Answer on Question #78937 – Math – Discrete Mathematics

Question

a) Simplify the Boolean function F = AB + (AC)’ + AB ’C(AB + C).

Solution

AB + (AC)' + AB ‘C(AB+C) = AB + A' + C' + ABB ‘C + AB ‘C (according to formulas 1, 2 and 3)
AB + A' + C' + ABB ‘C + AB'C = AB + A’ + C’ + AB 'C (according to formulas 4 and 5)
AB + A’ + C’ + AB 'C = A' + B + C' + AB 'C (according to formula 8)
A' + B + C' + AB 'C = A' + C' + (B + AB 'C)
A' + C' + (B + AB 'C) = A' + C' + (B + AC) (according to formula 8)
A' + C' + (B + AC) = A' + B + C' + AC
A' + B + C' + AC = A’ + B + C’ + C (according to formula 8)
A' + B + C' + C = A' + B' + 1 (according to formula 6)
A' + B + 1 = 1 (according to formula 7)

Formula 1 (OR Distributive law): A(B + C) = AB + AC
Formula 2: (AB)’ = A’ + B’
Formula 3: AA = A
Formula 4: AA’ = 0
Formula 5: A + 0 = A
Formula 6: A + A’ = 1
Formula 7: A + 1 = A’ + 1 = 1
Formula 8: AB + A' = A' + B ⇔ A ‘B + A = A + B
Proof of formula 8:

Formula 8.1 (AND Distributive law): A + (BC) = (A + B)(A + C)

A’ B + A = (A + A’)(A + B) (according to formula 8.1)
(A + A’)(A + B) = 1(A + B) (according to formula 6)
1(A + B) = A + B

AB + A’ = (A’ + A)(A’ + B) (according to formula 8.1)
(A’ + A)(A’ + B) = 1(A’ + B) (according to formula 6)
1(A’ + B) = A’ + B

Answer: F = 1.