SUMMARY OF COMBINATIONAL LOGIC

I. Logic Variables

Logic variables take on only two states. The two states are represented by a 1 (logic one) or a 0 (logic zero), although TRUE and FALSE, ON and OFF, HIGH and LOW, are also names given to the two states. The states are exclusive. That is:

If $A \neq 0$, then $A = 1$
If $A \neq 1$, then $A = 0$

II. Three Basic Boolean Operations

A. "OR"

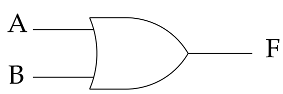
Expression: $F = A + B$
Read: "*F* is equal to *A or B*"

Meaning: *F* is true (1) if either *A or B* is true.

Truth Table:

F	*A*	*B*
0	0	0
1	0	1
1	1	0
1	1	1

Logic Symbol:



B. "AND"

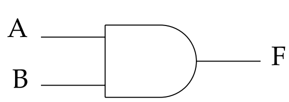
Expression: $F = A \bullet B = AB$
Read: "*F* is equal to *A and B*""

Meaning: *F* is true (1) if *A and B* are true.

Truth Table:

F	*A*	*B*
0	0	0
0	0	1
0	1	0
1	1	1

Logic Symbol:



C. "NOT"

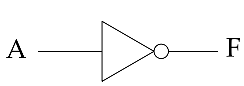
Expression: $F = \overline{A}$
Read: "*F* is equal to *not A*"

Meaning: *F* is true (1) if *A* is *not* true.

Truth Table:

F	*A*
1	0
0	1

Logic Symbol:



III. Derived Logic Operations

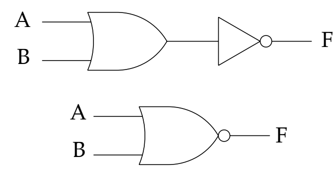
A. "NOR"

Expression: $F = \overline{A + B}$
Read: "*F* is equal to *A nor B*"
Meaning: Combined OR and NOT operations. *F* is true (1) if the quantity $A + B$ is not true.

Truth Table:

F	*A*	*B*
1	0	0
0	0	1
0	1	0
0	1	1

Logic Symbol:



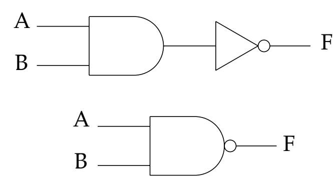
B. "NAND"

Expression: $F = \overline{AB}$
Meaning: Combined AND and NOT operations. *F* is true (1) is the quantity *AB* is not true.

Truth Table:

F	*A*	*B*
1	0	0
1	0	1
1	1	0
0	1	1

Logic Symbol:



IV. Basic Theorems

With the basic logic operations it is possible to deduce a set of basic theorems.

$1 + A = 1$ $\quad 0A = 0$
$0 + A = A$ $\quad 1A = A$
$A + A = A$ $\quad AA = A$
$A + \overline{A} = 1$ $\quad A\overline{A} = 0$
$\overline{\overline{A}} = A$

$A + B = B + A$ $\quad AB = BA$
$A + (B + C) = A + B) + C$ $\quad A(BC) = (AB)C$
$A(B + C) = AB + AC$ $\quad (A+B)(A+C) = A + BC$

V. DeMorgan's Theorem's

$$\overline{A + B} = \overline{A}\ \overline{B}$$
$$\overline{AB} = \overline{A} + \overline{B}$$

Once expressions or logic symbol diagrams are written for a logic system, they can be manipulated (simplified) using the above rules.