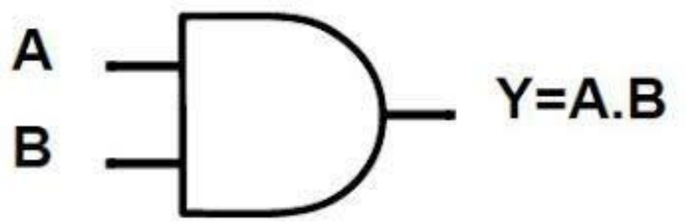
Boolean Algebra & Logic operators

IS 1202

Computer Systems

AND Operation

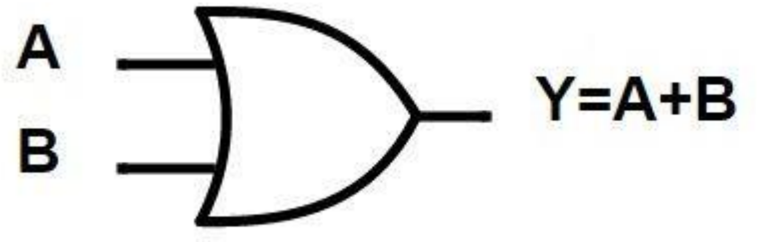
$$A.B = A \wedge B$$



A	B	Y = A.B
0	0	0
0	1	0
1	0	0
1	1	1

OR Operation

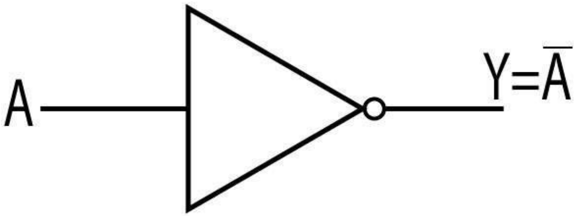
$A + B = A \vee B$



A	B	Y = A + B
0	0	0
0	1	1
1	0	1
1	1	1

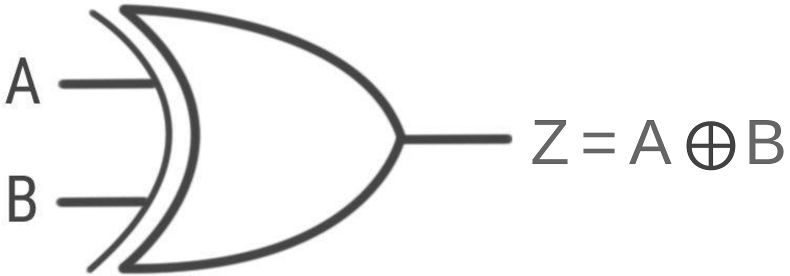
NOT Operation

$$\overline{A} = \neg A = \sim A = A'$$



A	Y
1	0
0	1

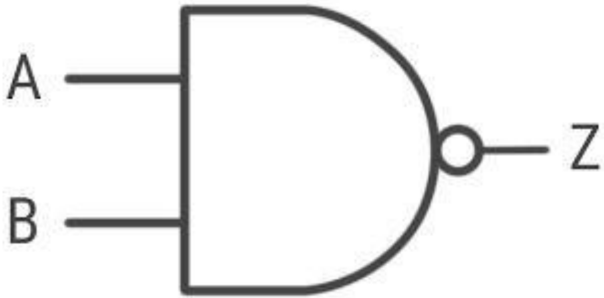
XOR Operation

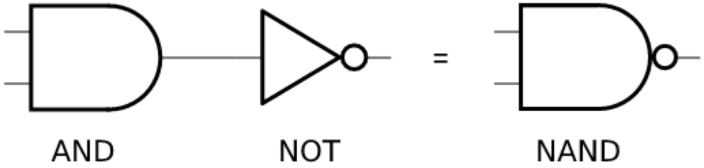


A	B	$Z = A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

NAND Operation

$$\overline{(A\,.\,B)} \equiv \overline{(A \wedge B)} \equiv (A\,.\,B)' \equiv \neg(A \wedge B)$$

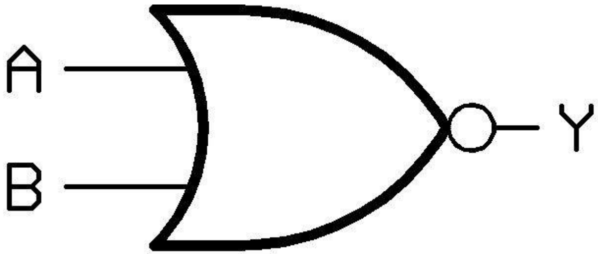




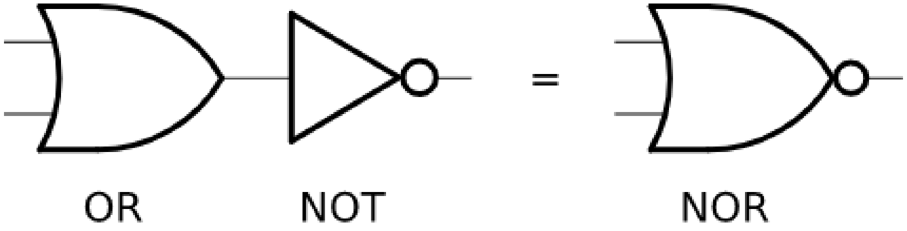
A	B	z
0	0	1
0	1	1
1	0	1
1	1	0

NOR Operation

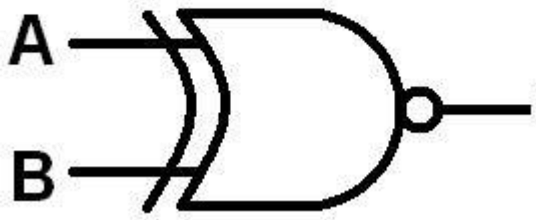
$$\overline{(A + B)} = \overline{(A \vee B)} = (A + B)' = \neg(A \vee B)$$



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

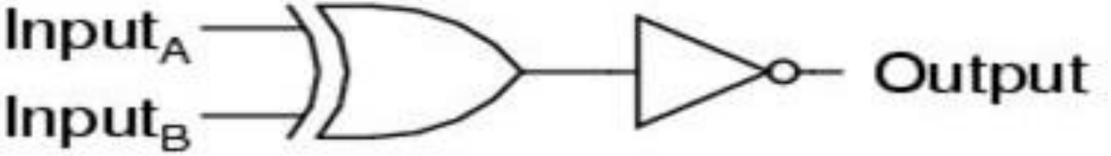


XNOR Operation

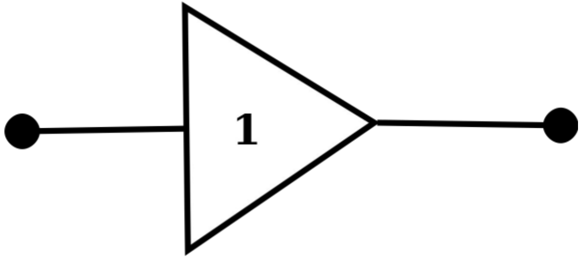


$Y = \overline{A \square B}$

A	B	$Y = \overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1



Buffer

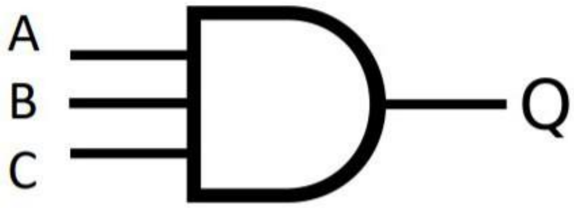


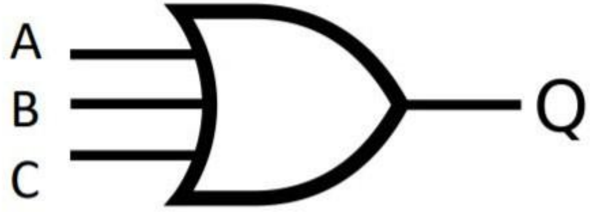
A	Q
0	0
1	1

- A basic logic gate that passes its input, unchanged, to its output.

Multi Input Logic Gates

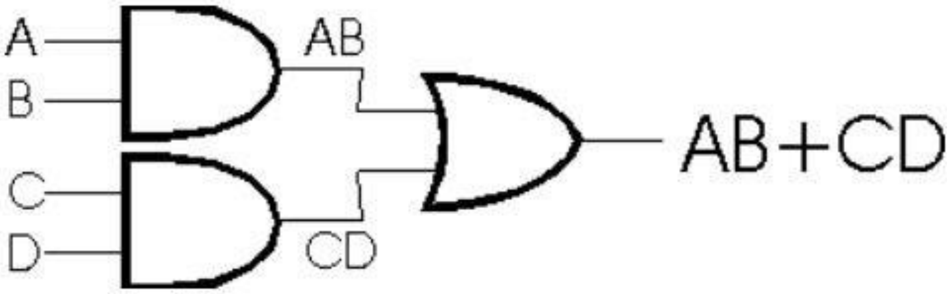
- Gates with more than two inputs are available.
- AND Gate with three inputs (A.B.C)
- OR Gate with three inputs (A+B+C)





Drawing Logic Circuits

AB + CD

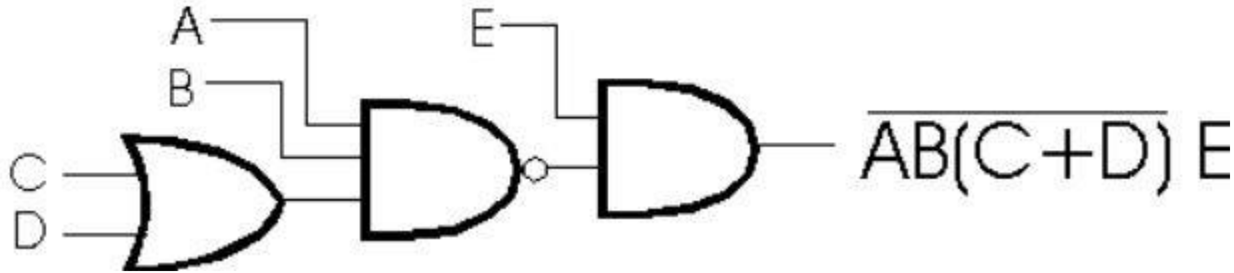


Operator Precedence

- Parenthesis
- NOT
- AND
- OR

Operator Precedence

Drawing Logic circuits contd.



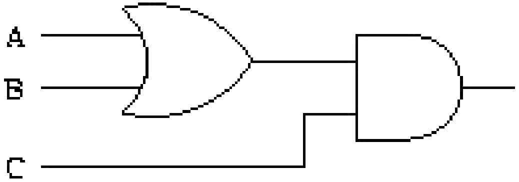
$\overline{AB.(C+D)}.E$

Exercise

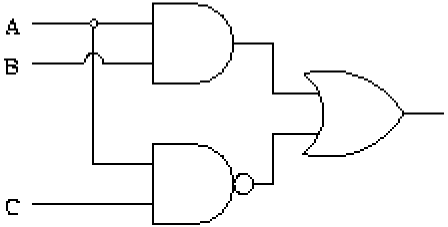
Draw the logic circuits for the following boolean expressions

- $(A + B)C$
- $A + BC + \overline{D}$.
- $AB + \overline{AC}$.
- $(\overline{A + B})(C + D)\ \overline{C}$.

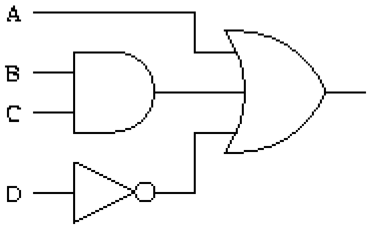
- Draw a logic circuit for (A + B)C



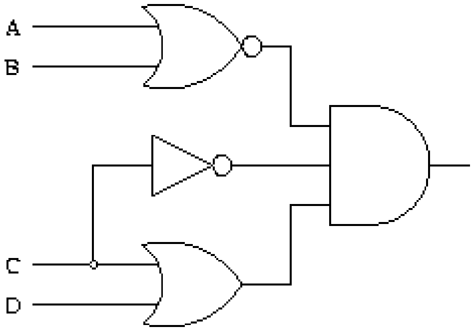
- Draw a logic circuit for AB + A$\overline{C}$.



- Draw a logic circuit for A + BC + $\overline{D}$.



- Draw a logic circuit for $\overline{(A + B)}$(C + D)$\overline{C}$.



Exercise

Draw the truth tables for the following boolean expressions

1. $A\,(B + C)$
2. $(A+B)\overline{(C.A)}$
3. $A\overline{B}\,\overline{C} + \overline{A}BC$
4. $(A \oplus B) \oplus C$

1. $A(B + C)$

A	B	C	(B+C)	A(B+C)
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	1	0
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

2. $(A+B)\overline{(C.A)}$

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

3. $Z = A.\bar{B}.\bar{C} + \bar{A}.B.C$

A	B	C	$\bar{A}$	$\bar{B}$	$\bar{C}$	B.C	$\bar{B}.\bar{C}$	$A(\bar{B}.\bar{C})$	$\bar{A}(B.C)$	Z
0	0	0	1	1	1	0	1	0	0	0
0	0	1	1	1	0	0	0	0	0	0
0	1	0	1	0	1	0	0	0	0	0
0	1	1	1	0	0	1	0	0	1	1
1	0	0	0	1	1	0	1	1	0	1
1	0	1	0	1	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0
1	1	1	0	0	0	1	0	0	0	0

4. $(A \oplus B) \oplus C$

A	B	C	$(A\oplus B)$	$(A\oplus B)\oplus C$
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	0
1	0	0	1	1
1	0	1	1	0
1	1	0	0	0
1	1	1	0	1