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

23EET202 / DIGITAL ELECTRONICS AND INTEGRATED CIRCUITS

II YEAR / IV SEMESTER

UNIT-I: MINIMIZATION TECHNIQUES AND GATES

Topic: BOOLEAN ALGEBRA MINIMIZATION

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TOPIC OUTLINE

Logic Gates

Boolean Algebra

Postulates and Laws

Demorgan's Theorem

Duality Principle

Min / Max Terms

Boolean Expressions

DE MORGANS THEOREM

Statement:

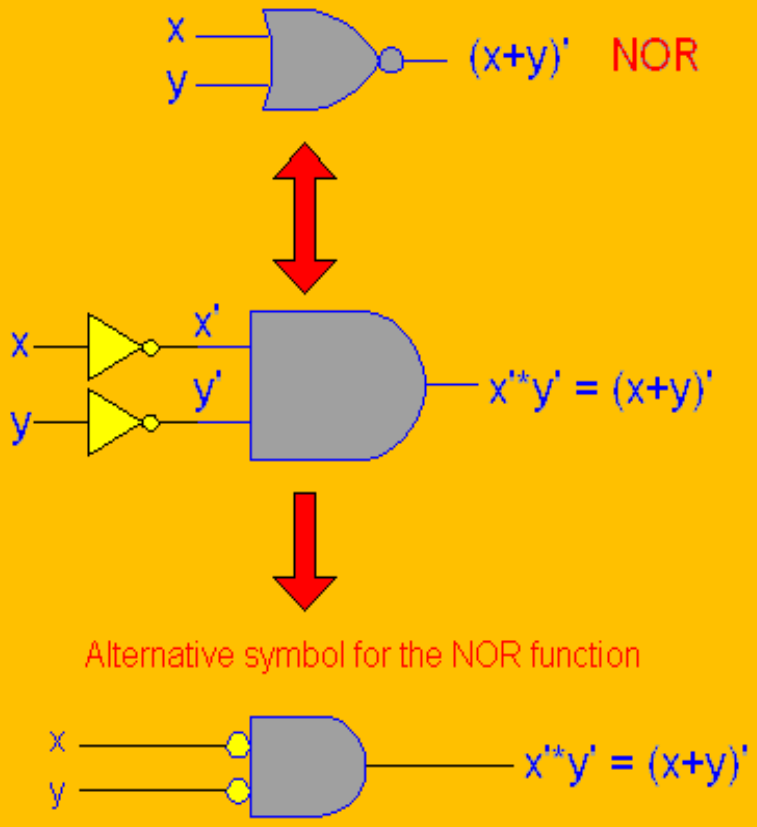
1. (x+y)' = x' * y‘

2. (x*y)' = x' + y'

x	y	x+y	(x+y)'	X’	Y’	x' * y‘
0	0	0	**1**	1	1	**1**
0	1	1	**0**	1	0	**0**
1	0	1	**0**	0	1	**0**
1	1	1	**0**	0	0	**0**

Truth table verification

DE MORGANS THEOREM



Statement:

1. (x+y)' = x' * y'

2. (x*y)' = x' + y'

Logical verification

DUALITY PRINCIPLE

Statement: **It states that replacing OR into AND, AND into OR, 0s into 1s, 1s into 0s…..the expression remains same.**

	Function	Dual
Commutation	$A+B=B+A$	$AB+BA$
Association	$A+(B+C)=(A+B)+C$	$A(BC)=(AB)C$
Distribution	$A+BC=(A+B)(A+C)$	$A(B+C)=AB+AC$
Absorption	$A+AB=A$	$A(A+B)=A$
De Morgan	$\overline{A+B}=\overline{A}\cdot\overline{B}$	$\overline{AB}=\overline{A}+\overline{B}$
Consensus	$AC+B\overline{C}=$	$(A+C)(B+\overline{C})=$
	$AB+AC+B\overline{C}$	$(A+B)(A+C)(B+\overline{C})$

MIN / MAX TERM

- **STANDARD FORM:**
- **A Minterm** is a product which consists of all the literals in the normal form or the complement form but NOT BOTH
- **A Maxterm** is a sum which consists of all the literals in the normal form or the complement form but NOT BOTH
- **CANONICAL FORM:**
- **SOP (Sum of Product)** consist of any number of literals arranged in product and it is added together
- **POS (Product of Sum)** consist of any number of literals arranged in sum and it is multiplied together

MIN / MAX TERM

Variable			Minterm		Maxterm	
x	y	z	Term	Designation	Term	Designation
0	0	0	x'y'z'	m_0	x+y+z	M_0
0	0	1	x'y'z	m_1	x+y+z'	M_1
0	1	0	x'yz'	m_2	x+y'+z	M_2
0	1	1	x'yz	m_3	x+y'+z'	M_3
1	0	0	xy'z'	m_4	x'+y+z	M_4
1	0	1	xy'z	m_5	x'+y+z'	M_5
1	1	0	xyz'	m_6	x'+y'+z	M_6
1	1	1	xyz	m_7	x'+y'+z'	M_7

MIN / MAX TERM

- **Conversion to Minterms**

E.g.: f(a,b,c) = a’ + bc’ + ab’c

- To convert a’ to a minterm, the 2 variables (b, c) must be added, without changing its functionality .
- Since a’=a’•1 & 1 = b+b’, a’= a’(b + b’) = a’b + a’b’
- Similarly, a’b = a’b(c + c’) = a’bc + a’bc’ and
- a’b’ = a’b’(c+c’) = a’b’c + a’b’c’
- bc’ = bc’(a+a’) = abc’ + a’bc’

Ans: f = a’bc+a’bc’+a’b’c+a’b’c’+abc’+a’bc’+ab’c

BOOLEAN EXPRESSION

SOP: The sum-of-products form for our function is:

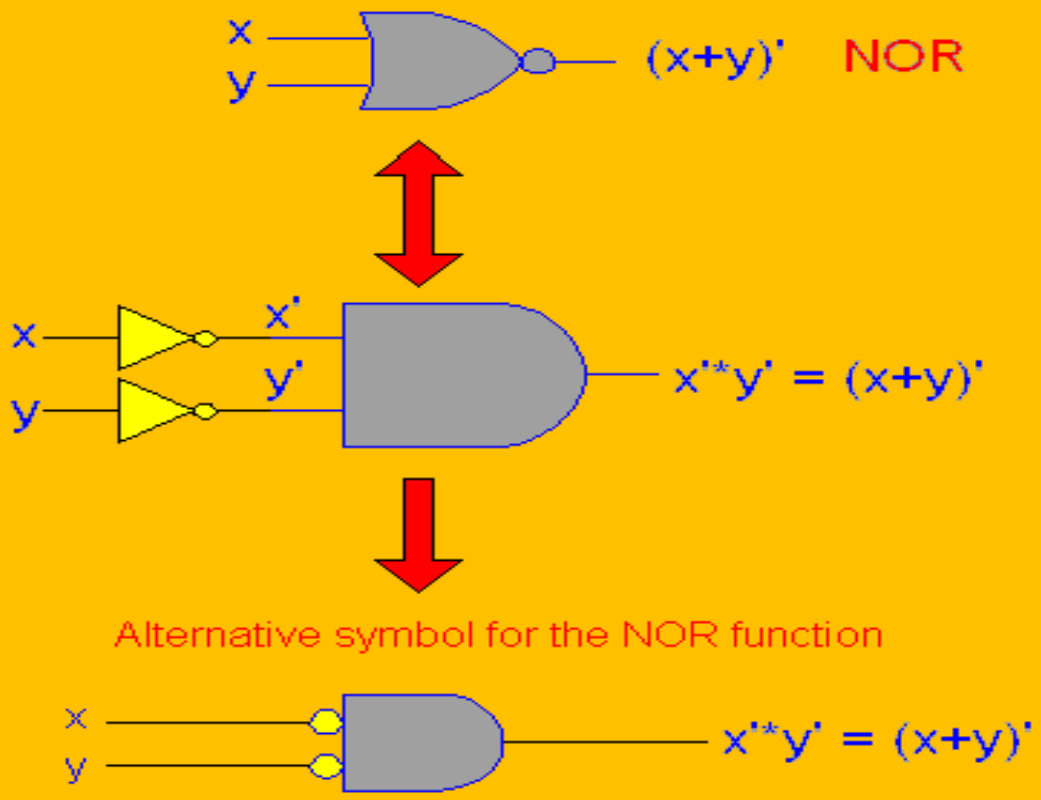
$$F(x,y,z) = \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + xy\bar{z} + xyz$$

We note that this function is not in simplest terms. Our aim is only to rewrite our function in canonical sum-of-products form.

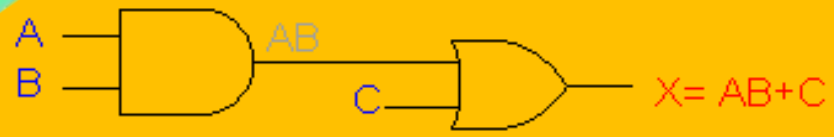
$$F(x,y,z) = x\bar{z} + y$$

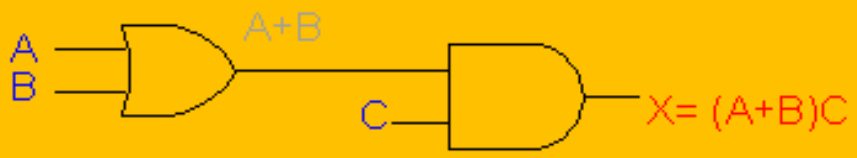
x	y	z	$x\bar{z}+y$
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

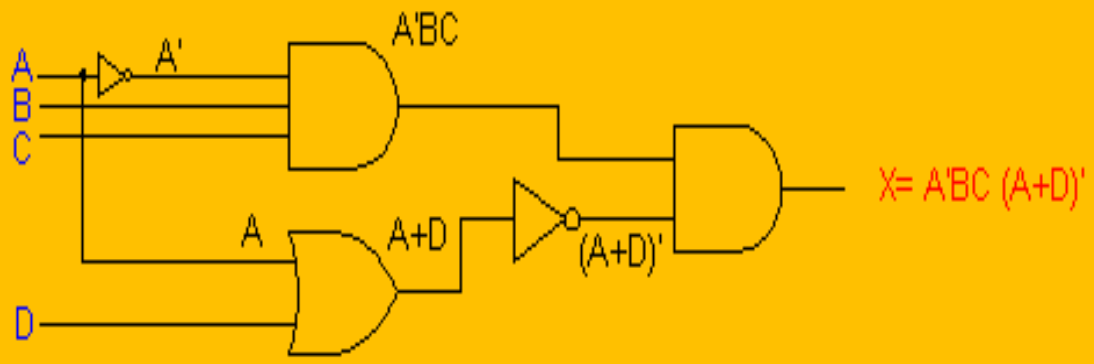
BOOLEAN LOGICAL EXPRESSION



BOOLEAN LOGICAL EXPRESSION







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