Boolean Algebra Laws

Operations in Boolean Algebra

Before understanding the laws of Boolean algebra, let us quickly go through the various logic operations and their truth values used in Boolean algebra for calculation.

The basic logic operations are

Logic Operation	Logic Operator	Notation	Truth Value
Boolean multiplication/Conjunction	AND	p . q or p ∧ q	The result is true when both the statements are true.
Boolean addition/Disjunction	OR	p + q or p v q	The result is true when both or either of the statements is true.
Boolean complement/Negation	NOT	¬ p or ~p or p’ or p^C	The result is true when the statement is false and false when it is true.

What are Boolean Algebra Laws?

Boolean algebra laws and theorems are a set of rules that are required to reduce or simplify any given complex boolean expression. Following is a list of boolean algebra laws which most commonly used.

Boolean laws	**Description**
Annulment law	• A . 0 = 0 • A + 1 = 1
Identity law	• A . 1 = A • A + 0 = A
Idempotent law	• A . A = A • A + A = A
Complement law	• A . A^C = 0 • A + A^C = 1
Commutative Law	• A . B = B . A

	• A + B = B + A
Associative law	• A . (B . C) = (A . B) . C • A + (B + C) = (A + B) + C
Distributive law	• A(B + C) = AB + AC • A + (BC) = (A + B)(A + C)
Absorption law	• A.(A + B) = A • A + (A . B) = A
Involution law	• (A')' = A
De Morgan's law	• $(A + B)^C = A^C . B^C$ • $(A . B)^C = A^C + B^C$

In addition to these Boolean algebra laws, we have boolean postulates, which are used to algebraically solve boolean expressions into a simplified form.

- 0.0 = 0; boolean multiplication of 0
- 1.1 = 1; boolean multiplication of 1
- 0 + 0 = 0; boolean addition of 0
- 1 + 1 = 1; boolean addition of 1
- 1.0 = 0; boolean multiplication of 1 and 0
- 1 + 0 = 1; boolean addition of 1 and 0
- 1' = 0; boolean complement of 1
- 0' = 1; boolean complement of 0