 LED, 1 Quad AND gate , 1 Quad XOR gate, 1 Quad OR gate, 1 Hex inverter

Circuit Diagram:



Link of TINKERCAD Workspace:

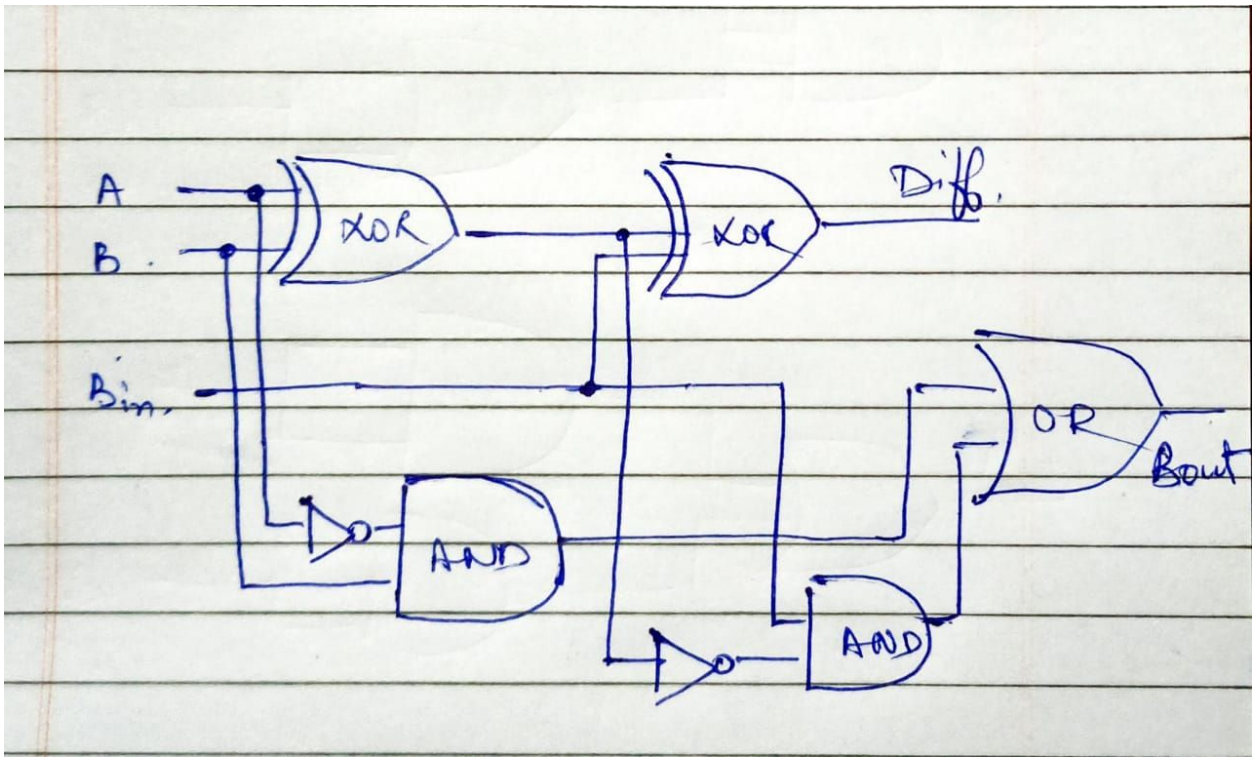
https://www.tinkercad.com/things/cvX9NElAqv2-copy-of-lab2c-full-adder/editel?sharecode=v9nl9XsJ0ybwXKDPXUzyJwVj-79LOR3hsCsYD4rtRPk

Truth Table:

B in	Y	X	diff	B out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	1
0	1	1	0	0

1	0	0	1	1
1	0	1	0	0
1	1	0	0	1
1	1	1	1	1

Logic circuit diagram:



Observations/Results:

From the above experiment we can show that the Difference is given by (**X ⊕ Y)⊕B in** and the borrow(B out) is given by A' .B + (A⊕B').Bin.

Applications of the experiment

1. It is used to subtract n-bits at a time
2. It is used in digital devices
3. It can be used to carry out division