IIID

INDRAPRASTHA INSTITUTE *of* INFORMATION TECHNOLOGY DELHI

Department of Electronics & Communication Engineering

ECE111|Digital Circuits
Section: B

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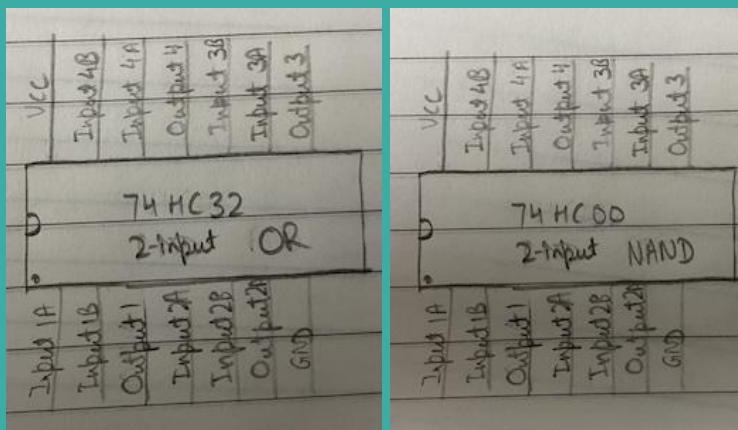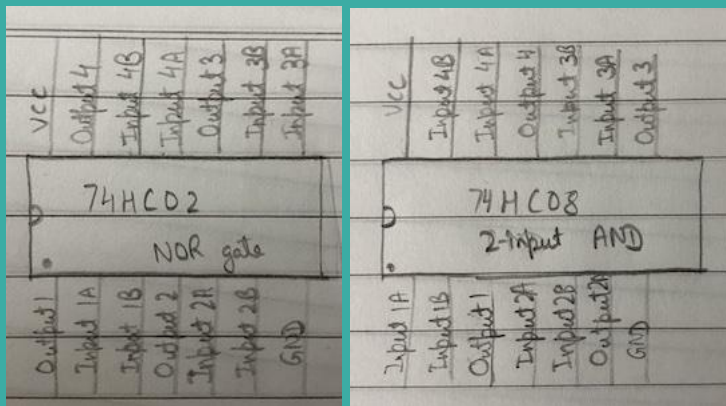## Part A: DeMorgan's theorem

Aim: To verify DeMorgan's law

Components/ICs Used: Breadboard, led, wires, slide switch, led, resistors, NOR Gate, AND, gate, NAND gate, OR gate, power supply.
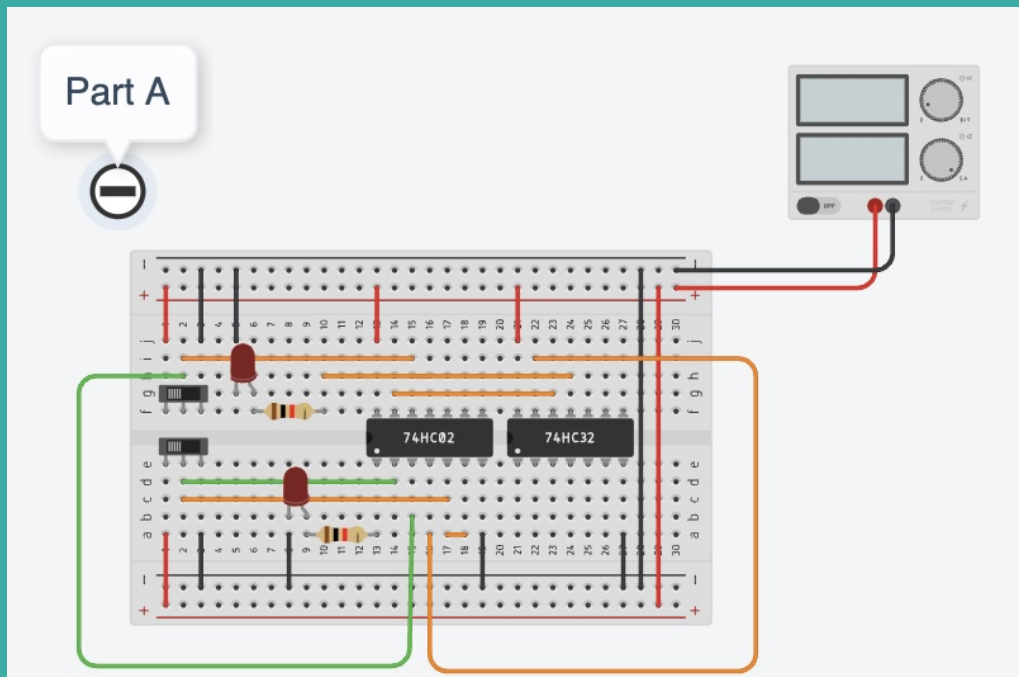
Link of TINKERCAD Workspace (if applicable):
Y=(A+B)'
Y=(A.B)'

Pin Diagram of the IC (If Applicable):

74HC02 NOR gate

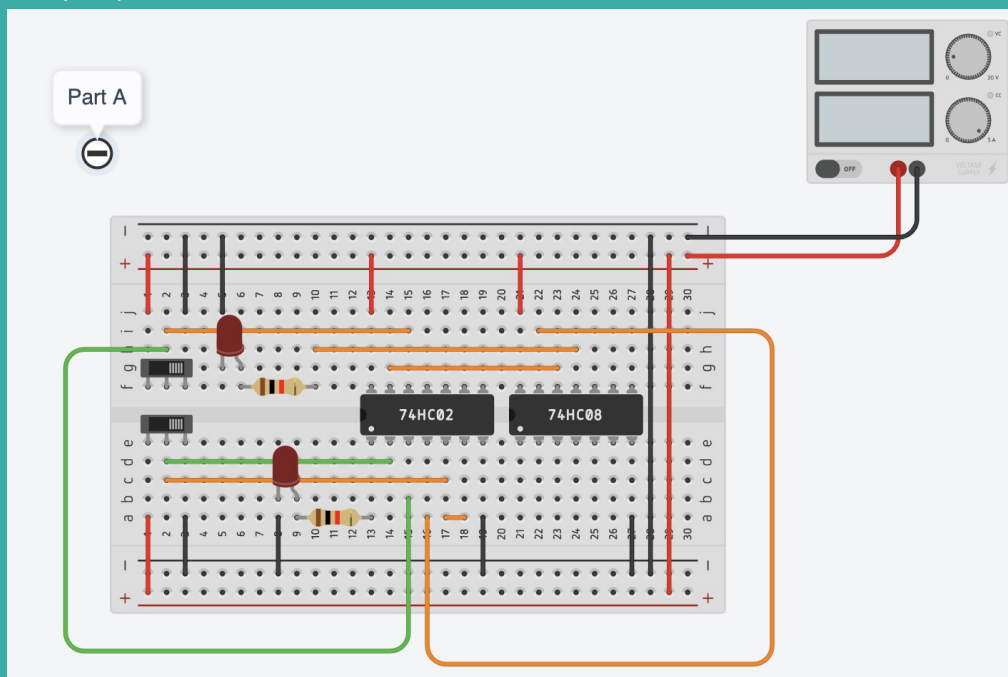74HC08 2-input AND

74HC32 2-input OR

74HC00 2-input NAND

Circuit Diagram: (Screenshot of Circuitverse/TinkerCAD workspace)

$Y = (A+B)' = A'*B'$

$Y = (A.B)' = A'+B'$

Truth Table:

Y = (A+B)' = A'*B'

A	B	A'	B'	(A+B)'	A'*B'
0	0	1	1	1	1
0	1	1	0	0	0
1	0	0	1	0	0
1	1	0	0	0	0

Y = (A*B)' = A' + B'

A	B	A'	B'	(A*B)'	A'+B'
0	0	1	1	1	1
0	1	1	0	1	1
1	0	0	1	1	1
1	1	0	0	0	0

Observations/Results: DeMorgan's law is verified

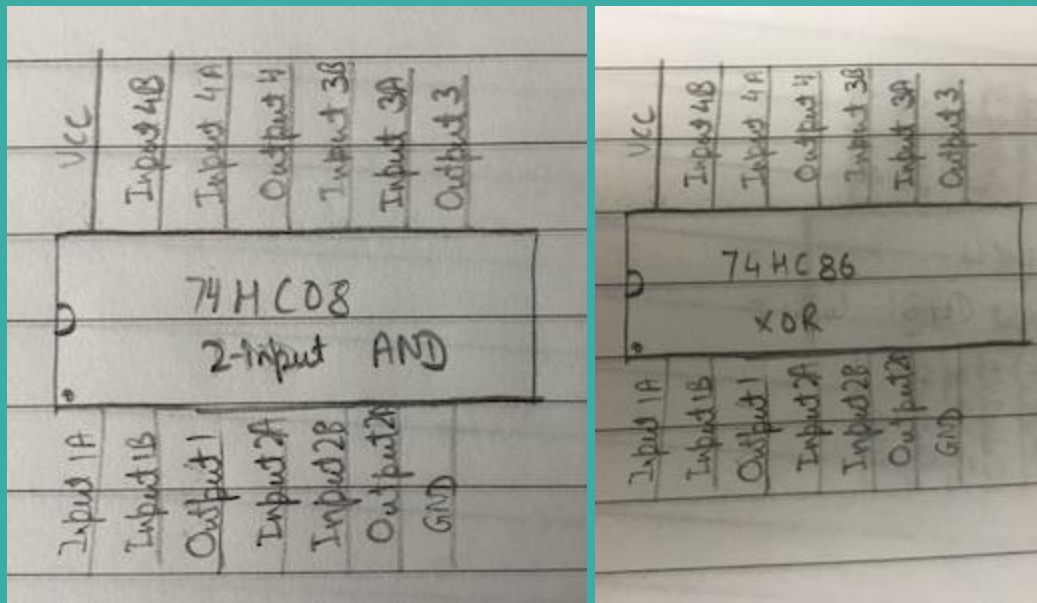Application: DeMorgan's law is used to simplify circuits

Part B: Binary Half Alder

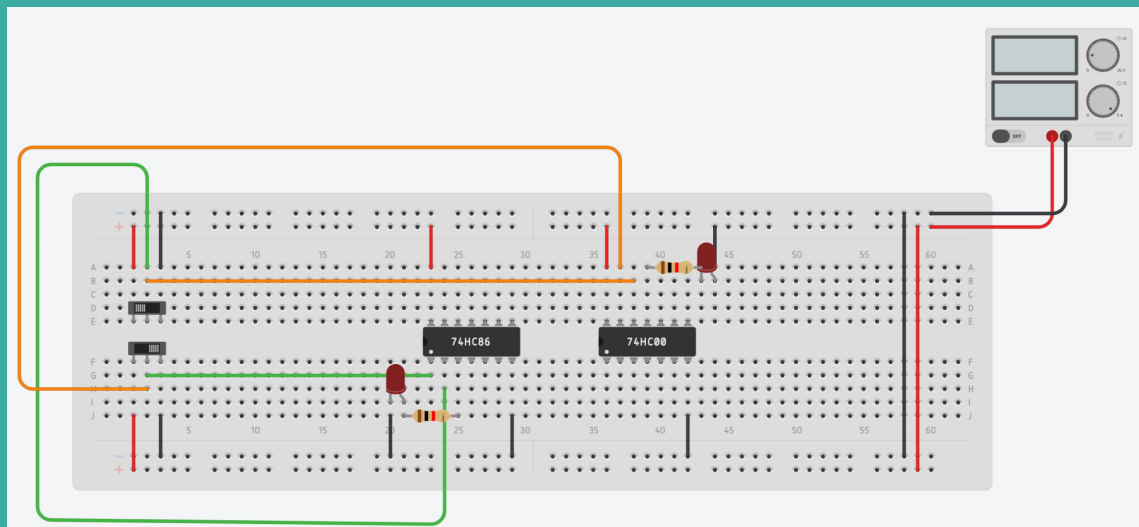Aim: To create binary half alder circuit in tinkercad

Components/ICs Used: Breadboard, wires, power supply, resistors, LEDs, slide switches, AND gate, XOR gate.

Link of TINKERCAD Workspace (if applicable): Half-Alder

Pin Diagram of the IC (If Applicable):

Circuit Diagram: (Screenshot of Circuitverse/TinkerCAD workspace)

Truth Table:

A	B	A⊕B (Sum)	A*B (Carry)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Observations/Results: This circuit adds two binary, one-bit numbers.

Application: To add two one-bit binary numbers.

Part C: Binary full subtractor using gates

Aim: To verify that the DIFFERENCE and BORROW outputs are given by the following logic expressions:
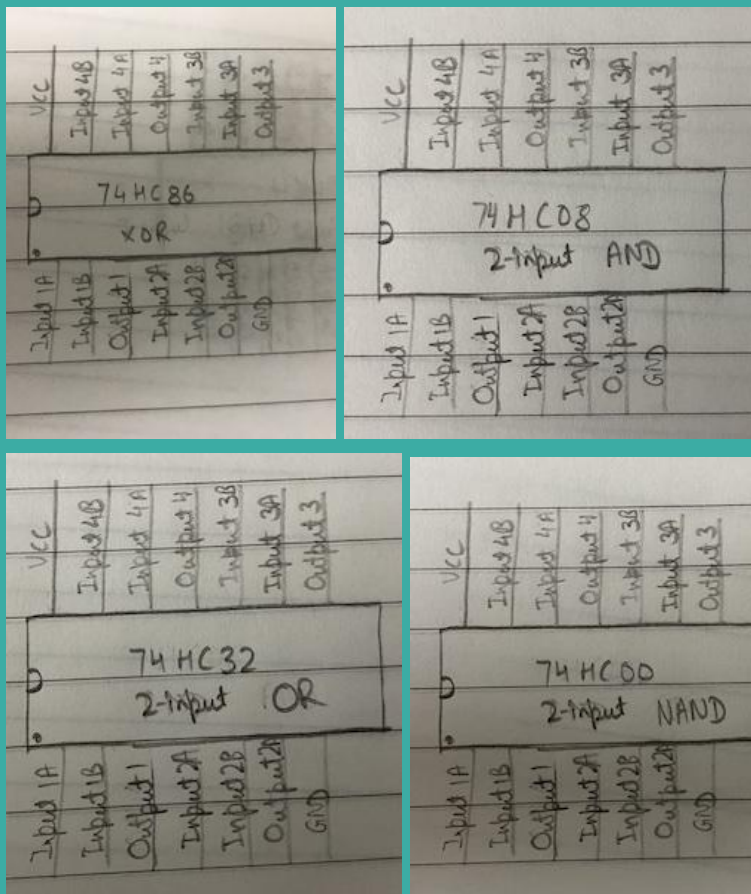
DIFFERENCE = A $\oplus$ B $\oplus$ Bin and
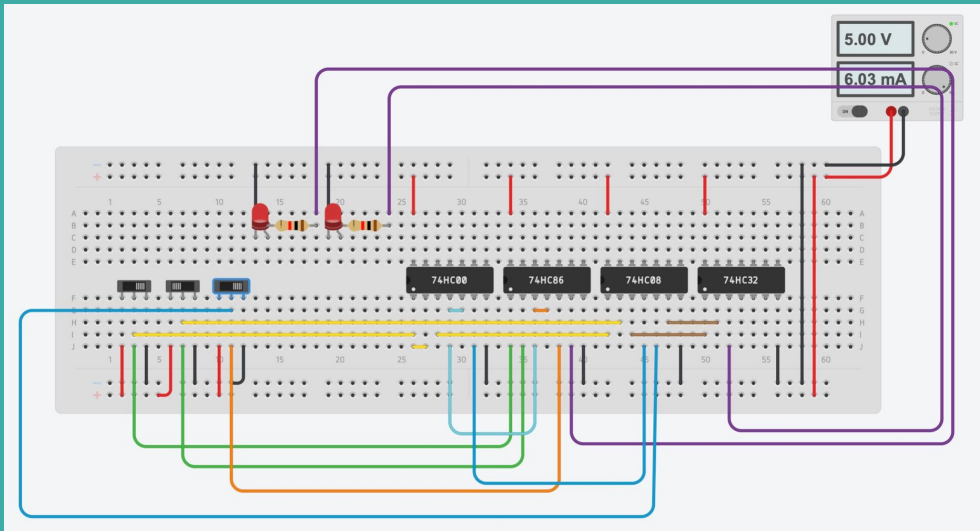BORROW (Bout) = A' .B + (A$\oplus$B)'.Bin.

Components/ICs Used: Breadboard, wires, LEDs, resistors, NAND gate, OR gate, XOR gate, AND gate, slide switches, power supply.

Link of TINKERCAD Workspace (if applicable): PartC

Pin Diagram of the IC (If Applicable):

Circuit Diagram: (Screenshot of Circuitverse/TinkerCAD workspace)

Truth Table:

A	B	Bin	Difference	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Observations/Results: The logic expressions are verified

Application: To subtract to binary number with Borrow input and give difference and borrow
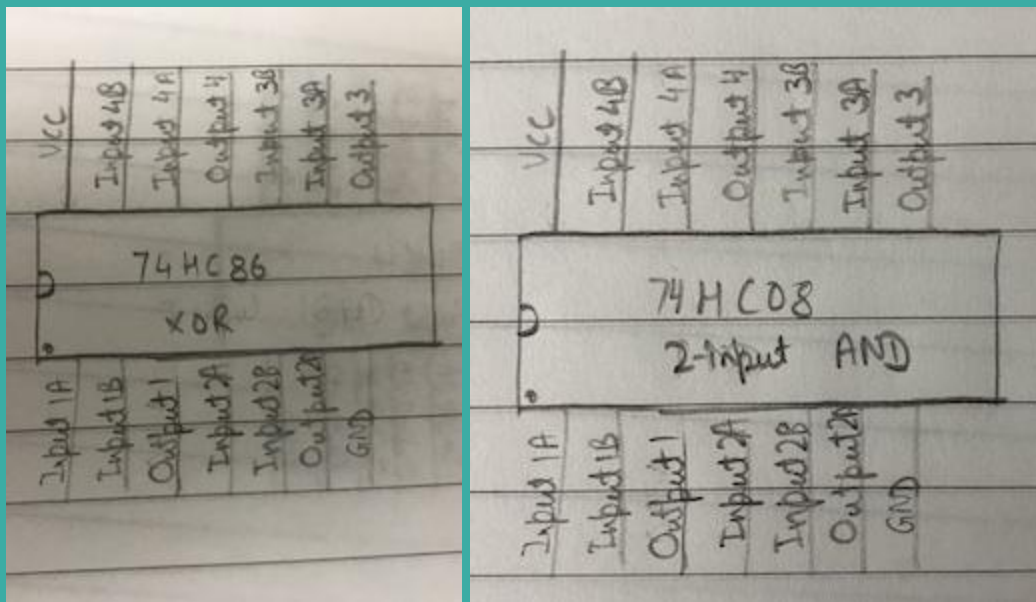
Problem Statement

Statement Solution:

      Warning = Glass removed $\oplus$ Weight removed
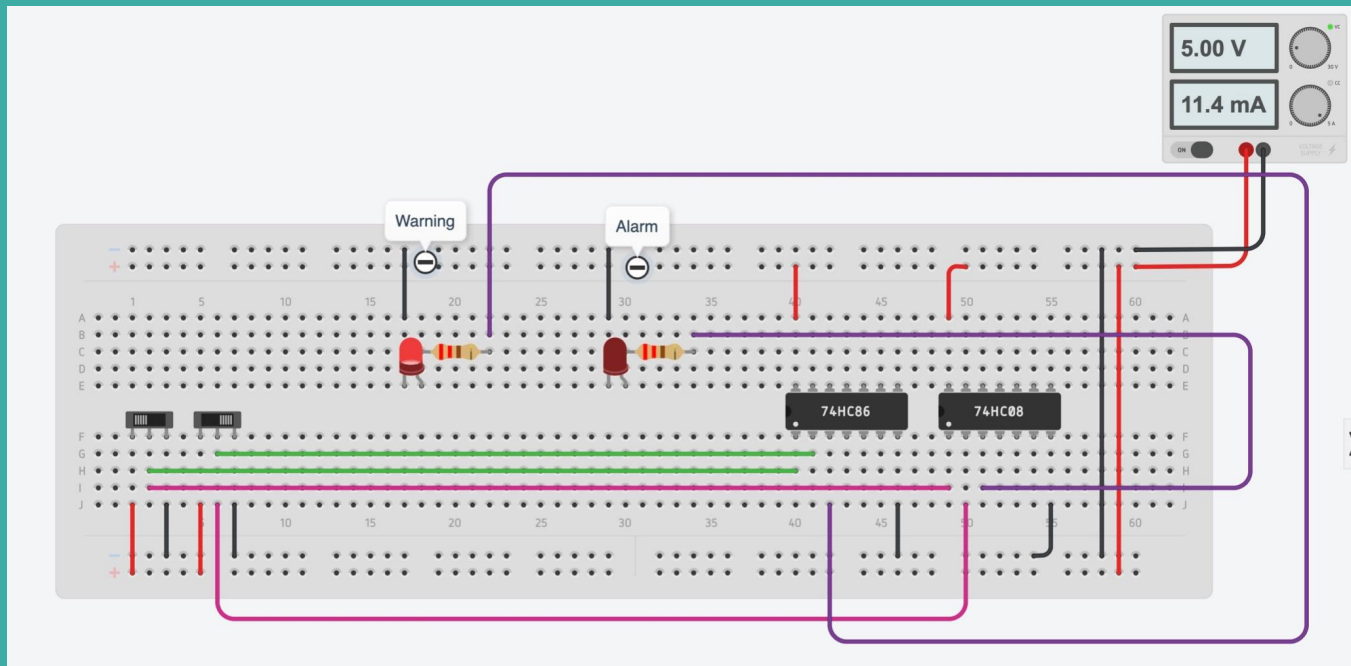
      Alarm = Glass removed * Weight removed

Components/ICs Used: Breadboard, wires, LEDs, resistors, slide switches, power supply, AND, XOR gate.

Link of TINKERCAD Workspace (if applicable): ProblemSolution

Pin Diagram of the IC (If Applicable):

Circuit Implementation:

Truth Table:

Glass Removed	Weight Removed	Warning	Alarm
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1