

Subject: Discrete mathematics

Topic: NAND,NOR,XOR gates

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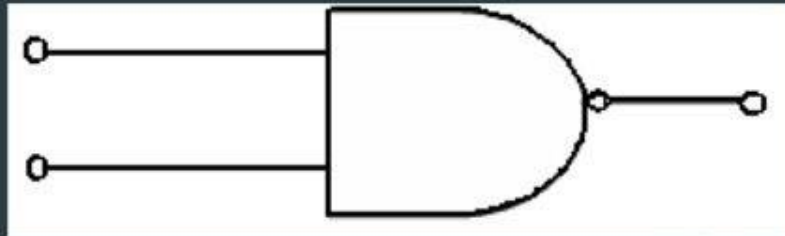
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NAND,NOR,XOR GATE

➤ NAND Gate:

- ▶ The NAND gate is the one of the popular logic element because it can be used as a universal gate; that is NAND gate can be used in combination to perform the AND, OR, and inverter operations.
- ▶ NAND Gate is constructed by attaching NOT Gate at the output of AND Gate, hence NAND Gate is called NOT- AND Gate.
- ▶ The output of NAND gate is low when all inputs are high, otherwise all outputs are high.

Logical Symbol



➤ Truth Table and Expression of NAND Gate:

Inputs		Output
A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

- ▶ Its logical expression is, $X = (AB)'$

➤ NOR Gate:

- ▶ The NOR gate, like the NAND gate, NOR gate is also useful logical element because it can also be used as a universal gate.
- ▶ NOR gate can be used in combination to perform the AND, OR and Inverter operations.
- ▶ NOR Gate is the combination of NOT gate at the output of OR gate, hence NOR gate is type of NOT-OR gate.
- ▶ The Output of NOR gate is high when all inputs are low otherwise the output is low.

Logical Symbol



➤ Truth Table and Expression of NOR Gate:

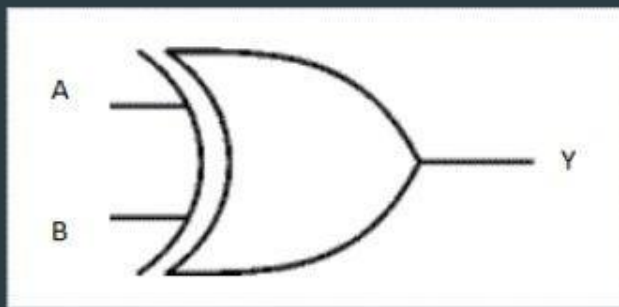
Inputs		Output
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

- ▶ Its expression is, $X=(A+B)'$

➤ Exclusive- OR Gate:

- ▶ The exclusive-OR gate has a graphical symbol similar to that of the OR gate, except for the additional curved line on the input side.
- ▶ If both inputs are Low or both are High then it produces the output Low or 0. otherwise it produce the High.

Logical Symbol



➤ Truth Table and Expression of Ex-OR Gate:

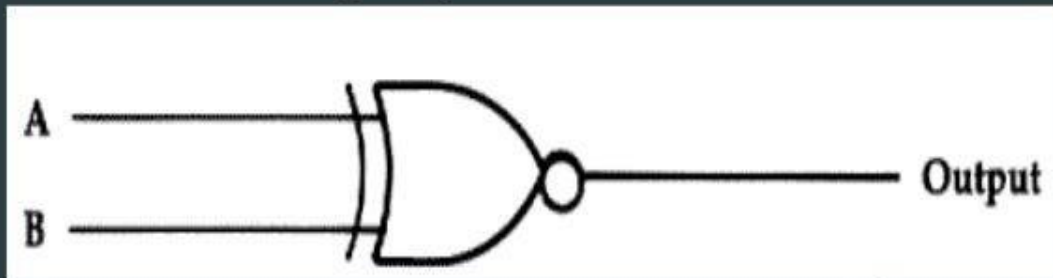
Inputs		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

- ▶ It's logical expression is $X=AB'+A'B$
- ▶ $X = A \oplus B$

➤ Exclusive-Nor gate:

- ▶ The exclusive-NOR gate is the complement of the exclusive-OR gate, as indicated by small circle on the output side of the graphic symbol.
- ▶ If both inputs are Low or both are High then it produces the output High or 1. otherwise it produce the Low output.

Logical symbol



➤ Truth Table and Expression of Ex-NOR Gate:

Inputs		Output
A	B	X
0	0	1
0	1	0
1	0	0
1	1	1

- ▶ It's logical expression is $X = AB + A'B'$
- ▶ $X = A \odot B$