



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



19ECB231/ Digital Electronics

Principle of Duality & Boolean expression





Function Definitions

The logic operations given previously are defined as follows :
Define $f(X,Y)$ to be some function of the variables X and Y .

$f(X,Y) = X \cdot Y$
1 if $X = 1$ and $Y = 1$
0 Otherwise



| AND | | |
|-----|---|--------|
| X | Y | F(X,Y) |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

$f(X,Y) = X + Y$
1 if $X = 1$ or $Y = 1$
0 Otherwise



| OR | | |
|----|---|--------|
| X | Y | F(X,Y) |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

$f(X) = X'$
1 if $X = 0$
0 Otherwise



| NOT | |
|-----|--------|
| X | F(X,Y) |
| 0 | 1 |
| 1 | 0 |



Principle of Duality

All the laws presented till now have two forms for each law.

The duality principle helps in simplifying the proof of both forms everywhere.

It states that: If a theorem/property holds good in Boolean algebra, then by

- i. Interchanging 0 and 1
- ii. Interchanging + and \cdot
- iii. Keeping the form of variables as such also holds true.

The result obtained by doing so is called **dual** of the theorem/property



Idempotent Law

This law states that

$$X + X = X$$

$$X \cdot X = X$$

***Idempotence** describes the property of operations in **mathematics** and **computer science** that yield the same result after the operation is applied multiple times.*



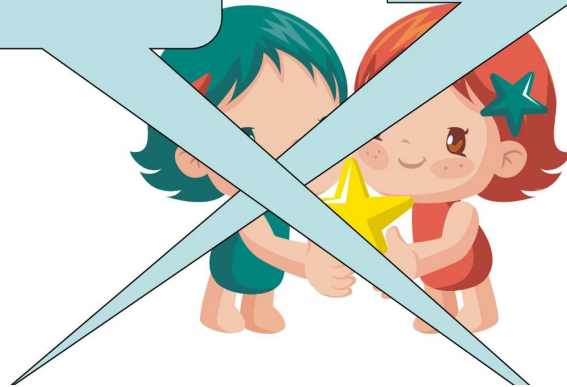
Involution Law

This law states that

$$(x')' = x$$

Please don't avoid coming to my party

You mean ,I must come to the party ?





Exercises

Using the laws of Boolean algebra, verify the following equations algebraically.

1. $x \cdot y' + y' \cdot z = x \cdot y' \cdot z + x \cdot y' z' + x' \cdot y' \cdot z$

1. $xy + yz + yz' = y$

1. $xy + yz + y'z = xy + z$

1. $x \cdot y + x' \cdot z + y \cdot z = x \cdot y + x' \cdot z$

1. $x'y'z' + x'y'z + x'yz + x'yz' + xy'z' + xy'z = x' + y'$



Exercises contd...

Using the laws of Boolean algebra, verify the following equations algebraically.

6. $x'y'z' + x'y'z + xy'z = y'(x'+z)$

6. $xy' + x'y = (xy + x'y')'$

6. $(x+y+z)(xyz)' = xy' + yz' + zx'$

6. $xy' + yz' + zx' = x'y + y'z + z'x$

6. $(a'+b').(a'+b).(a+b') = a'.b'$



RECAP



Thank You!