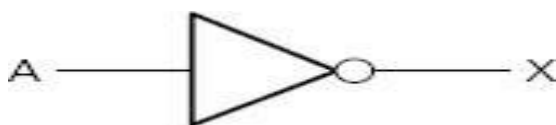


Logic gates and logic circuits

Key definitions

Logic gates	Logic gates take in binary inputs and produce a binary output
Logic circuits	Logic circuits are made up of several logic gates and are designed to carry out a specific function
Truth tables	Truth tables check the output of a logic circuit

NOT gate:



Description:

The output, X, is 1
if: the input, A, is

0

Truth table:

Input	Output
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A	X
0	1
1	0

How to write this:

$X = \text{NOT } A$ (logic notation)

$X = \bar{a}$ (Boolean algebra)

AND gate



Description:

The output, X, is 1 if: both inputs, A and B, are 1 **Truth table:**

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

How to write this:

$X = A \text{ AND } B$ (logic notation)

$X = a.b$ (Boolean algebra)



OR gate



Description:

The output, X, is 1 if:
either input, A or B, is 1

Truth table:

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

How to write this:

$X = A \text{ OR } B$ (logic notation)

$X = a + b$ (Boolean algebra)

N AND gate



Description:

The output, X, is 1 if: input A AND input B are NOT both 1

Truth table:

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

How to write this:

$X = A \text{ NAND } B$ (logic notation)

$X = \overline{a \cdot b}$ (Boolean algebra)

NOR gate



Description:

The output, X, is 1 if: neither input A nor input B is 1

Truth table:

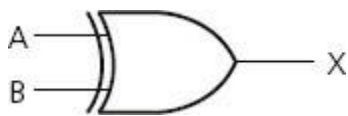
Inputs		Output
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

How to write this:

$X = A \text{ NOR } B$ (logic notation)

$X = \overline{a + b}$ (Boolean algebra)

XOR gate



Description:

The output, X, is 1 if: (input A is 1 AND input B is 0) OR (input A is 0 AND input B is 1) **Truth table:**

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



How to write this:

$X = A \text{ XOR } B$ (logic notation)

$X = (a \cdot b) + (\bar{a} \cdot b)$ (Boolean algebra)

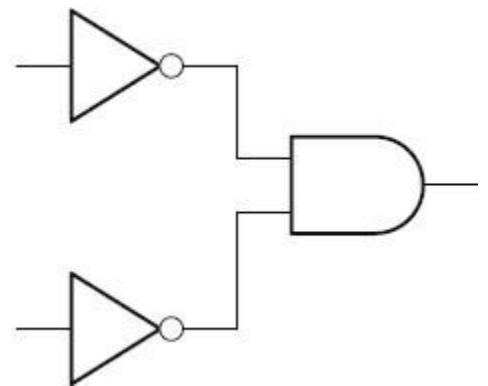
NOTE: this is sometimes written as: $\overline{(a + b)} \cdot (a \cdot b)$

Common errors

- Many marks are lost by not being very clear with the symbol for each of the 6 logic gates; it is often worth writing the gate's name inside the symbol if art is not one of your strong points.
- Do not confuse the following:



with:



They do not produce the same result!

