Sept 8, 2017

$F1(x,y) = xy + x'$

$F2(x,y,z) = xy + yz + zx'$

explain a two-variable function

Describe

Truth Table

Input 1 col/input

Output function

input

| x | y | F1 |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

all the patterns of xy

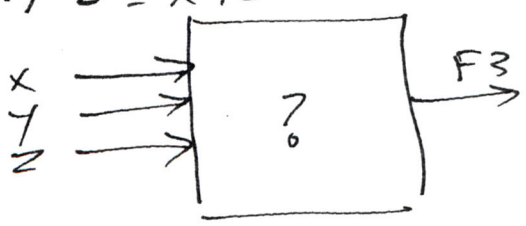
x, y binary variable

$F1 = x \cdot y + x'$

| | or |
|---|---|
| 00 | $0 \cdot 0 + 1 = 0 + 1 = 1$ |
| 01 | $0 \cdot 1 + 1 = 0 + 1 = 1$ |
| 10 | $1 \cdot 0 + 0 = 0 + 0 = 0$ |
| 11 | $1 \cdot 1 + 0 = 1 + 0 = 1$ |

3-variable function

| | x | y | z | F3 output | |
|---|---|---|---|---|---|
| $m_0$ | 0 | 0 | 0 | 0 | $x' \cdot y' \cdot z' = x'y'z'$ |
| $m_1$ | 0 | 0 | 1 | 1 ✓ | $x'y'z$ |
| $m_2$ | 0 | 1 | 0 | 0 | |
| $m_3$ | 0 | 1 | 1 | 0 | |
| $m_4$ | 1 | 0 | 0 | 1 ✓ | |
| $m_5$ | 1 | 0 | 1 | 1 ✓ | |
| $m_6$ | 1 | 1 | 0 | 1 ✓ | |
| $m_7$ | 1 | 1 | 1 | 1 ✓ | $xyz$ |




F3(x,y,z) = Sum of minterms notation

$m1 + m4 + m5 + m6 + m7$

$F3(x,y,z) = \Sigma(1,4,5,6,7)$

Sum of minterms

Boolean expression

Boolean variables

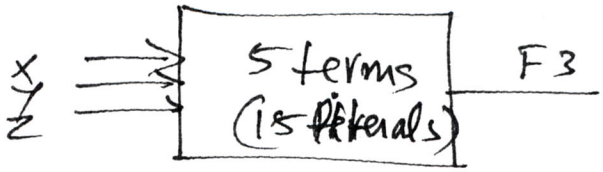
Boolean terms

$F3(x,y,z) = \Sigma(1,4,5,6,7)$

$= x'y'z + xy'z' + xy'z + xyz' + xyz$

F3 has 5 terms

F3 has $5 \times 3 = 15$ literals




minimize ↓ terms

minimize ↓ literals

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(3)

$F(x,y,z) = x'y'z + xy'z' + xy'z + xyz' + xyz$

Boolean Algebraic simplification

"factorize" "common"

~~$= z(x'y' + xy + xy)$~~

$= x(y'z' + y'z + yz' + yz) + x'y'z$

$= x((y'(z'+z)) + y(z'+z)) + x'y'z$ (each $(z'+z) = 1$)

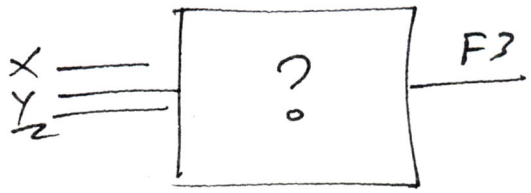
$= x(y' \cdot 1 + y \cdot 1) + x'y'z$

$= x(y' + y) + x'y'z$ ($y' + y = 1$)

$= x + x'y'z$ Distributive law

$= (x + x')(x + y'z)$ ($x + x' = 1$)

$= 1 \cdot (x + y'z) = x + y'z$




④

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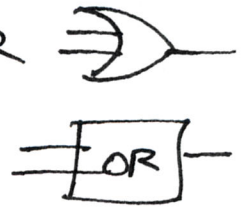
x yz

Logic gate + OR







• AND



/ NOT

$F_3(x,y,z)$

$F_3(x,y,z)$