BASIC GATES AND TRUTH TABLE

Basic logic gates (AND, OR, NOT) are fundamental digital circuits that perform logical operations (True/False, 1/0) on binary inputs, with truth tables defining output for all input combinations, while NAND, NOR, XOR, and XNOR are derived from them, using 0 (Low/Off) and 1 (High/On) to represent states.

Basic Gates & Truth Tables

- **AND Gate**: Output is 1 (High) only if *all* inputs are 1 (High).
  - Boolean: $Y = A \cdot B$
  - Table: 00=0, 01=0, 10=0, 11=1
- **OR Gate**: Output is 1 (High) if *at least one* input is 1 (High).
  - Boolean: $Y = A + B$
  - Table: 00=0, 01=1, 10=1, 11=1
- **NOT Gate (Inverter)**: Inverts the input; 0 becomes 1, 1 becomes 0.
  - Boolean: $Y = \overline{A}$ (or $\neg A$)
  - Table: 0=1, 1=0

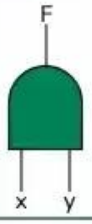
Derived Gates

- **NAND Gate (NOT-AND)**: Inverse of AND; output is 0 only if both inputs are 1.
  - Boolean: $Y = \overline{(A \cdot B)}$
  - Table: 00=1, 01=1, 10=1, 11=0
- **NOR Gate (NOT-OR)**: Inverse of OR; output is 1 only if all inputs are 0.
  - Boolean: $Y = \overline{(A + B)}$
  - Table: 00=1, 01=0, 10=0, 11=0
- **XOR Gate (Exclusive OR)**: Output is 1 if inputs are *different*.
  - Boolean: $Y = A \oplus B$
  - Table: 00=0, 01=1, 10=1, 11=0
- **XNOR Gate (Exclusive NOR)**: Output is 1 if inputs are the *same*.
  - Boolean: $Y = A \odot B$ or $\overline{(A \oplus B)}$
  - Table: 00=1, 01=0, 10=0, 11=1
- **Binary**: Uses 0 (Low/Off/False) and 1 (High/On/True).
- **Truth Table**: Lists all possible input combinations and their corresponding outputs.
- **Boolean Algebra**: Uses symbols like . (AND), + (OR), and $\overline{\ }$ (NOT) to represent logic.

AND Gate: Outputs 1 only when both inputs are 1.

OR Gate: Outputs 1 when at least one input is 1.

NOT Gate (Inverter): Outputs the reverse value.

Name	AND	OR	Inverter	Buffer	NAND	NOR	Exclusive-OR (XOR)	Exclusive-NOR or equivalence
Graphic Symbol								
Algebraic Function	$F = x \cdot y$	$F = x + y$	$F = x^1$	$F = x$	$F = (xy)^1$	$F = (x+y)^1$	$F = xy^1 + x^1y = x \oplus y$	$F = xy + x^1y^1 = (x \oplus y)$
Truth Table	x y | F 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1	x y | F 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 1	x | F 0 | 1 1 | 0	x | F 0 | 0 1 | 1	x y | F 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0	x y | F 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 0	x y | F 0 0 | 0 0 1 | 1 1 0 | 1 1 1 | 0	x y | F 0 0 | 1 0 1 | 0 1 0 | 0 1 1 | 1