Tables :-

OR gate :-

A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

AND gate -

A	B	$A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

NOT gate :-

A	$Y = \bar{A}$
0	1
1	0

NAND gate :-

A	B	$\overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

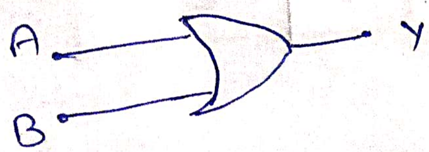
Experiment - 1

Objective:- Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR Gates :-

Theory:- A logic gate is a kind of basic building block of a digital circuit having two inputs and one output. The basic logic gates are -

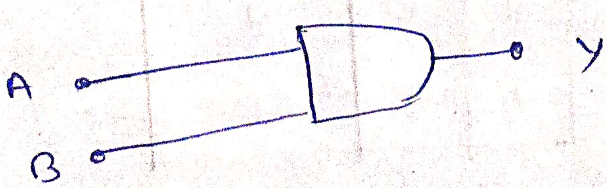
1. **OR gate:-** The OR gate output attains the state 1 when one or more inputs attain the state 1.

Boolean expression : $Y = A + B$



2. **AND gate:-** The AND gate outputs attains the state 1 only if both the inputs attain the state 1.

Boolean expression : $Y = A \cdot B$.



NOR gate :-

A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

XOR gate :-

A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

XNOR gate :-

A	B	$\overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

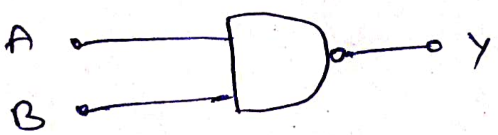
3- NOT gate :- NOT gate inverts the input state. if input is 1 output is 0 and viceversa

Boolean expression :- $Y = \bar{A}$

4- NAND gate :- The digital circuit with the out of logical AND of all inputs inverted.

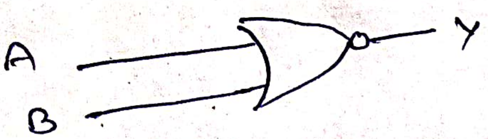
Boolean expression :-

$Y = \overline{A \cdot B}$



5- NOR gate :- Digital circuit with the output that is the logical OR of all those inputs inverted.

Boolean expression :- $Y = \overline{A+B}$

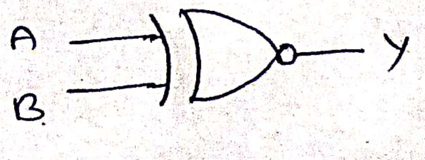


6- XOR gate :- Digital circuit which outputs 0 if both inputs are same otherwise 1.

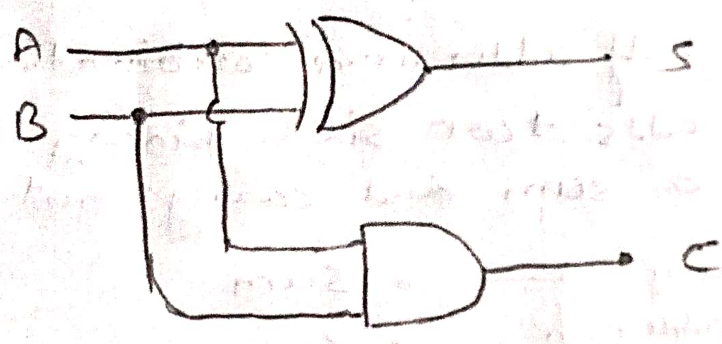
$Y = A \oplus B = A\bar{B} + \bar{A}B$

7- XNOR gate :- Digital circuit which outputs 1 only if the inputs are same.

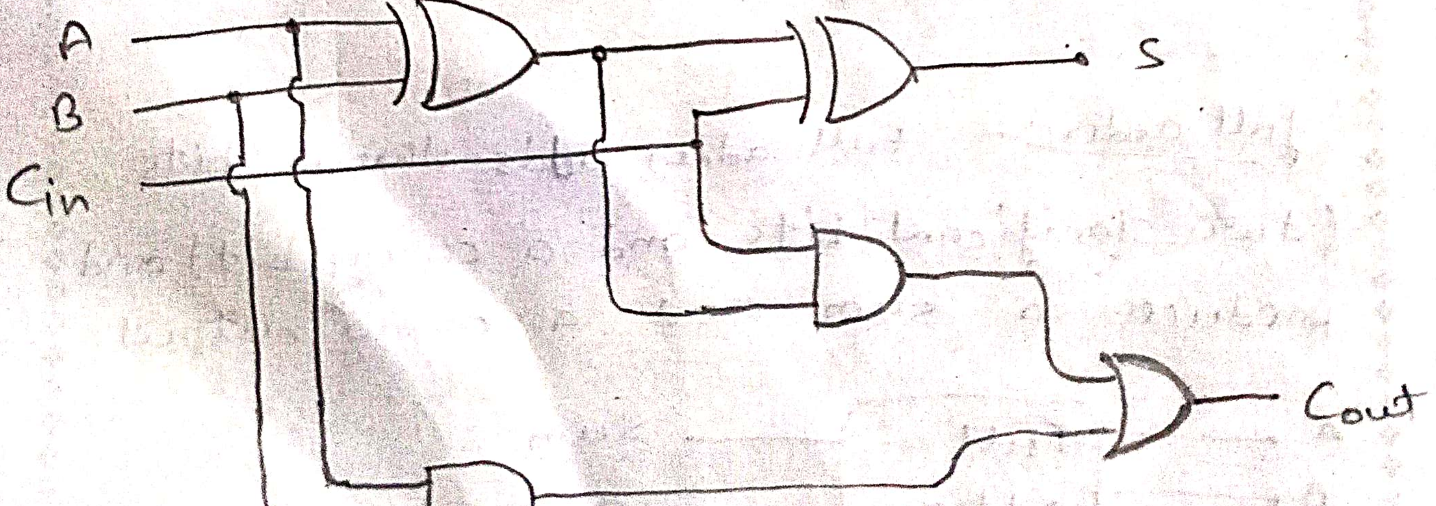
$Y = \overline{A \oplus B} = \overline{A\bar{B} + \bar{A}B}$



Circuit diagram:-



Half adder.

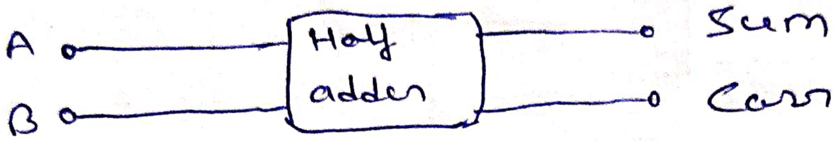


Full adder

Objective :- Construction of half and full adder using XOR and NAND gates and verification of it's application.

Theory :-

Half adder :- Half adder is a combination circuit that adds two single binary digits and produce a sum and carry output.

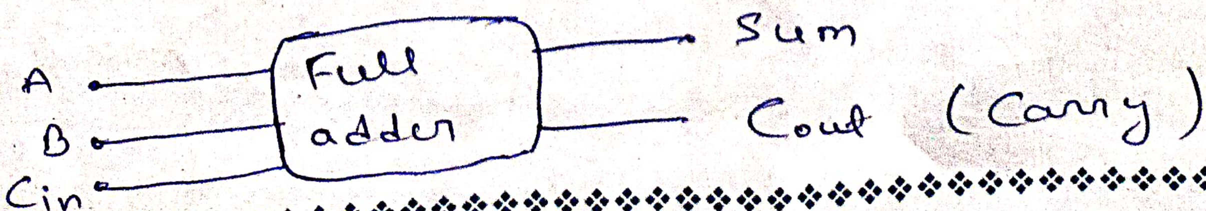


Sum = $A \oplus B$ Carry = $A \cdot B$

Truth table :-

A	B	Sum (S)	Carry (C)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

full adder :- Full adder adds three bits (two significant bits and a carry bit) and produces a sum and a carry output.



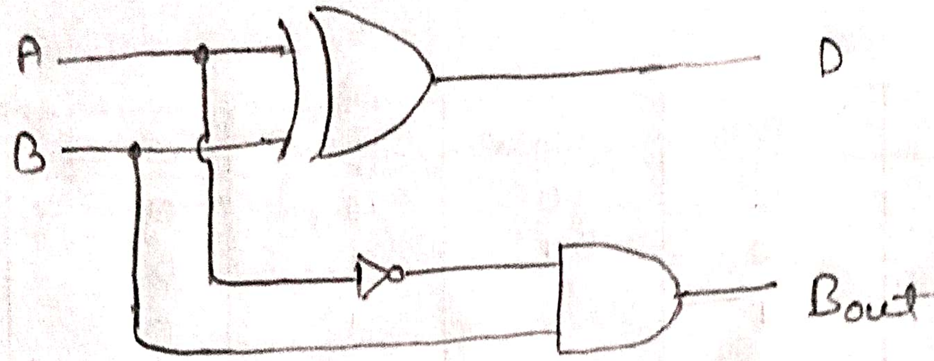
Sum = $A \oplus B \oplus Cin$

Cout (Carry) = $(A \cdot B) + (Cin \cdot (A \oplus B))$

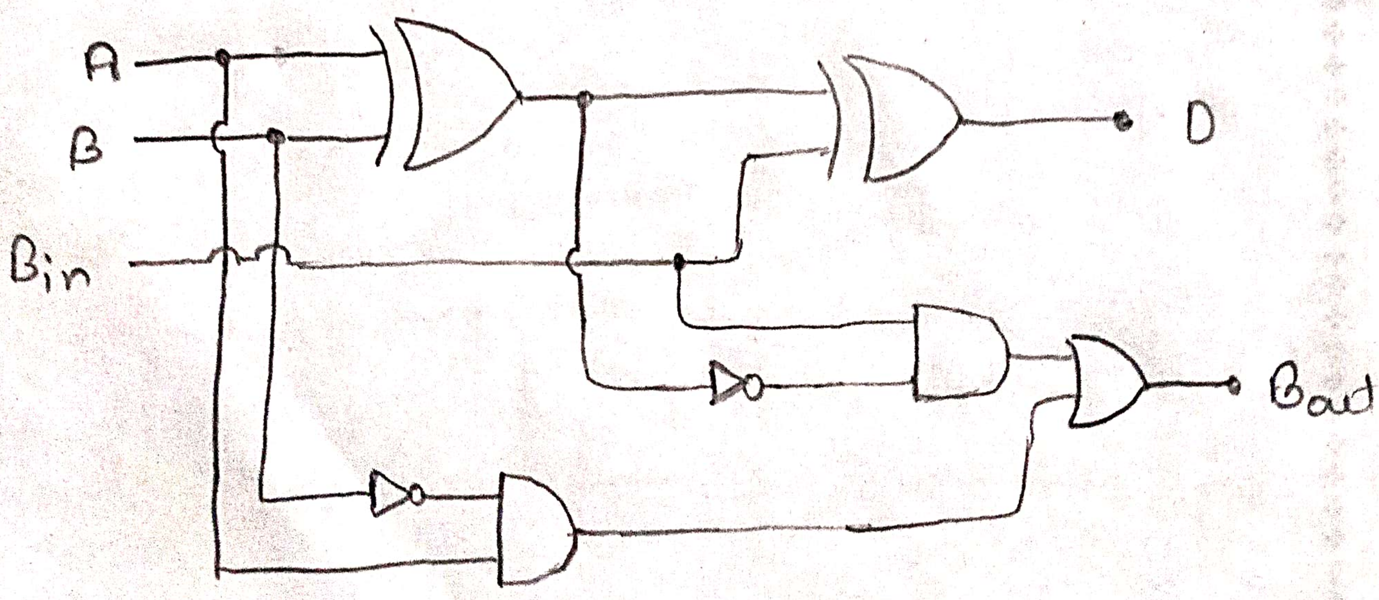
Truth table:-

A	B	Cin	Sum	Carry
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

Circuit diagram :-



Half subtractor.



Full subtractor

Objective :- Study and varify half and full subtractor.

Theory :-

Half subtractor :- Half subtractor is a combinational circuit that subtracts two single binary digits and produces a difference and a borrow output.

Difference = $A \oplus B$

Borrow = $\bar{A} \cdot B$

Truth - table :-

A	B	Difference (D)	Borrow (B_out)
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Full subtractor :- A full subtractor substracts three bits (two significant and a borrow bit) and produces a difference and a borrow output.

$D = A \oplus B \oplus B_{in}$

$B_{out} = \bar{A} \cdot B + B_{in} \cdot (\bar{A} + B)$

Truth-table:-

A	B	Bin	Difference(D)	Borrow
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	1
1	1	0	0	0
1	1	1	1	1