Boolean Algebra Reference

Axioms of Boolean Algebra*

1a. $0 \cdot 0 = 0$

1b. $1 + 1 = 1$

2a. $1 \cdot 1 = 1$

2b. $0 + 0 = 0$

3a. $0 \cdot 1 = 1 \cdot 0 = 0$

3b. $1 + 0 = 0 + 1 = 1$

4a. If $x = 0$, then $\overline{x} = 1$

4b. If $x = 1$, then $\overline{x} = 0$

Single-Variable Theorems

5a. $x \cdot 0 = 0$

5b. $x + 1 = 1$

6a. $x \cdot 1 = x$

6b. $x + 0 = x$

7a. $x \cdot x = x$

7b. $x + x = x$

8a. $x \cdot \overline{x} = 0$

8b. $x + \overline{x} = 1$

9. $\overline{\overline{x}} = x$

Two- and Three-Variable Properties

10a. $x \cdot y = y \cdot x$ *Commutative*

10b. $x + y = y + x$

11a. $x \cdot (y \cdot z) = (x \cdot y) \cdot z$ *Associative*

11b. $x + (y + z) = (x + y) + z$

12a. $x \cdot (y + z) = x \cdot y + x \cdot z$ *Distributive*

12b. $x + y \cdot z = (x + y) \cdot (x + z)$

13a. $x + x \cdot y = x$ *Absorption*

13b. $x \cdot (x + y) = x$

14a. $x \cdot y + x \cdot \overline{y} = x$ *Combining*

14b. $(x + y) \cdot (x + \overline{y}) = x$

15a. $\overline{x \cdot y} = \overline{x} + \overline{y}$ *DeMorgan's theorem*

15b. $\overline{x + y} = \overline{x} \cdot \overline{y}$

16a. $x + \overline{x} \cdot y = x + y$

16b. $x \cdot (\overline{x} + y) = x \cdot y$

17a. $x \cdot y + y \cdot z + \overline{x} \cdot z = x \cdot y + \overline{x} \cdot z$ *Consensus*

17b. $(x + y) \cdot (y + z) \cdot (\overline{x} + z) = (x + y) \cdot (\overline{x} + z)$

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* Information copied from Brown, S. & Vranesic, Z. (2008). *Fundamentals of Digital Logic with Verilog Design,* 2nd ed. Boston: McGraw-Hill, pp. 29-31.