

3 Boolean Algebra

Laws of Boolean Algebra

Law	AND	OR
Identity	$1 \bullet A = A$	$0 + A = A$
Null	$0 \bullet A = 0$	$1 + A = 1$
Idempotent	$A \bullet A = A$	$A + A = A$
Complement	$A \bullet \bar{A} = 0$	$A + \bar{A} = 1$
Commutative	$A \bullet B = B \bullet A$	$A + B = B + A$
Associative	$(A \bullet B) \bullet C = (A \bullet C) \bullet B$	$(A + B) + C = A + (B + C)$
Distributive	$A + (B \bullet C) = (A+B) \bullet (A+C)$	$A \bullet (B + C) = (A \bullet B) + (A \bullet C)$
Absorption	$A \bullet (A + B) = A$	$A + (A \bullet B) = A$
DeMorgans	$\overline{A \bullet B} = \bar{A} + \bar{B}$	$\overline{A + B} = \bar{A} \bullet \bar{B}$
Double Complement	$\overline{\bar{A}} = A$	

Rules for K-maps (Karnaugh-maps)

- No group can contain zero
- Groups can't be diagonal
- Grouping in power of 2 (1,2,4,8...)
- Each group must be as large as possible
- Groups can overlap
- Each "1" must be part of one group
- Groups can wrap around the map (left & right)

Example of K-map

$$\bar{B}A\bar{C} + AB\bar{C} + ABC + \bar{A}BC + \bar{A}B\bar{C}$$

		BC			
		00	01	11	10
A	0	0	0	1	1
	1	1	0	1	1

→ Simplified version: $\bar{B} + A\bar{C}$