Study of Universal Gates

Objective:-

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

Logic Circuit Component:-

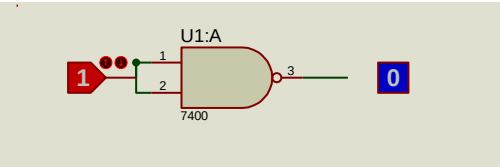
NAND – IC No: 7400 Quad gate

NOR – IC No: 7402 Quad gate

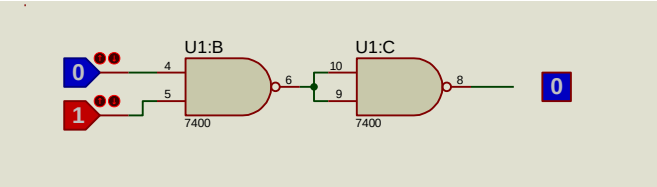
Logic Circuit Diagram:

Using NAND Gate Only:

NOT



AND



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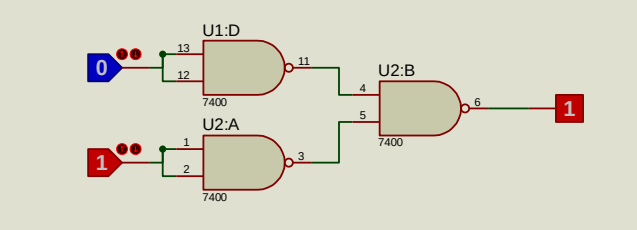
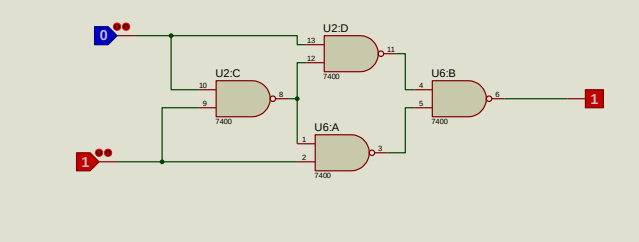
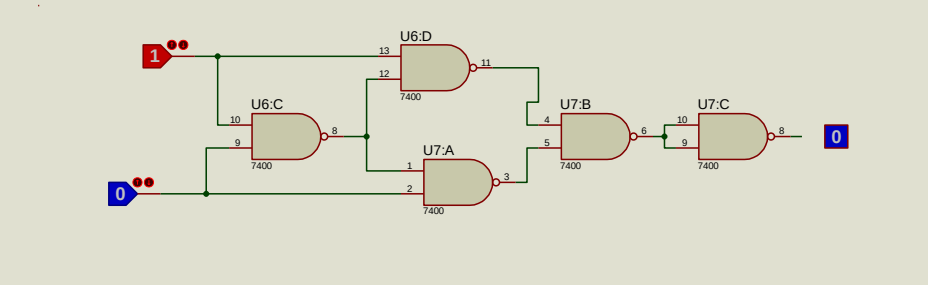


X-OR

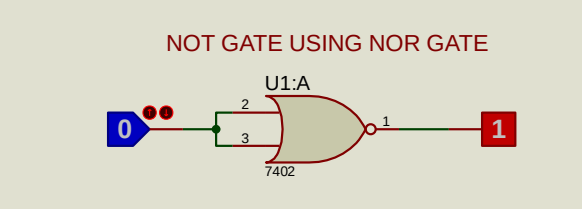


X-NOR



Using NOR GATE Only :

NOT



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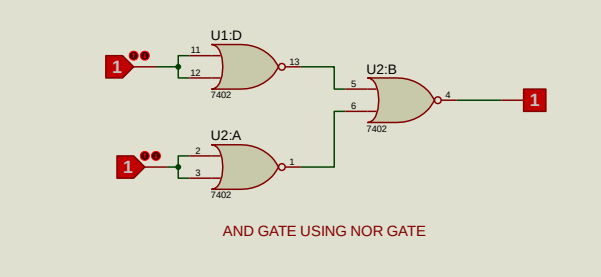

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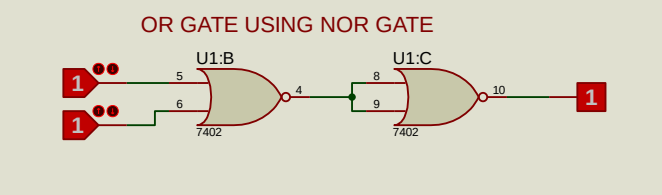
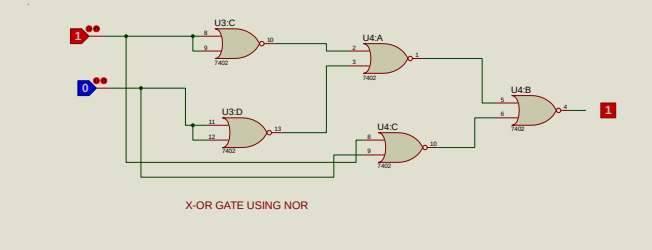
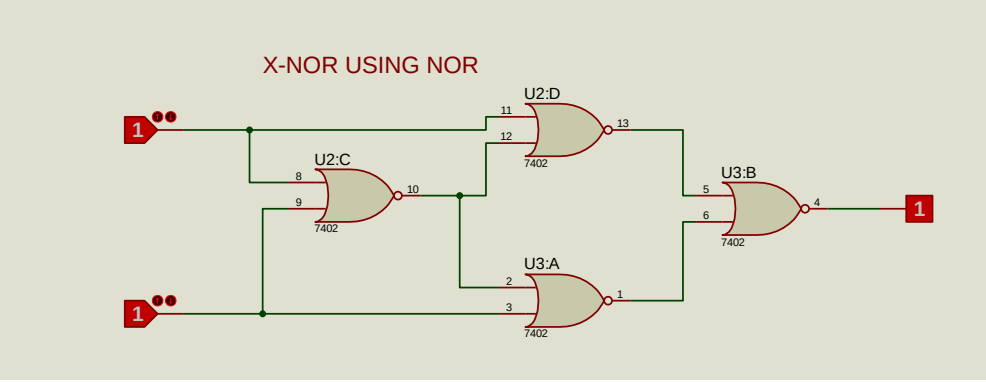


X-OR

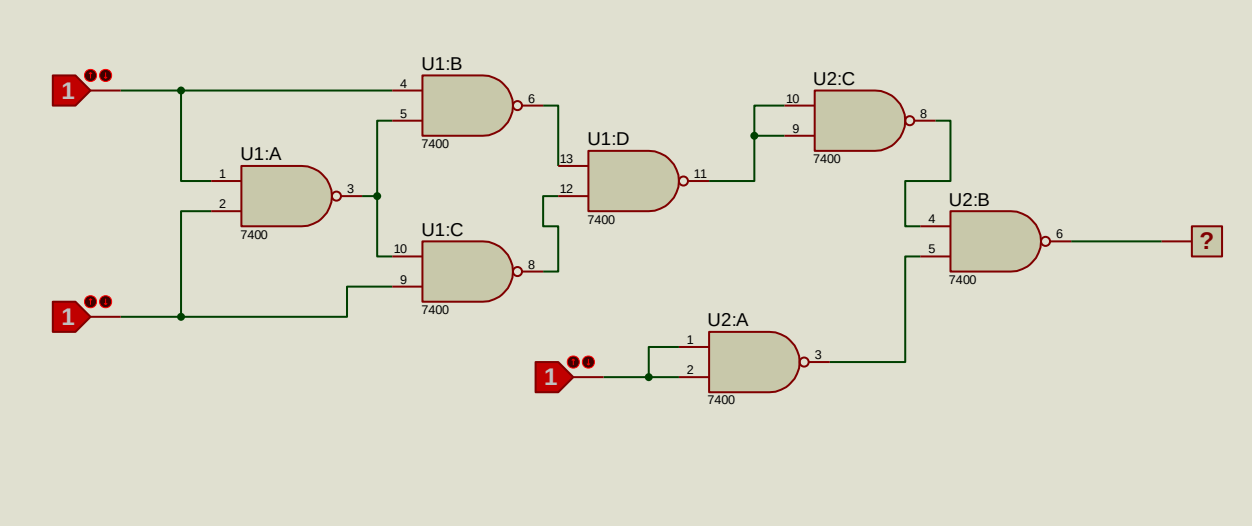


X-NOR

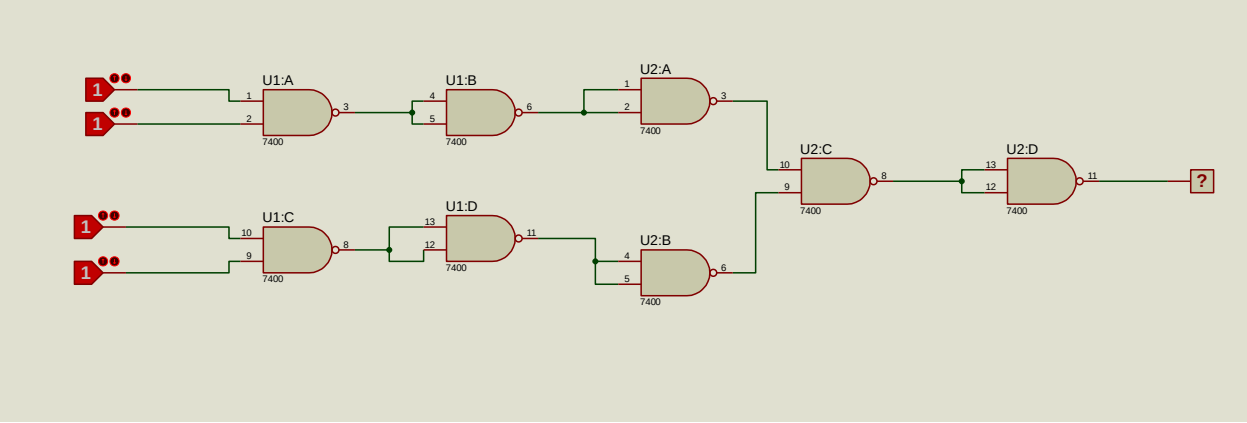


Some Given Equation :

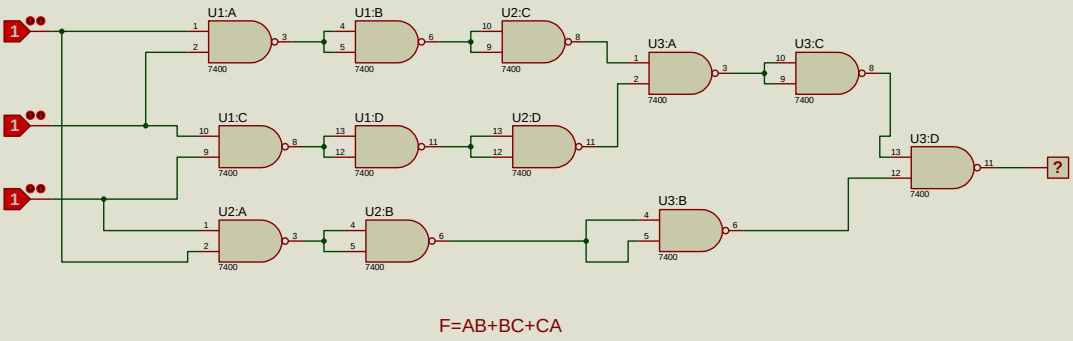
Using NAND GATE , Y=(A(+)B)+C



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 rather than NOR, it May cause More Gates If we choose NOR. So, In a minimum way we can Implementing any Circuit is useful for us cause,it will reduce our connection . There will be less chance for making mistakes. Lesser Time will recurred for implementing such circuits. And The Most Important we can derived the truth table and logic function more correctly. So, It’s is important for whichever Universal Gate we are choosing looking for the better solution and correctness.

First Five Basic Circuits for each NAND and NOR are our basic Implementation. Next We Pick up 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.