

Computer Organisation and Assembly CSCI 2121

Manipulation of Boolean functions:

1. Consider $F(x, y, z) = \bar{x}yz + \bar{x}y\bar{z} + xz$. Simplify the expression to two terms. Draw circuits to represent both expressions.
2. Simplify $AB + \bar{A}C + BC$ and show that the BC term is redundant $AB + \bar{A}C$. This result is known as the consensus theorem.
3. Find the complements of the following Boolean functions: (i) $F_1 = \bar{x}y\bar{z} + \bar{x}\bar{y}z$ and (ii) $F_2 = x(\bar{y}\bar{z} + yz)$ (a) Using the De Morgan's rule and (b) Using the duality principle.
4. Standard Forms: As is clear from above, any Boolean function can be written many ways. Consequently there are forms considered **canonical** (or standard). Canonical forms can contain "sums" of "product" terms or *vice versa*. A product term, in which the literal (*i.e.* Boolean variable) or its complement appears **exactly once** is called a **minterm**. The corresponding "sum" term is called a **maxterm**.
5. The Sum of Minterms & Product of Maxterms: A standard algebraic expressions that can be directly obtained from a truth table. This usually contains more product terms than necessary. The expression is usually simplified to reduced the number of product terms and variables. The result is the Sum Of Products form (SOP). Another std. form is the "product" of "sums" (POS) form. The two forms are **duals** of each other. A BF can be obtained from a BF as a sum of minterms or a product of maxterms.