Computer Engineering Technology
Introduction to Boolean Algebra

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Learning Expectation Evaluate boolean expressions.

Boolean algebra is a branch of math used to process and manipulate binary information. Binary information is anything that can be described using two values (1 or 0, on or off).

Why is it useful?

We can use boolean algebra to design, simplify and help us predict the output from digital circuits – circuits inside your computer made using logic gates that process digital (on/off) electric signals.

Truth Table

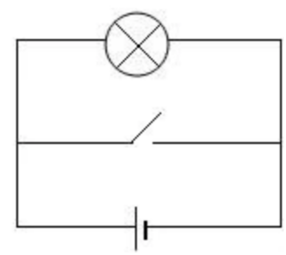
We will learn how to perform operations on boolean values (1 or 0).

A truth table shows the relationship between the input values and the result (output) of a boolean operator or function on the input values.

Boolean Operators

Not

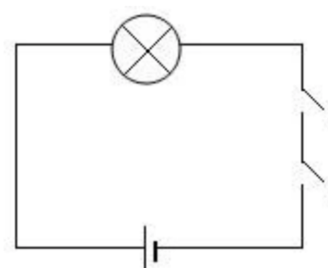
Input	Output
x	$\bar{x}$
1	0
0	1



And True when both x and y are true

And is known as the boolean product: xy, $x * y$

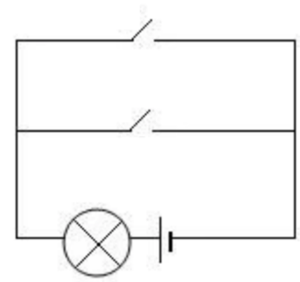
Inputs		Output
x	y	xy
1	1	1
1	0	0
0	1	0
0	0	0



Or True when at least one of x and y are true

And is known as the boolean sum: $x + y$

Inputs		Output
x	y	$x + y$
1	1	1
1	0	1
0	1	1
0	0	0



Operation Precedence

Just like in math, operations are completed from left to right in the following order:

Brackets Not And Or

Inputs					Output
x	y	z	!y	(!y)z	$x+\bar{y}z$
1	1	1	0	0	1
0	1	1	0	0	0
1	0	1	1	1	1
0	0	1	1	1	1
1	1	0	0	0	1
0	1	0	0	0	0
1	0	0	1	0	1
0	0	0	1	0	0

Practice Determine the output for each boolean expression.

In English	x	0	0	1	1
	y	0	1	0	1
Always true	$x+\bar{x}$	1	1	1	1
Always false	$x\bar{x}$	0	0	0	0
x and not y	$x\bar{y}$	0	0	1	0
XOR	$x\bar{y}+\bar{x}y$	0	1	1	0
NOR	$\overline{(x+y)}$	1	0	0	0
NOR	$\bar{x}\bar{y}$	1	0	0	0
Equality	$xy+\bar{x}\bar{y}$	1	0	0	1
NAND	$\overline{(xy)}$	1	1	1	0
NAND	$\bar{x}+\bar{y}$	1	1	1	0
if y then x	$x+\bar{y}$	1	0	1	1
if x then y	$y+\bar{x}$	1	1	0	1
Equality	$(\bar{x}+y)(x+\bar{y})$	1	0	0	1