



BOOLEAN ALGEBRA RULES

Digital logic design

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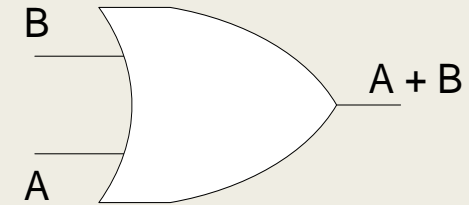
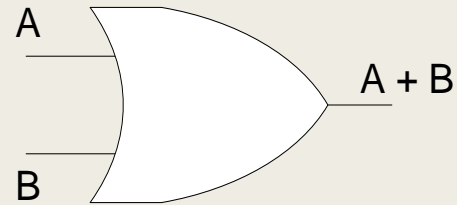
Laws, Rules & Theorems of Boolean Algebra

- Commutative Law
for addition and multiplication
- Associative Law
for addition and multiplication
- Distributive Law
- Rules of Boolean Algebra
- Demorgan's Theorems

Commutative Law

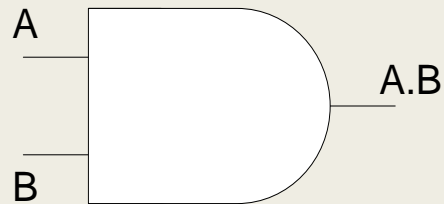
■ Commutative Law for Addition

$$A + B = B + A$$



■ Commutative Law for Multiplication

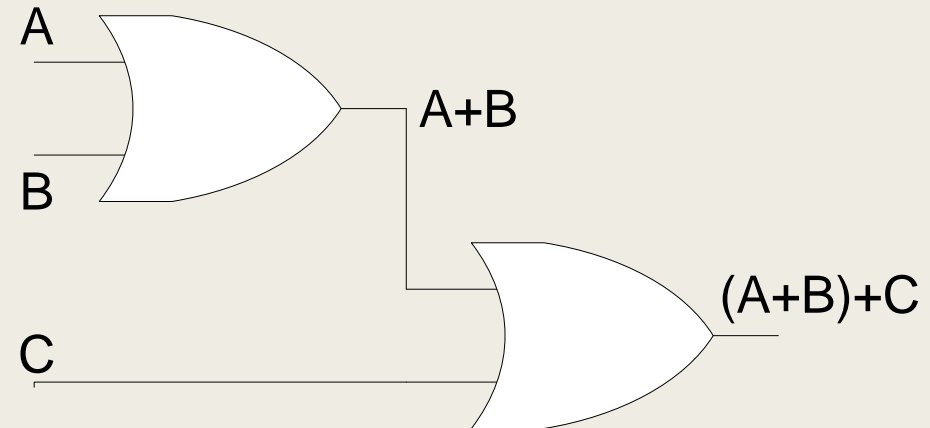
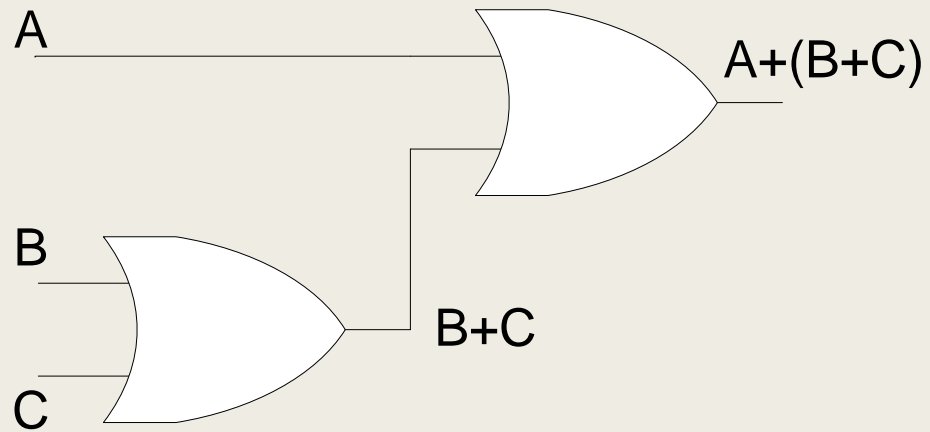
$$A.B.C = C.B.A$$



Associative Law

- Associative Law for Addition

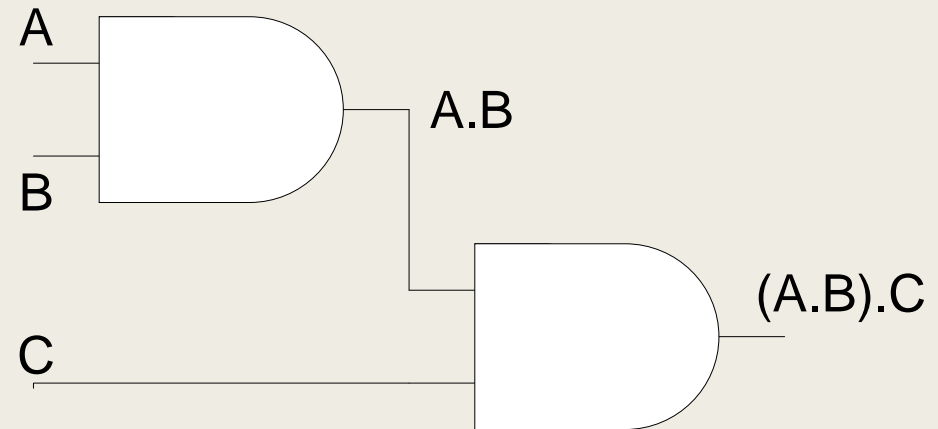
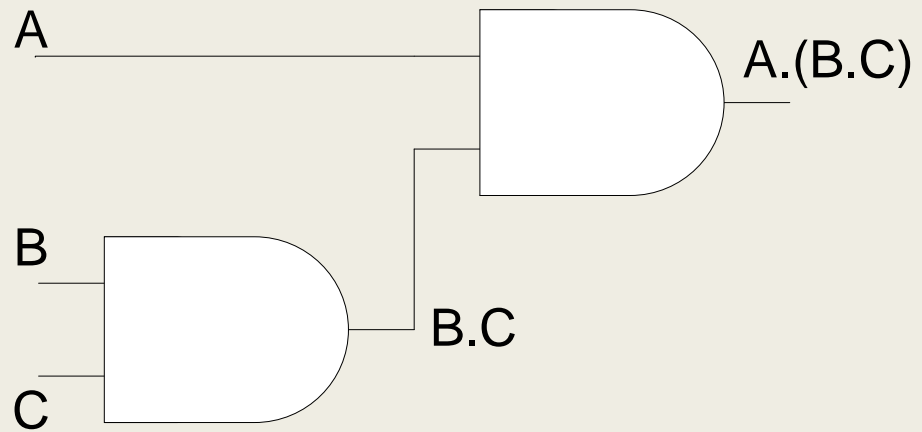
$$A + (B + C) = (A + B) + C$$



Associative Law

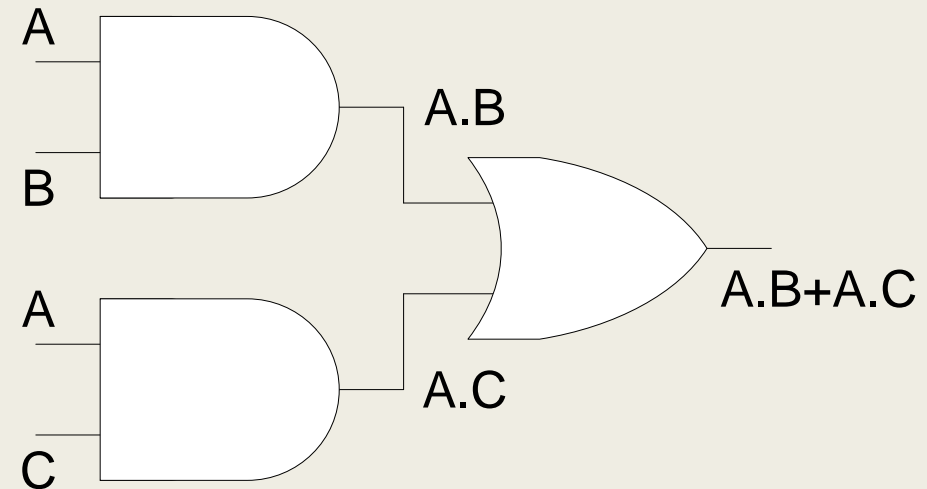
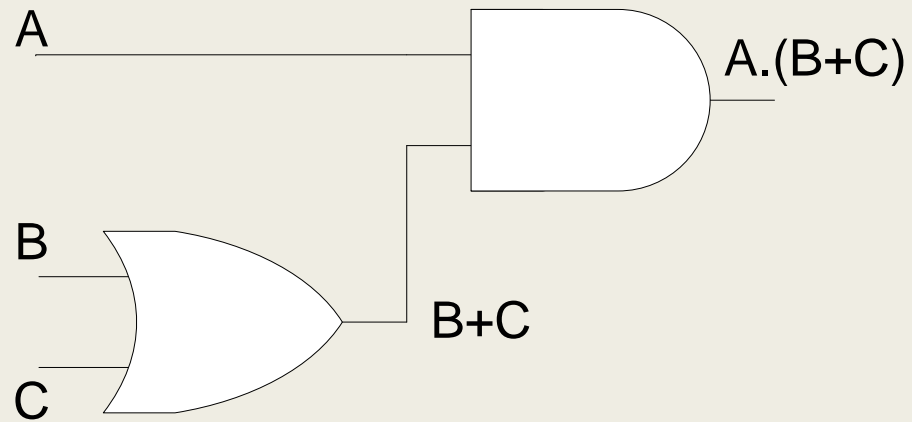
- Associative Law for Multiplication

$$A.(B.C) = (A.B).C$$



Distributive Law

- $A.(B + C) = A.B + A.C$
- $(A+B).(A+C) = A+B.C$



Rules of Boolean Algebra

1) $A + 0 = A$

3) $A + 1 = 1$

5) $A + A = A$

7) $A + \overline{A} = 1$

9) $\overline{\overline{A}} = A$

2) $A \cdot 0 = 0$

4) $A \cdot 1 = A$

6) $A \cdot A = A$

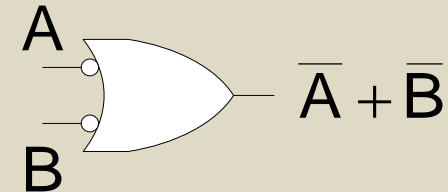
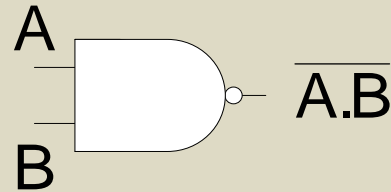
8) $A \cdot \overline{A} = 0$

If A=0	IF A=1

Demorgan's Theorems

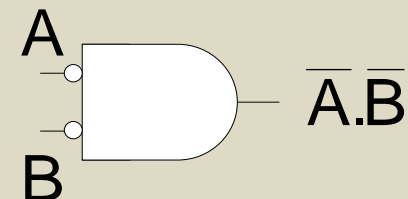
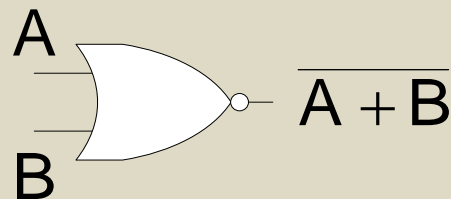
- First Theorem

$$\overline{A.B} = \overline{A} + \overline{B}$$

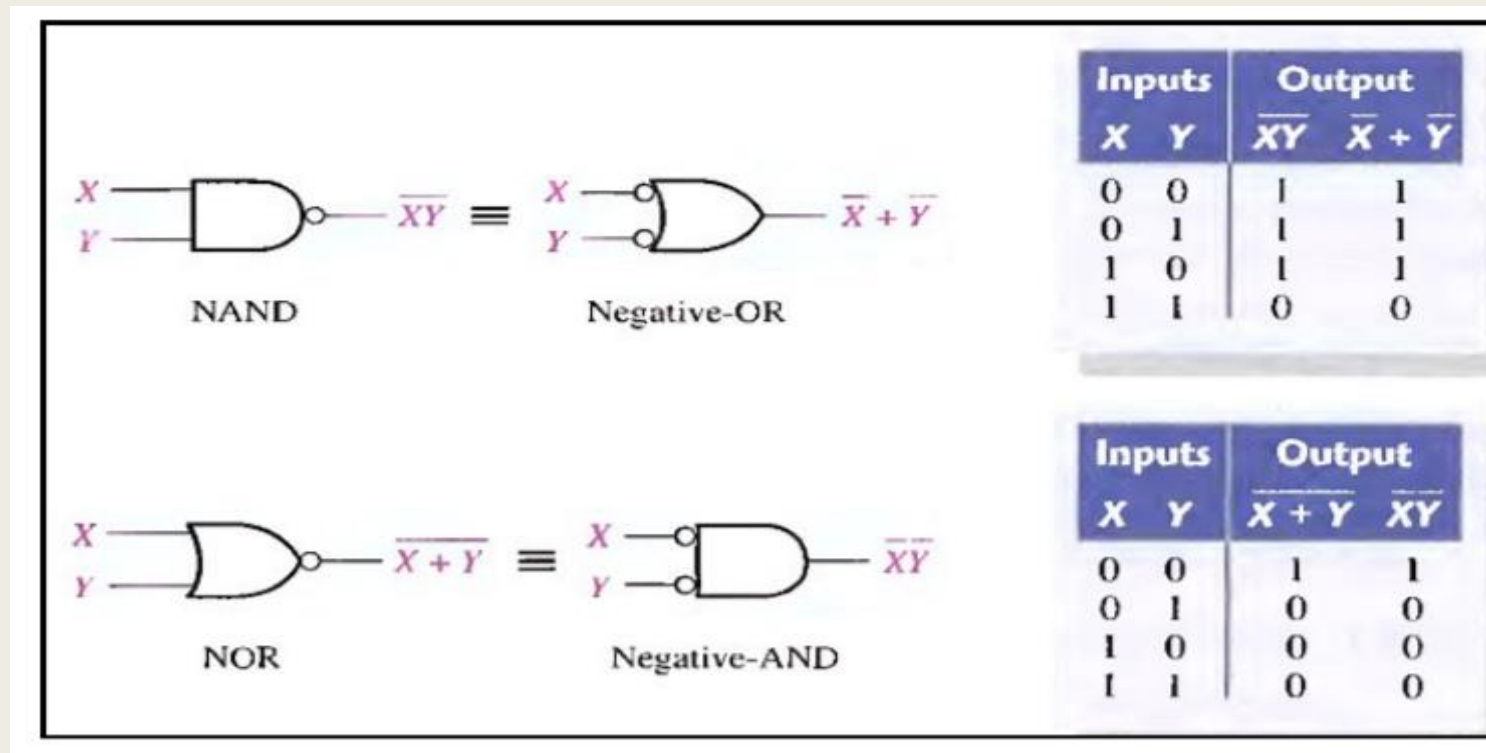


- Second Theorem

$$\overline{\overline{A} + \overline{B}} = \overline{\overline{A}}.\overline{\overline{B}}$$



Demorgan's Theorems and truth tables



Demorgan's Theorems

- Any number of variables

$$\overline{X.Y.Z} = \overline{X} + \overline{Y} + \overline{Z}$$

$$\overline{X + Y + Z} = \overline{X}.\overline{Y}.\overline{Z}$$

- Combination of variables

$$\begin{aligned}\overline{(A + B.C).(A.C + B)} &= \overline{(A + B.C)} + \overline{(A.C + B)} \\ &= \overline{A}.\overline{(B.C)} + \overline{(A.C)}.\overline{B} = \overline{A}.\overline{(B + C)} + \overline{(A + C)}.\overline{B} \\ &= \overline{A}.\overline{B} + \overline{A}.\overline{C} + \overline{A}.\overline{B} + \overline{B}.\overline{C} \\ &= \overline{A}.\overline{B} + \overline{A}.\overline{C} + \overline{B}.\overline{C}\end{aligned}$$

Boolean Algebra

Laws, Rules & Theorems of Boolean Algebra

1. $X + 0 = X$

3. $X + 1 = 1$

5. $X + X = X$

7. $X + \overline{X} = 1$

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

2. $X \cdot 1 = X$

4. $X \cdot 0 = 0$

6. $X \cdot X = X$

8. $X \cdot \overline{X} = 0$

10. $X + Y = Y + X$

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

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

16. $\overline{X + Y} = \overline{X} \cdot \overline{Y}$

11. $XY = YX$

13. $(XY)Z = X(YZ)$

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

17. $\overline{X \cdot Y} = \overline{X} + \overline{Y}$

Commutative

Associative

Distributive

DeMorgan's

Thank You