Simplification Using Algebraic Functions

In this approach, one Boolean expression is minimized into an equivalent expression by applying Boolean identities.

Problem 1

Minimize the following Boolean expression using Boolean identities −

$$F(A,B,C) = A'B + BC' + BC + AB'C'$$

Solution

Given, $F(A,B,C) = A'B + BC' + BC + AB'C'$

Or, $F(A,B,C) = A'B + (BC' + BC') + BC + AB'C'$

[By idempotent law, BC' = BC' + BC']

Or, $F(A,B,C) = A'B + (BC' + BC) + (BC' + AB'C')$

Or, $F(A,B,C) = A'B + B(C' + C) + C'(B + AB')$

[By distributive laws]

Or, $F(A,B,C) = A'B + B.1 + C'(B + A)$

[(C' + C) = 1 and absorption law (B + AB')= (B + A)]

Or, $F(A,B,C) = A'B + B + C'(B + A)$

[B.1 = B]

Or, $F(A,B,C) = B(A' + 1) + C'(B + A)$

Or, $F(A,B,C) = B.1 + C'(B + A)$

[(A' + 1) = 1]

Or, $F(A,B,C) = B + C'(B + A)$

[As, B.1 = B]

Or, $F(A,B,C) = B + BC' + AC'$

Or, $F(A,B,C) = B(1 + C') + AC'$

Or, $F(A,B,C) = B.1 + AC'$

[As, (1 + C') = 1]

Or, $F(A,B,C) = B + AC'$

[As, B.1 = B]

So, $F(A,B,C) = B + AC'$ is the minimized form.

Problem 2

Minimize the following Boolean expression using Boolean identities −

$$F(A,B,C) = (A + B)(A + C)$$

Solution

Given, $F(A,B,C) = (A + B)(A + C)$

Or, $F(A,B,C) = A.A + A.C + B.A + B.C$ [Applying distributive Rule]

Or, $F(A,B,C) = A + A.C + B.A + B.C$ [Applying Idempotent Law]

Or, $F(A,B,C) = A(1 + C) + B.A + B.C$ [Applying distributive Law]

Or, $F(A,B,C) = A + B.A + B.C$ [Applying dominance Law]

Or, $F(A,B,C) = (A + 1).A + B.C$ [Applying distributive Law]

Or, $F(A,B,C) = 1.A + B.C$ [Applying dominance Law]

Or, $F(A,B,C) = A + B.C$ [Applying dominance Law]

So, $F(A,B,C) = A + BC$ is the minimized form.