

Using Laws and Theorems to Simplify an Equation

Lab 3 Helps

Lab 3 requires the use of at least two of the theorems on the “Laws and Theorems of Boolean Algebra” sheet to simplify one of the signals. Here is a quick example of how to solve a similar problem:

Example: Simplify $F = AB'C + A'B'C + A'BC$

The first task is to identify any two of the product terms that only have one variable different. For example, $AB'C$ is only one variable different than $A'B'C$ (the A , A' is different). Alternatively, we can identify that $A'B'C$ is only one variable different than $A'BC$ (the B' , B). Which one of these should we pick to simplify? Why not use both of these?

$$\begin{aligned} F &= AB'C + A'B'C + A'BC \\ &= AB'C + A'B'C + A'B'C + A'BC && \text{Theorem 3} \\ &= (AB'C + A'B'C) + (A'B'C + A'BC) && \text{Theorem 7} \\ &= B'C(A + A') + A'C(B' + B) && \text{Theorem 8} \\ &= B'C(1) + A'C(1) && \text{Theorem 5} \\ &= B'C + A'C && \text{Theorem 1D} \end{aligned}$$

Theorem 10 is the “shortcut” combination of theorems 7, 8, 5, and 1D. We could simply apply theorems 3 and 10 to simplify this expression.