SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF CSE - IoT

COURSE NAME:19EC306 / DIGITAL CIRCUITS

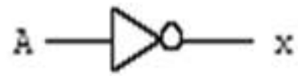
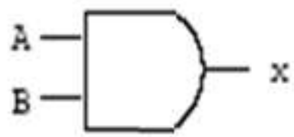
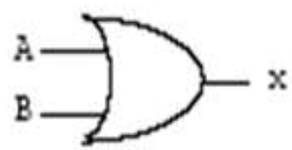
II YEAR/III SEMESTER

UNIT:1- MINIMIZATION TECHNIQUES AND LOGIC GATES

TOPIC:LOGIC GATES

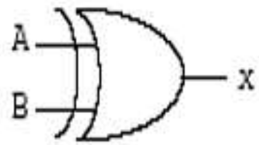
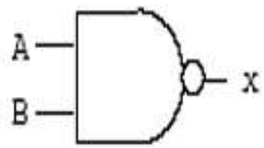
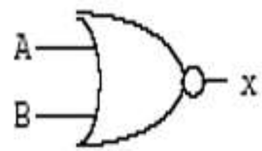
Boolean function and truth table

- The most basic gates are

Name	Graphic symbol	Algebraic function	Truth table	
Inverter		x = A'	A | x 0 | 1 1 | 0	
AND		x = AB	A B | x 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	True if both are true.
OR		x = A + B	A B | x 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	True if either one is true.

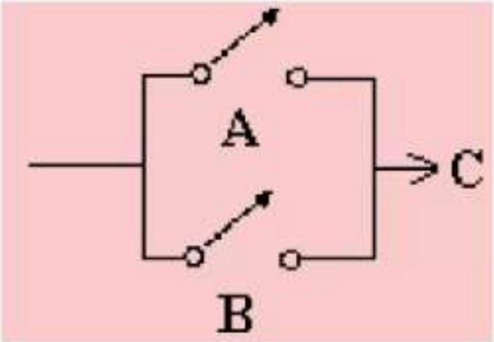
Boolean function and truth table

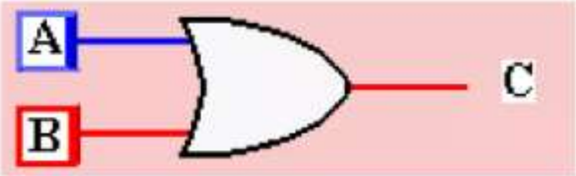
- Other common gates include:

Name	Graphic symbol	Algebraic function	Truth table	
Exclusive-OR (XOR)		$x = A \oplus B$ $= A'B + AB'$	A B | x 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	Parity check: True if only one is true.
NAND		$x = (AB)'$	A B | x 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	Inversion of AND.
NOR		$x = A + B$	A B | x 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	Inversion of OR.

OR GATE

- Current flows if either switch is closed
  - Logic notation A + B = C



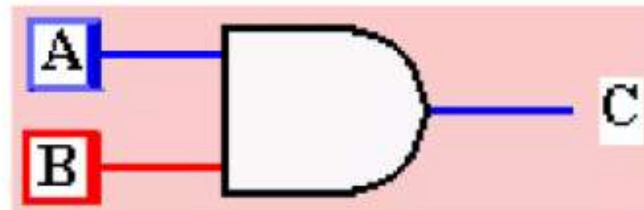


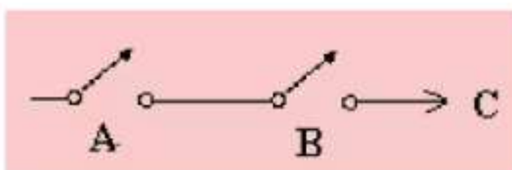
A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

AND GATE

AND Gate

- In order for current to flow, both switches must be closed
  - Logic notation A•B = C
    (Sometimes AB = C)

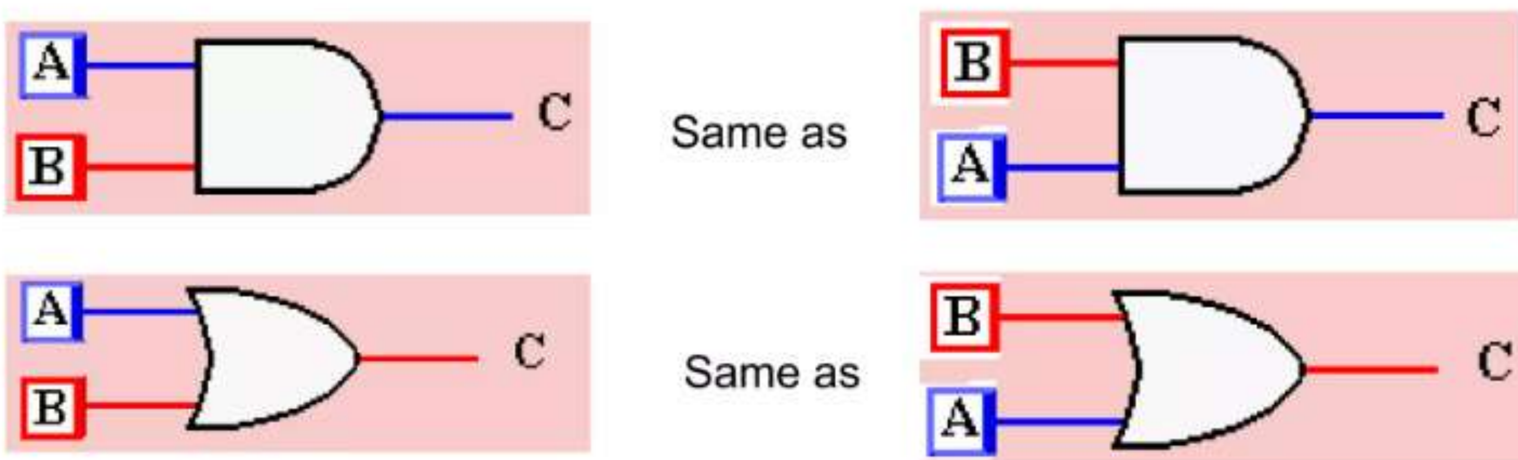




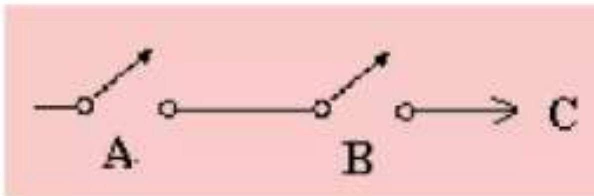
A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

PROPERTIES OF AND & OR

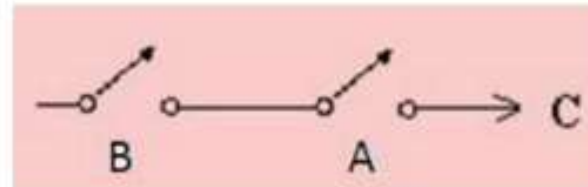
- Commutation
  - A + B = B + A
  - A • B = B • A



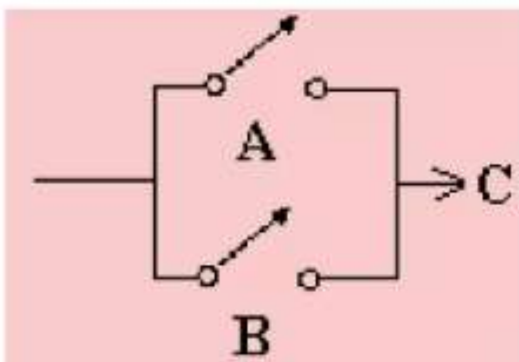
COMMUTATION CIRCUIT



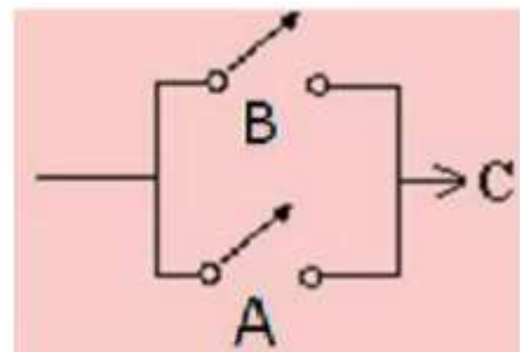
A • B



B • A



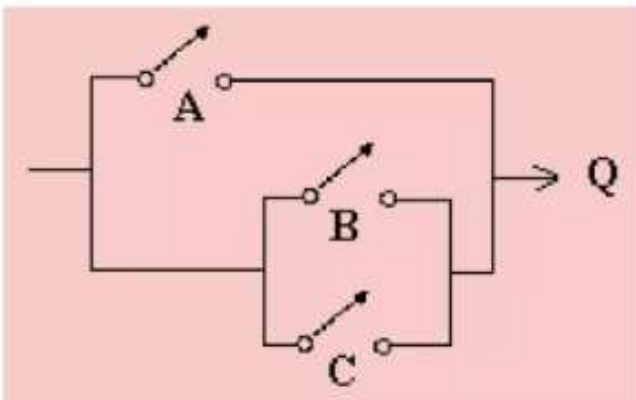
A + B



B + A

ASSOCIATIVE CIRCUIT

- ❖ A + (B + C) = (A + B) + C



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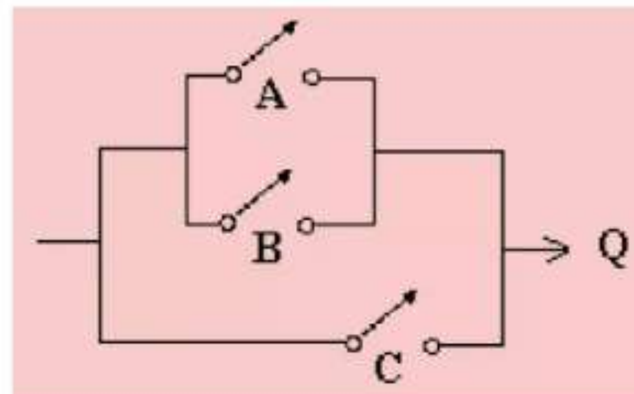
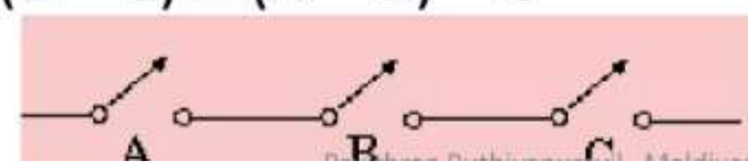
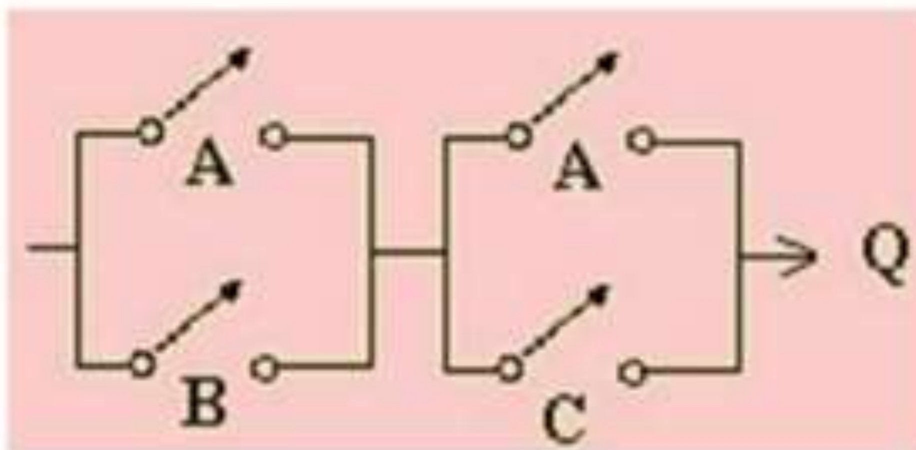


- ❖ A • (B • C) = (A • B) • C

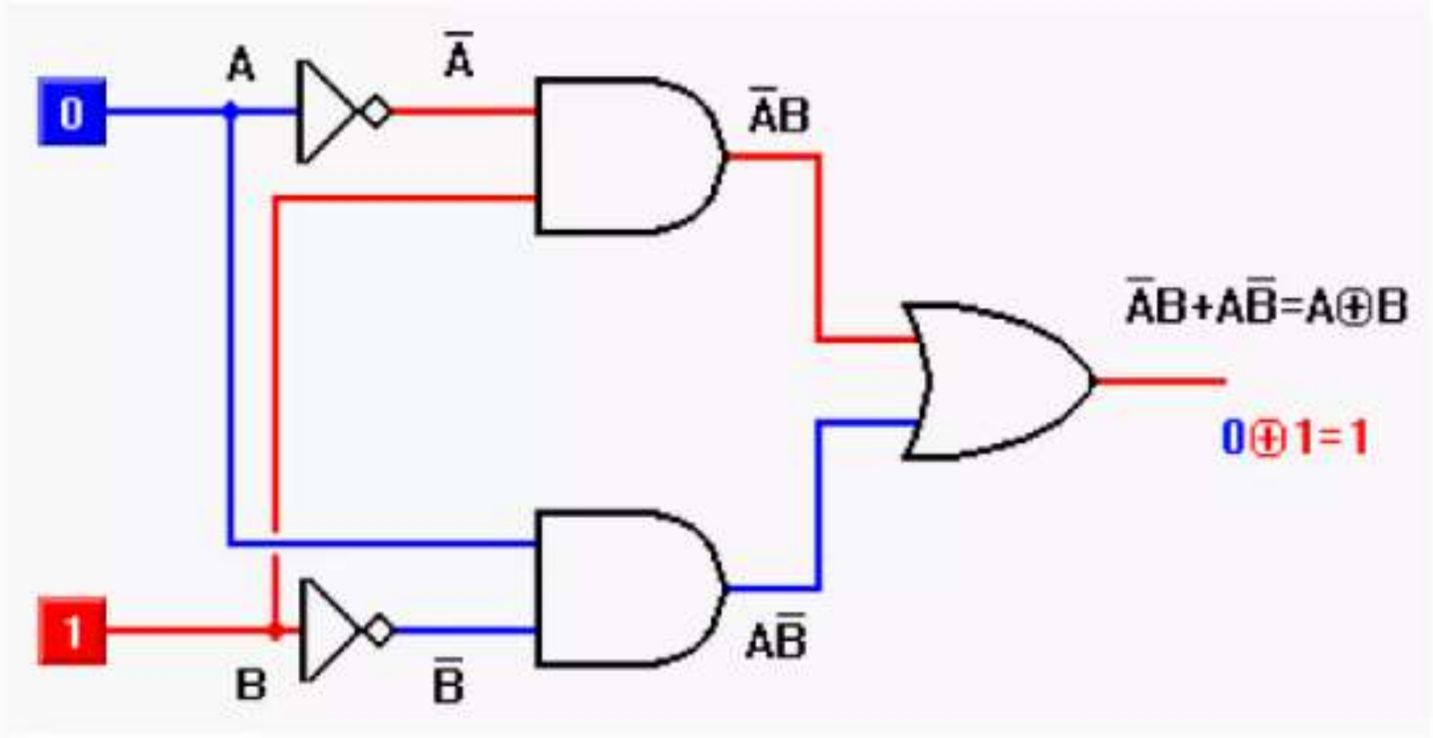


DISTRIBUTIVE PROPERTY

$$(A + B) \bullet (A + C)$$



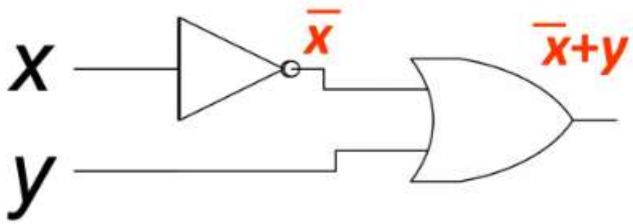
CIRCUIT FOR XOR



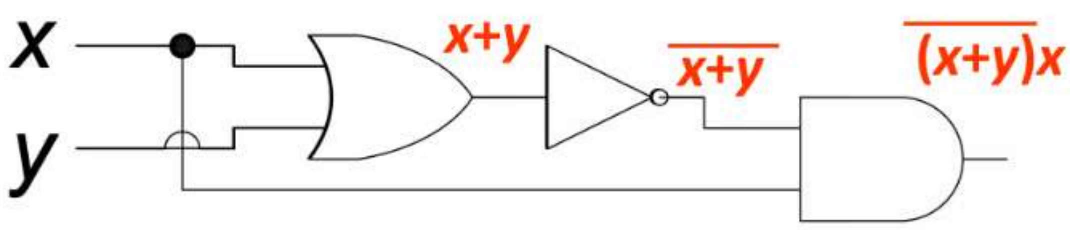
$$A \oplus B = \overline{A} \cdot B + A \cdot \overline{B}$$

Converting between circuits and equations

a) $\overline{x}+y$



b) $\overline{(x+y)}x$



Thank you