

Chapter 2: Boolean Algebra & Logic Gates

Outline

- Boolean Algebra.
- Simplifying logic circuits.
- Binary Variable.
- Logical operator.
 - AND (\cdot), OR ($+$), NOT ($'$), XOR.
 - NAND, NOR, XNOR.
- Truth Tables.
- The dual of a boolean expression.
- The duality principle.
- Axioms and Theorems of Boolean Algebra.
- Logic Gate Symbols.
- Variable vs Literal vs Term.
- **Product Term** vs **Sum Term**.
- **Complement** of a function.
- Standard Forms:
 - **Sum of Products (SOP)**.
 - **Product of Sums (POS)**.
- **Minterm** = Standard Product.
- **Maxterm** = Standard Sum.
- **Canonical Forms**:
 - **Sum of Minterms**.
 - **Product of Maxterms**.
- Get the **Boolean expression** from the **truth table**.
- Drawing the **logic diagram** of the circuit.
- Drawing using **NAND** and **NOR**.

Simplifying logic circuits

By reducing the number of terms, the number of literals, or both in a Boolean expression.

A general conversion procedure:

To convert from one canonical form to another, interchange the symbols \sum and \prod and list those numbers missing from the original form.

Important Notes:

- The maxterm with subscript j is a complement of the minterm with the same subscript j and vice versa.

$$i.e. \quad M_j = m'_j$$

- The **complement** of a function expressed as the **sum of minterms** equals the sum of minterms missing from the original function.
- The implementation of Boolean functions with **NAND** gates requires that the functions be in **sum-of-products** form.
- The total number of minterms or maxterms for a boolean functions is 2^n where n is the number of binary variables.