REALIZATION OF GATES USING NOR GATE

SNS COLLEGE OF ENGINEERING

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An Autonomous Institution

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REALIZATION OF GATES USING NOR GATE

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INTRODUCTION TO UNIVERSAL GATES

- What are Universal Gates?
- Why?

What are Universal Gates?

- NAND gate
- NOR gate

NOR Gate

2- Input NOR Gate

Truth Table

Input A	Input B	0 = (A + B)'
0	0	1
0	1	0
1	0	0
1	1	0

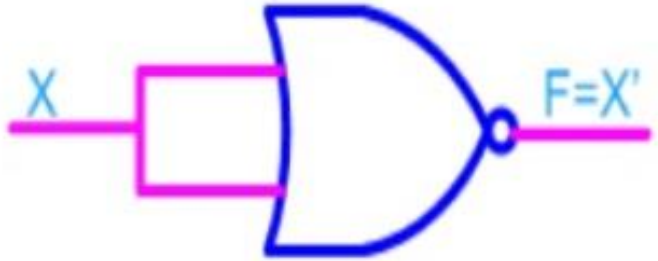
3 Input NOR Gate

Truth Table

Input A	Input B	Input C	X = (A,B,C)
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

NOR as NOT

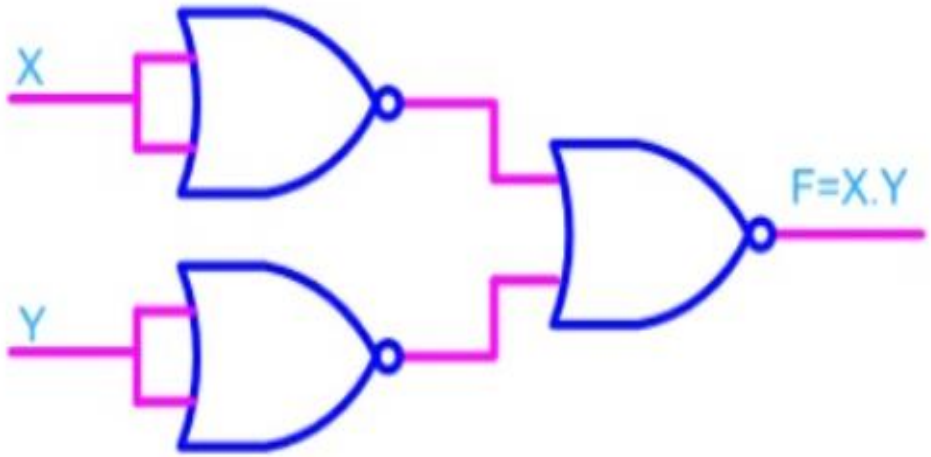
Input	Output	Rule
(X+X)'	= X'	Idempotent



NOR as AND

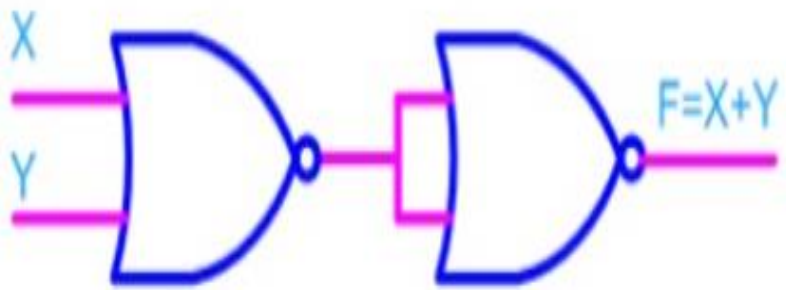
Implementing AND using NOR gates

Input	Output	Rule
((X+X)'+(Y+Y)')'	=(X'+Y')'	Idempotent
	= X".Y"	DeMorgan
	= (X.Y)	Involution



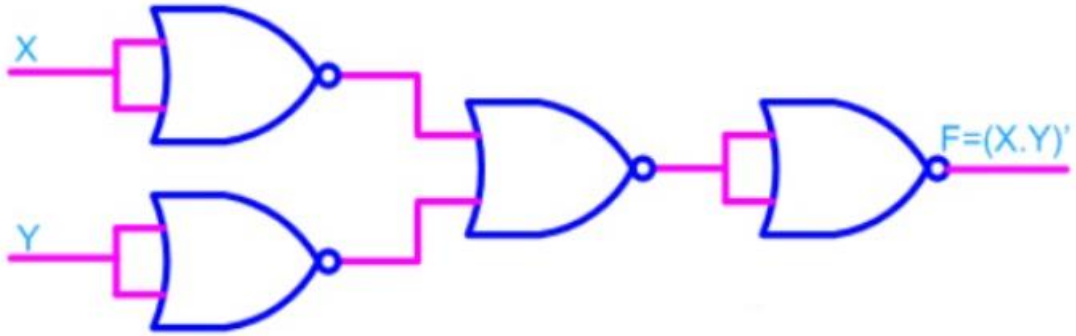
NOR as OR

Input	Output	Rule
((X+Y)'+(X+Y)')'	= ((X+Y)')'	Idempotent
	= X+Y	Involution



NAND USING NOR

Input	Output	Rule
((X+Y)'+(X+Y)')'	= ((X+Y)')'	Idempotent
	= X+Y	Involution
	= (X+Y)'	Idempotent



EXOR USING NOR

The output of the XOR gate is given by,

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

Taking the double complement on the right-hand side, we get,

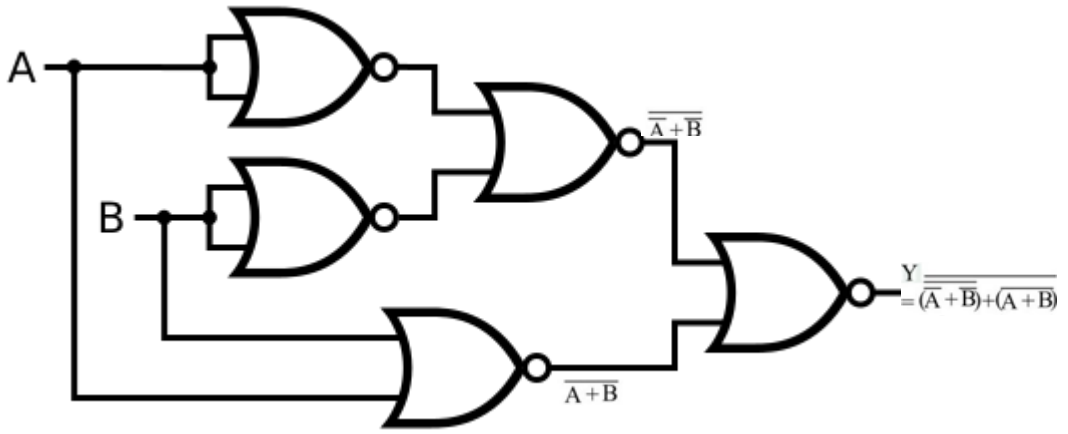
$$Y = \overline{\overline{A \oplus B}} = \overline{A \odot B}$$

$$\Rightarrow Y = \overline{\overline{AB} + \overline{A}.\overline{B}}$$

$$\Rightarrow Y = \overline{\overline{AB} + (\overline{A} + \overline{B})}$$

$$\Rightarrow Y = \overline{\overline{\overline{AB}} + \overline{(A + B)}}$$

$$\Rightarrow Y = \overline{\overline{(\overline{A} + \overline{B})} + \overline{(A + B)}}$$



Hence, this Boolean expression is equivalent to the output of the XOR gate

EXNOR USING NOR

$$Y = \overline{\overline{A + \overline{(A+B)}} + \overline{B + \overline{(A+B)}}}$$

$$Y = \overline{\overline{A + \overline{(A+B)}} \cdot \overline{B + \overline{(A+B)}}}$$

$$Y = (A + \overline{(A+B)}) \cdot (B + \overline{(A+B)})$$

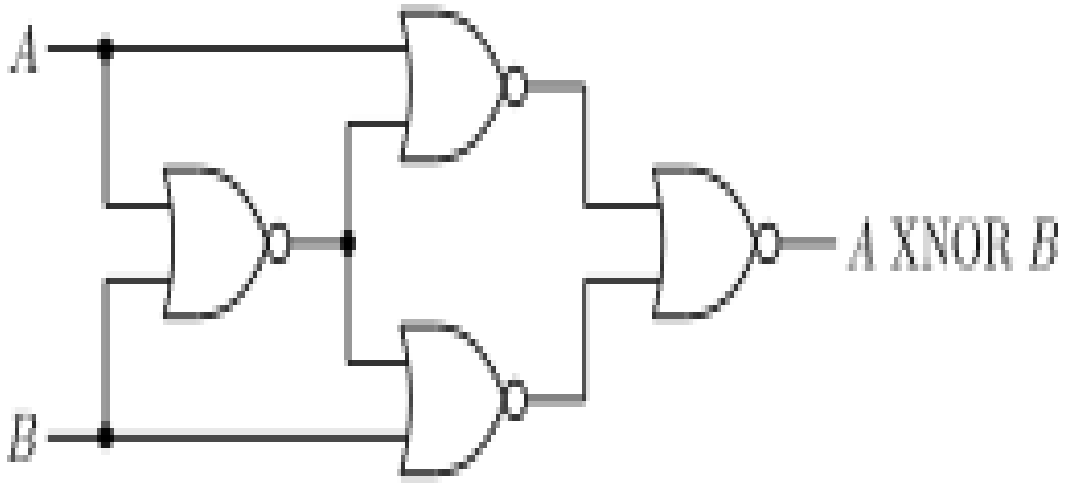
$$Y = (A + (\bar{A} \cdot \bar{B}))\,(B + (\bar{A} \cdot \bar{B}))$$

$$Y = (A + \bar{A})\,(A + \bar{B})\,(\bar{A} + B)\,(B + \bar{B})$$

$$Y = (A + \bar{B})\,(\bar{A} + B)$$

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

$$\therefore Y = A \cdot B + \bar{A} \cdot \bar{B}$$



Assessment 1

1. How many NOR gates are required to implement one EXOR gate.

2. Draw the NAND gate using NOR gates.


Thank
you