Digital Logic Design

Representation of Boolean Expressions

Boolean Expressions can be written in two forms

- Sum of Products (SOP)
  - Non Standard SOP
  - Standard SOP
- Product of Sum (POS)
  - Non Standard POS
  - Standard POS

Sum of Product

- This form of Boolean expression representation uses multiplication of inputs which are then summed up together.
  - $\bar{A}BC + A\bar{D} + \overline{BC}D$
  - $\bar{A}BC + AB\bar{C} + \overline{ABC}$

Non Standard SOP Expression

In this form of representation, all the product terms will not have all the inputs associated with the system.

$$\bar{A}BC + A\bar{D} + \overline{BC}D$$

In the above expression, the total number of inputs for the system is 4 (A, B, C, D). But for the first product term, we see there is input A,B,C is present, D is missing, for the second term, we see A and D is present, but B and C is missing and for the last product term, B,C and D is present but A is missing.

Sum of Product

Standard SOP Expression

In this form of representation, all the product terms should have all the inputs associated with the system.

$$\bar{A}BC + AB\bar{C} + \overline{AB}C$$

In the above expression, the total number of inputs for the system is 3 (A, B, C). We can see that the first product term has all 3 inputs, the second product term has all 3 inputs and the third product term also has 3 inputs.

Product of Sum

- This form of Boolean expression representation uses addition of inputs which are then multiplied together.
    - $(A + \bar{B} + C)(A + B + \bar{C})(\bar{A} + \bar{B} + C)$
    - $(A + \bar{B})(B + \bar{C})(\bar{A} + C)$

Non Standard POS Expression

In this form of representation, all the sum terms will not have all the inputs associated with the system.

$$(A + \bar{B})(B + \bar{C})(\bar{A} + C)$$

In the above expression, the total number of inputs for the system is 3 (A, B, & C). But for the first sum term, we see there is input A & B is present, C is missing, for the second term, we see B and C is present, but A is missing and for the last sum term, A & C is present but B is missing.

Product of Sum

In this form of representation, all the sum terms should have all the inputs associated with the system.

$$(A + \bar{B} + C)(A + B + \bar{C})(\bar{A} + \bar{B} + C)$$

In the above expression, the total number of inputs for the system is 3 (A, B, C). We can see that the first sum term has all 3 inputs, the second sum term has all 3 inputs and the third sum term also has 3 inputs.

Converting Non-Standard SOP to Standard SOP

Converting Non-Standard POS to Standard POS