

# Boolean Algebra Axioms, Theorems, Laws

Existence of 0 and 1:

$$X + 0 = X ; X \cdot 1 = X$$

$$X + 1 = 1 ; X \cdot 0 = 0$$

Idempotent laws

$$X + X = X ; X \cdot X = X$$

Involution law:

$$(X')' = X$$

Laws of complementarity:

$$X + X' = 1 ; X \cdot X' = 0$$

Commutative laws:

$$X + Y = Y + X ; X \cdot Y = Y \cdot X$$

Associative laws:

$$(X + Y) + Z = X + (Y + Z) = X + Y + Z$$

$$(XY)Z = X(YZ) = XYZ$$

Distributive laws:

$$X(Y + Z) = XY + XZ$$

$$X + YZ = (X + Y)(X + Z)$$

Simplification theorems:

$$XY + XY' = X$$

$$(X + Y)(X + Y') = X$$

$$X + XY = X$$

$$X(X + Y) = X$$

$$(X + Y')Y = XY$$

$$XY' + Y = X + Y$$

DeMorgan's laws:

$$(X + Y)' = X'Y'$$

$$(XY)' = X' + Y'$$