DIGITAL LOGIC AND COMPUETR AECHITECTURE

TOPIC NO 4

BOOLEAN ALGEBRA

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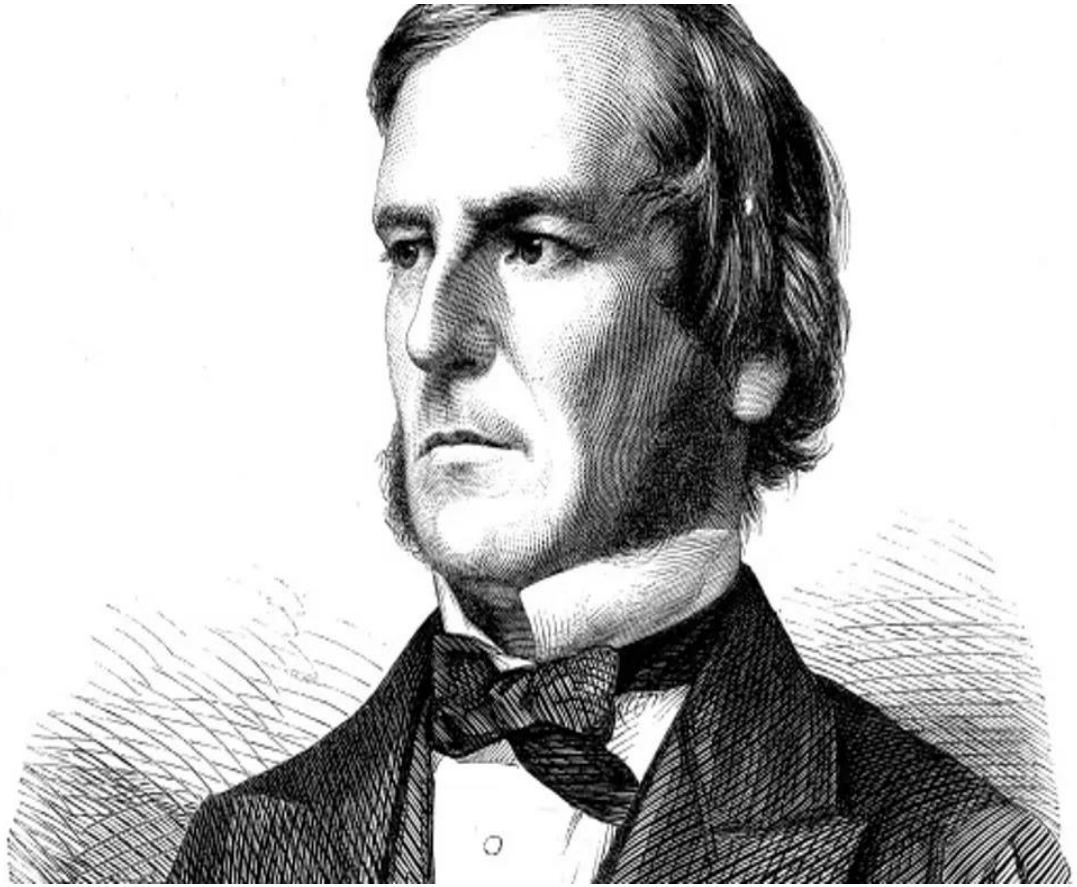
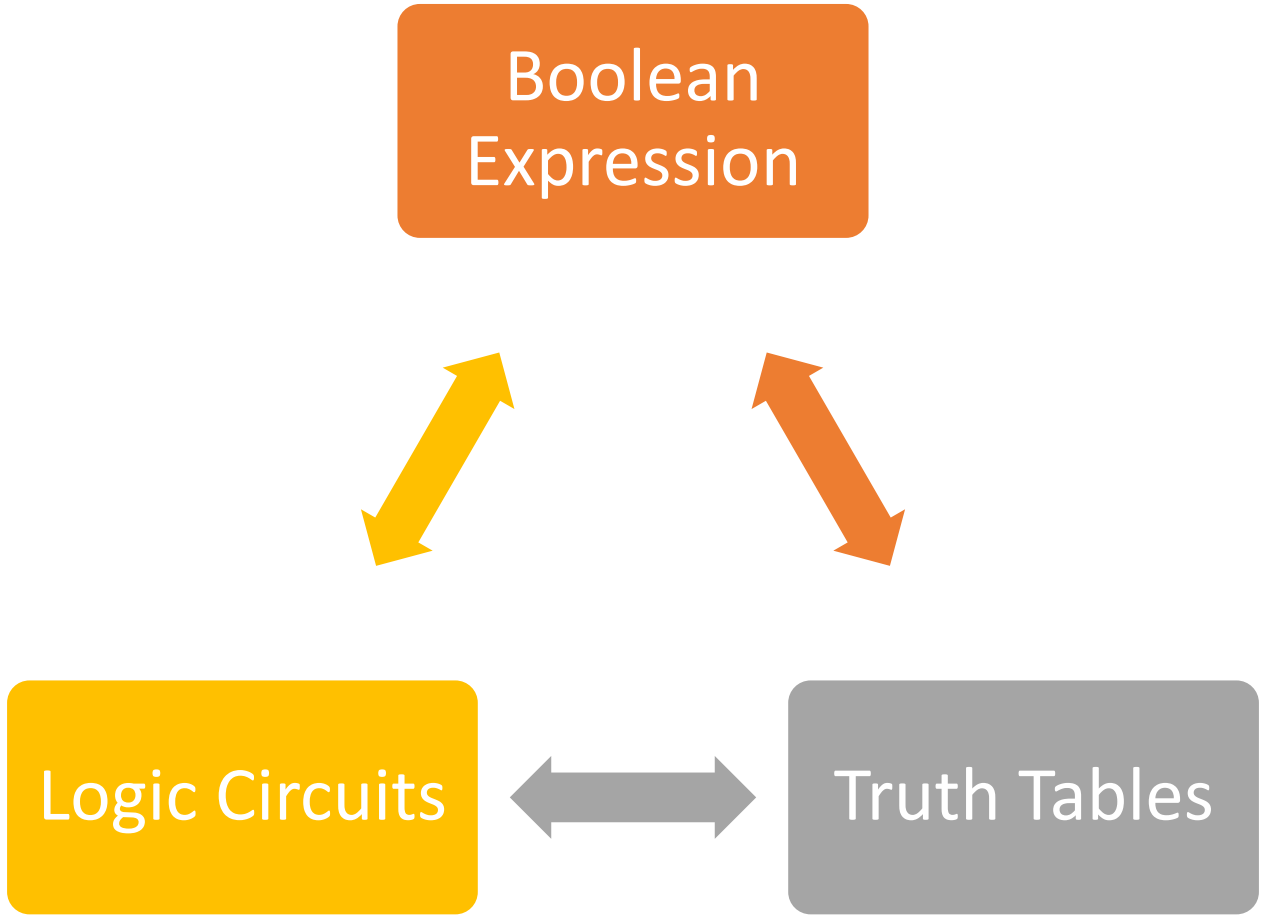
BOOLEAN ALGEBRA

- ✓It is the set of rules used to simplify given logic expression without changing its functionality
- ✓It is used when number of variables are less (like 1, 2, 3)

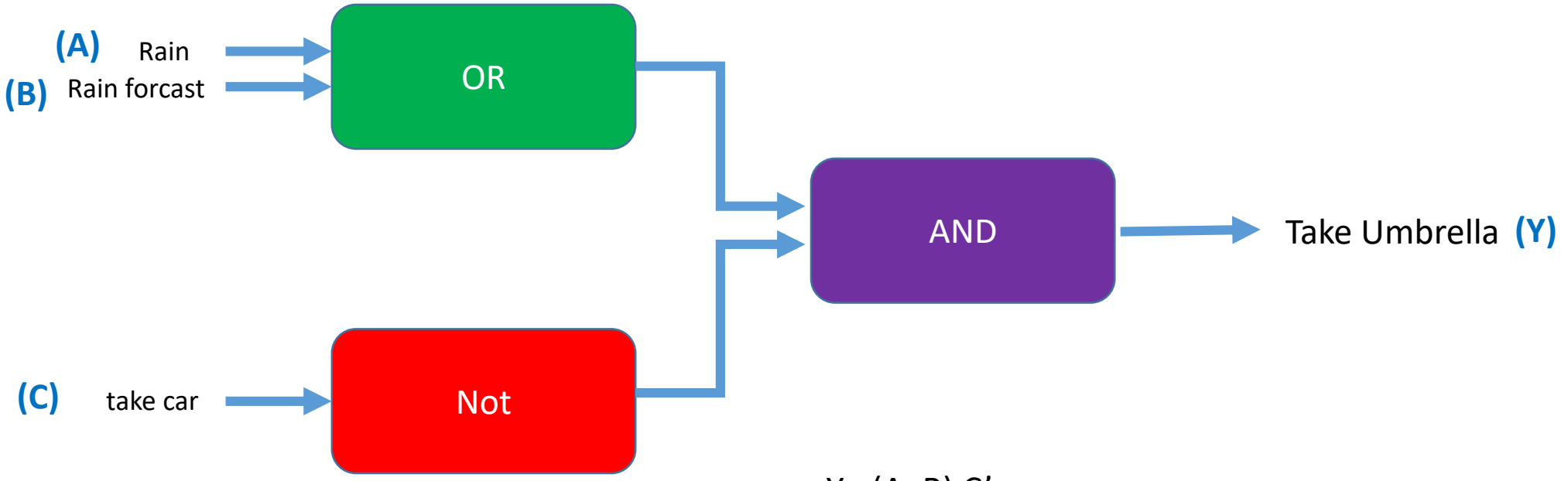


George Boole
1815 -1864

CYCLE



Real life example converted into Logic circuit



$Y = (A+B).C'$

CYCLE

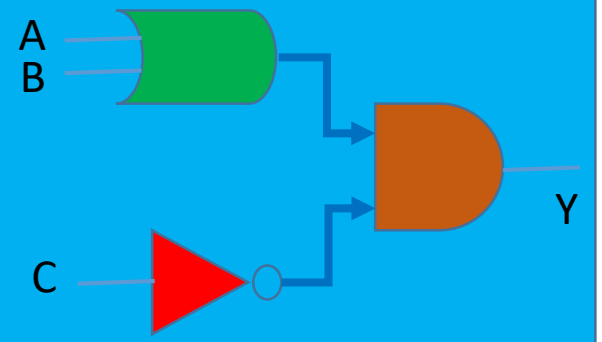
Boolean Expression

$Y = (A+B).C'$

Truth Table

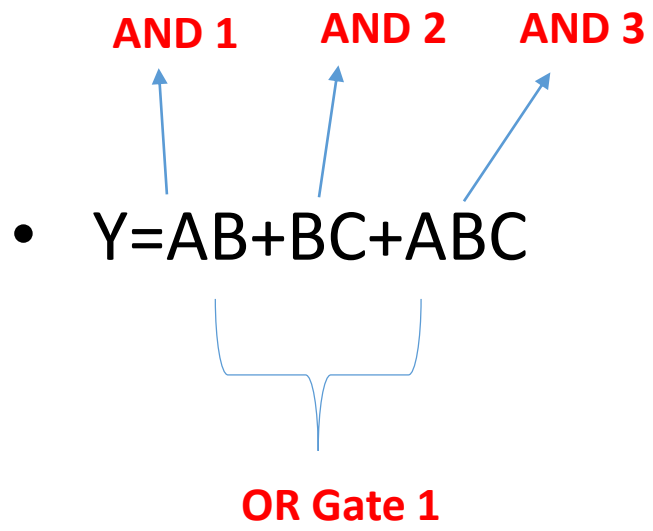
A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

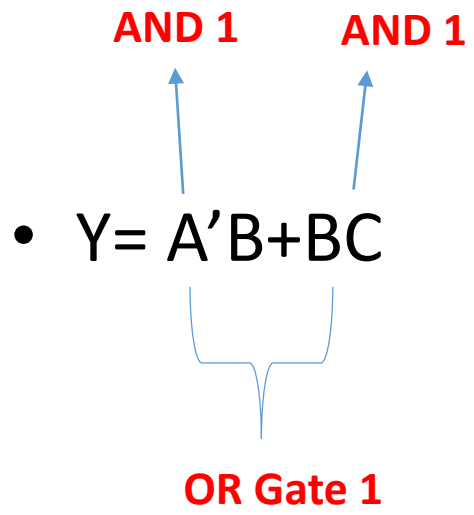
Logic Circuit



Reduction for of Expressions

- Example:





Introduction to Reduction techniques

1. Using Boolean Laws
2. K- Maps
3. Quine Mc-Cluskey

Know George Boole

BOOLEAN ALGEBRA:

- George Boole introduce a new Algebra called Boolean Algebra in 1854
- Ordinary Algebra deals with a real numbers where as Boolean Algebra deals with a set two elements 0 and 1

- Operators : '+' and '.'

- Rules are same as AND ,OR, and NOT

What is Boolean Algebra ?

- Boolean Algebra may be defined with
  - A set of elements
  - A set of operators
  - A number of postulates
- A set of elements is set of any collection of objects having a common property
  - S = (a,b,c,d)a £ S , e ∉ S
- A binary operators defined on a set S of elements is a rule that assigns each pair of elements from S to a unique element from S
  - a*b = c
    - +
    - .
    - -
- A postulates are used to reduced the rules theorems and properties

Boolean Laws:

AND LAW:
A.A =A
A.0 = 0
A.1 =1
$A.\overline{A} = 0$

OR LAW:
A+A = A
A+0 = A
A+1 = 1
$A+\overline{A} = 1$

NOT LAW:
$\overline{1} = 0$
$\overline{0} = 1$
$\overline{\overline{A}} = A$

COMMULATIVE LAW
A.B =B.A
A+B= B+A

ASSOCIATIVE LAW
A+(B+C) = (A+B)+C

DISTRUBUTIVE LAW
A(B+C) = AB+AC

Boolean Laws:

Other LAWs:
A+BC =(A+B)(A+C)
A+A’B=A+B
A(A’+B) =AB
AB+AB’ = A
(A+B) (A+B’)=A
AB+A’C=(A+C(A’+B))
A+AB=A
(A+B) (A’+C)=AC +A’B

Class work

- Verify any Boolean law using truth table method

DE Morgan's theorem

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

1	2	3	4	5	6	7	8
A	B	$\overline{A}$	$\overline{B}$	$\overline{A.B}$	$\overline{A} + \overline{B}$	$\overline{A+B}$	$\overline{A} \,.\, \overline{B}$
0	0	1	1	1	1	1	1
0	1	1	0	1	1	0	0
1	0	0	1	1	1	0	0
1	1	0	0	0	0	0	0

Canonical For of Expression

- Sum of Product (SOP)
- Product of sum (POS)