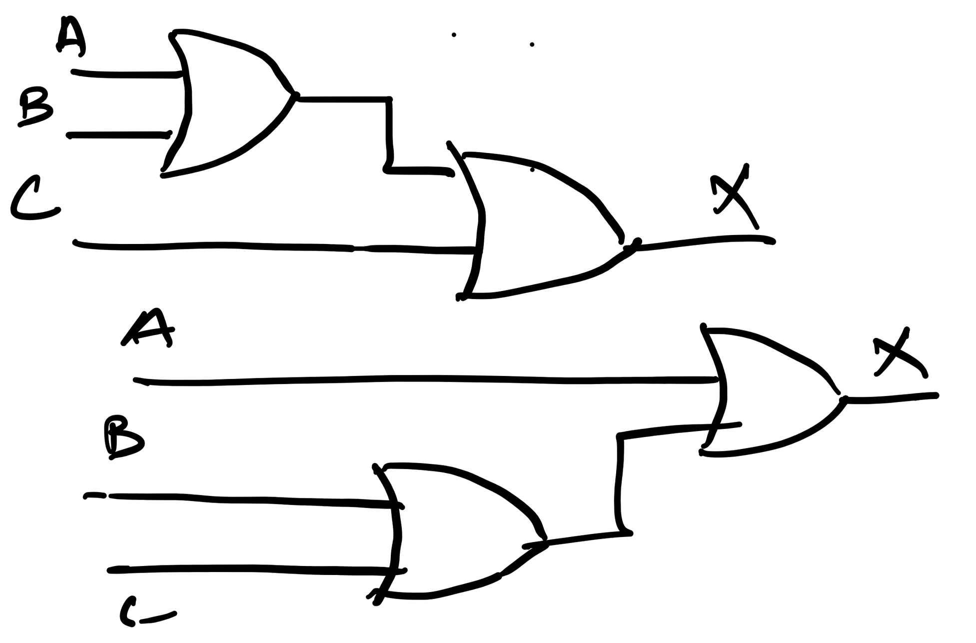
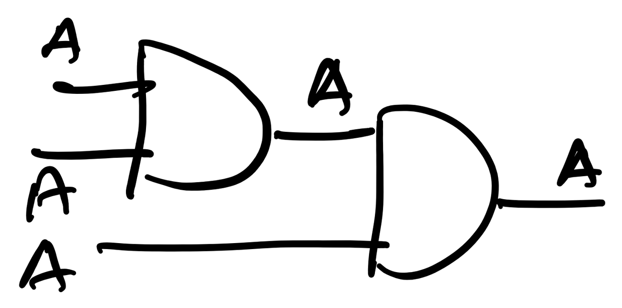
Laws explained

Sunday, 15 January 2023 8:45 PM

1. Commutative
2. Associative



3. $A \cdot (B+C) = (AB) + (AC)$
   $A + (B \cdot C) \quad (A+B) \cdot (A+C)$

4. 

5. Identity law:

$1 \cdot A = A \qquad 0 \cdot A = 0$

6. Null $\quad 1 + A = 1 \qquad 0 + A = A$

7. Inverse $\quad A \cdot \overline{A} = 0$
   $A + \overline{A} = 1$

8. Absorption:

$A \cdot (A+B) = A$ ✓
$A + (A \cdot B) = A$ ✓
$A + (\overline{A} \cdot B) = A+B$

$\overline{A}$	A	B	A+B	$\overline{A} \cdot B$	$A+(\overline{A}B)$
1	0	0	0	0	0
1	0	1	1	1	1
0	1	0	1	0	1
0	1	1	1	0	1

9. Double Complement

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

10. De-Morgan's Theorem:

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

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

Q. $A + B + \overline{A} + \overline{B}$ Associative law
$A + \overline{A} + B + \overline{B}$ Inverse law.
$1 + 1$
1
$\therefore A + B + \overline{A} + B = 1$.

Q. $ABC + \overline{A}BC + A\overline{B}C + AB\overline{C}$ Distributive law
$BC \cdot (A + \overline{A}) + A \cdot (\overline{B}C + B\overline{C})$ Inverse law / Null law
✓ $BC + A(\overline{B}C + B\overline{C})$

$ABC + \overline{A}BC + A\overline{B}C + AB\overline{C}$ Associative law
$ABC + (\overline{A}BC + A\overline{B}C + AB\overline{C})$ Distributive
$(ABC + \overline{A}BC) + (ABC + A\overline{B}C) + (ABC + AB\overline{C})$ Distributive law
$BC(A+\overline{A}) + AC(B+\overline{B}) + AB(C+\overline{C})$ Inverse law / Null law
$BC + AC + AB$

A	B	C	$\overline{A}$	$\overline{B}$	$\overline{C}$	BC	$\overline{B}C$	$B\overline{C}$	$\overline{B}C+B\overline{C}$	$A(\overline{B}C+B\overline{C})$	X
0	0	0	1	1	1	0	0	0	0	0	0
0	0	1	1	1	0	0	1	0	1	0	0
0	1	0	1	0	1	0	0	1	1	0	0
0	1	1	1	0	0	1	0	0	0	0	1
1	0	0	0	1	1	0	0	0	0	0	0
1	0	1	0	1	0	0	1	0	1	1	1
1	1	0	0	0	1	0	0	1	1	1	1
1	1	1	0	0	0	1	0	0	0	0	1

BC	AC	AB	X
0	0	0	0
0	0	0	0
0	0	0	0
1	0	0	1
0	0	0	0
0	1	0	1
0	0	1	1
1	1	1	1

Q. $\overline{A}A + \overline{A}B + AB + B\overline{B} + AAA + AA\overline{B}$ Inverse law
$0 + \overline{A}B + AB + 0 + AAA + AA\overline{B}$ Idempotent law
$0 + \overline{A}B + AB + 0 + A + A\overline{B}$ Identity law
$\overline{A}B + AB + A + A\overline{B}$ Distributive law
$B \cdot \underbrace{(\overline{A}+A)}_{\text{Inverse law}} + A \cdot \underbrace{(1+\overline{B})}_{\text{Null}}$

$B \cdot 1 + A \cdot 1$ Identity law
$B + A = A + B$ Commutative law.

Homework:

(i) O/N 18, P32, Q3 (9608)
Q. $A\overline{B}\overline{C} + AB\overline{C} + ABC$

(ii) M/J 19, P33, Q3(c) 9608

Q. $\overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}CD + \overline{A}\overline{B}C\overline{D} + \overline{A}B\overline{C}\overline{D}$