Study of Universal Gates and Implementing given Equation Using Universal Gates

Objective:-

- To be familiar with the Universal Gates
- Implementing Basic Gates and Given Gates through Universal Gates (Using NAND , NOR)
- To be familiarize how many Gates do we need to implement in on our breadboard. Like: More than 4 gates or Not

Logic Circuit Component:-

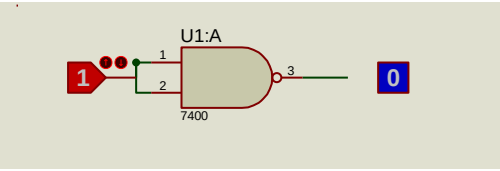
NAND – IC No: 7400 Quad gate

NOR – IC No: 7402 Quad gate

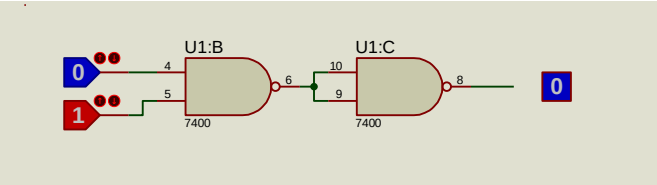
Logic Circuit Diagram:

Using NAND Gate Only:

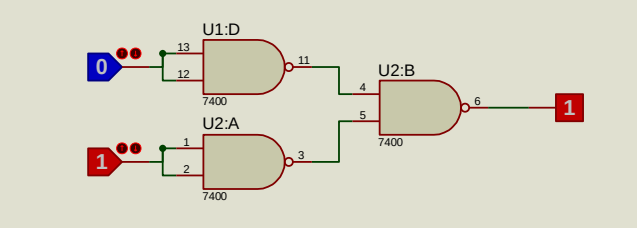
NOT



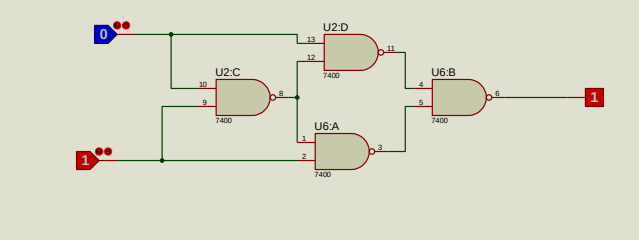
AND



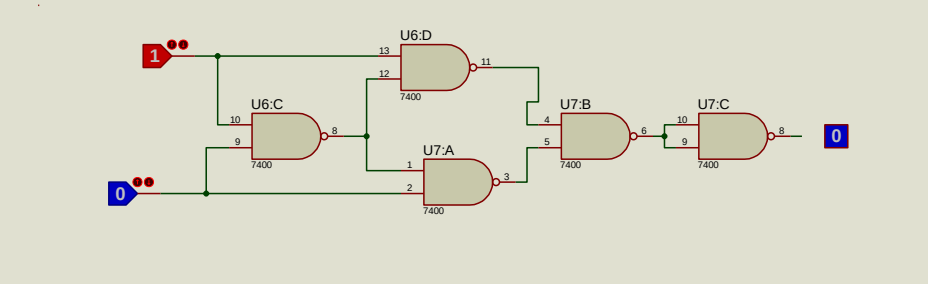
OR



X-OR

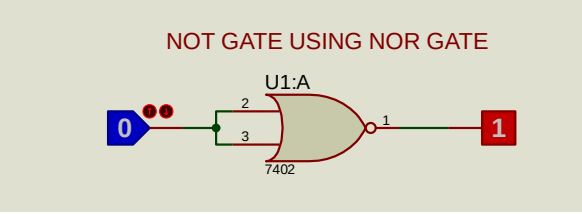


X-NOR



Using NOR GATE Only :

NOT



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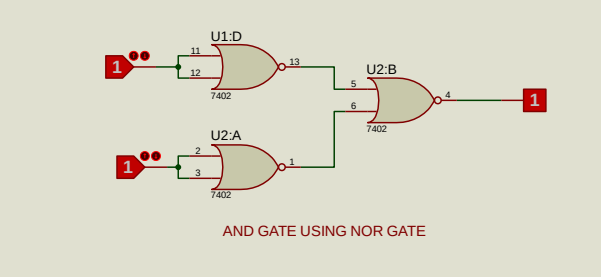

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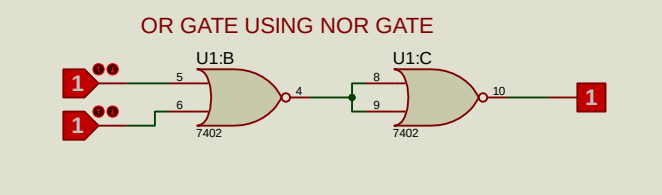
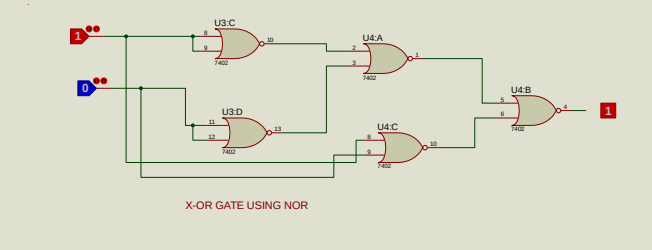
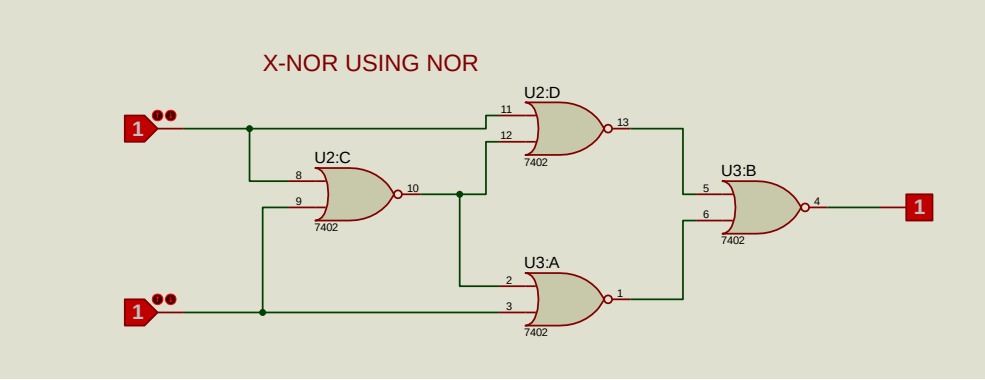


X-OR

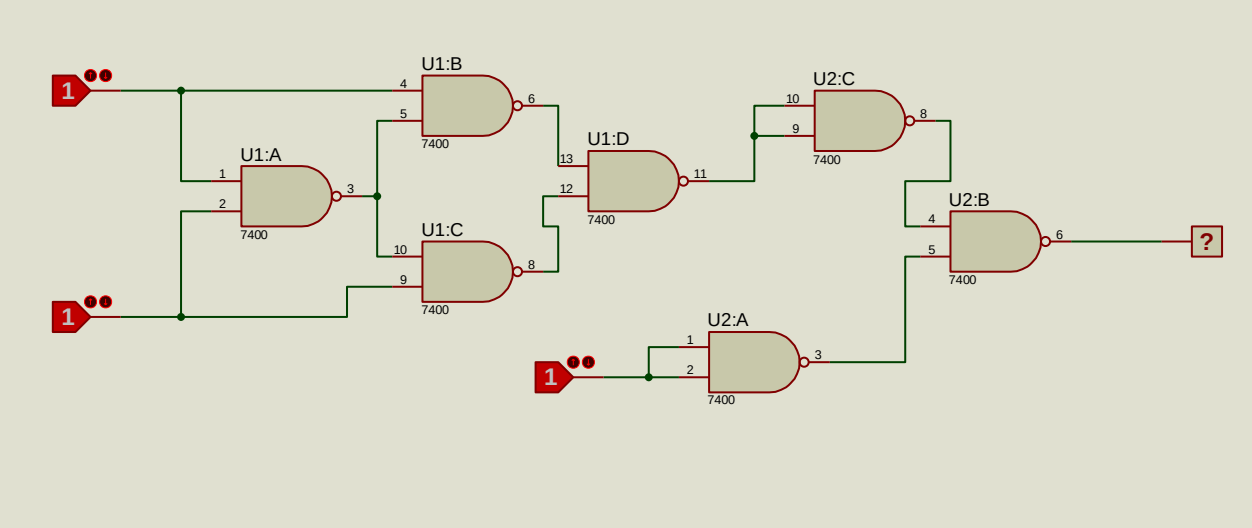


X-NOR

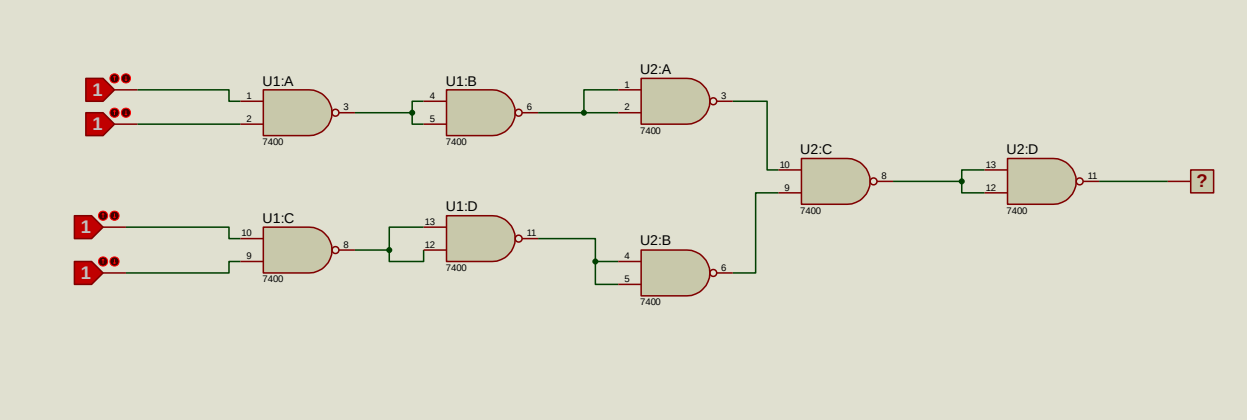


Some Given Equation :

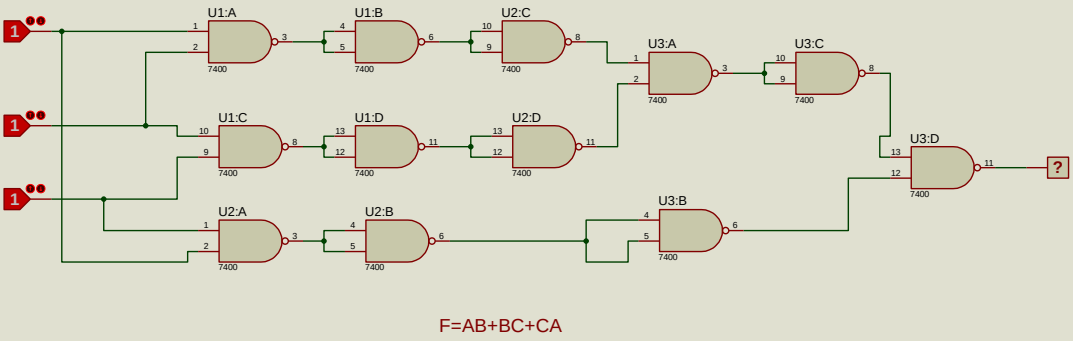
Using NAND GATE , Y=(A(+)B)+C



Using NAND GATE, Y=(AB+CD)'



Using NAND GATE , Y=AB+BC+CA



Required Truth Table and logic Function Derivation:

- NOT
- AND
- OR
- X-OR
- X-NOR
- (A (+) B) + C
- (AB+CD)’
- Y=AB+BC+CA

NOT GATE Using NAND

⇨ (AA)’
⇨ A’’
⇨ A

OR GATE Using NAND

⇨ A’ B’
⇨ (A’B’)’
⇨ A + B

AND GATE Using NAND

⇨ (AB)’
⇨ (AB)’’
⇨ AB

X-OR GATE Using NAND

⇨ (AB)’
⇨ ((A.(AB)’)’ (B.(AB)’)’)’
⇨ A.(A’+B’) + B.(A’+B’)
⇨ AB’ +A’B

X-NOR GATE Using NAND

⇨ (AB)’
⇨ (((A.(AB)’)’ (B.(AB)’)’)’)’
⇨ (A.(AB)’)’ (B.(AB)’)’
⇨ AB +A’B’

NOT GATE Using NOR

⇨ (A+A)’
⇨ A’’
⇨ A

OR GATE Using NOR

⇨ (A+B)’
⇨ (A+B)’’
⇨ A + B

AND GATE Using NOR

⇨ (A’+B’)
⇨ (A’+B’)’
⇨ AB

X-OR GATE Using NOR

- ⇨ (A+B)’
- ⇨ ((A+(A+B)’)’ (B+(A+B)’)’)’
- ⇨ (A+(A’B’)) (B+(A’B’))
- ⇨ AB’ +A’B

X-NOR GATE Using NOR

- ⇨ (A+B)’
- ⇨ (((A+(A+B)’)’ (B+(A+B)’)’)’)’
- ⇨ (A+(A+B)’)’ (B+(A+B)’)’
- ⇨ AB +A’B’

NOT

A	Y
0	1
1	0

AND

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

OR

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

X-OR

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

X-NOR

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

Y=(AB+CD)’

A	B	C	D	AB	CD	AB+CD	(AB+CD)’
0	0	0	0	0	0	0	1
0	0	0	1	0	0	0	1
0	0	1	0	0	0	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	0	0	1
0	1	0	1	0	0	0	1
0	1	1	0	0	0	0	1
0	1	1	1	0	1	1	0
1	0	0	0	0	0	0	1
1	0	0	1	0	0	0	1
1	0	1	0	0	0	0	1
1	0	1	1	0	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	0
1	1	1	0	1	0	1	0
1	1	1	1	1	1	1	0

Y=(A(+)B)+C

A	B	C	A(+)B	(A(+)B)+C
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	0	0
1	1	1	0	1

Y=AB+BC+CA

A	B	C	AB	BC	CA	AB+BC+CA
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	1	0	1
1	0	0	0	0	0	0
1	0	1	0	0	1	1
1	1	0	1	0	0	1
1	1	1	1	1	1	1

Discussion:

Implementing any kind Of Circuit Using NAND and NOR GATE Only. We Found somewhere it's better to use NAND gate rather than NOR, it May cause More Gates If we choose NOR. So, In a minimum way we can Implementing any given Circuit, it will reduce our connection . There will be less chance for making mistakes. And The Most Important things are we derived the truth table and logic function more correctly or not by checking the both results . Universal Gates Implementation is important for that. For better solution and correctness.

We implemented First Five Basic Circuits using NAND or NOR gates. Next We proved the given Equation Like: (A (+)B)+C , (AB+CD)' , AB+BC+CA

These Circuits Implementations are our preferable where we choose NAND or NOR gates for Implementation. By Using NAND gate simplification Through Truth Table and Circuit Diagram, we cross match our Implementation. And we are proved all of these Equation through truth table and circuit implementation.