Galala University, Faculty of Computer Science and Engineering

CSE 131 Logic Design

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Homework 5 sol

Problem 18:

Convert the following to the other canonical form:

(a) $F(x, y, z)= \Sigma(1,3,7)$ (b) $F(A,B,C,D)= \Pi(0,1,2,3,4,6,12)$

Solution:

(a) $F(x, y, z)= \Sigma(1,3,7) = \Pi(0,2,4,5,6)$

$F(x, y, z)= (x+y+z)\bullet(x+\bar{y}+z)\bullet(\bar{x}+y+z)\bullet(\bar{x}+y+\bar{z})\bullet(\bar{x}+\bar{y}+z)$

(b) $F(A,B,C,D)= \Pi(0,1,2,3,4,6,12)= \Sigma(5,7,8,9,10,11,13,14,15)$

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

$(\bar{A}B\bar{C}D)+(\bar{A}BCD)+(A\bar{B}\bar{C}\bar{D})+(A\bar{B}\bar{C}D)+(A\bar{B}C\bar{D})+(A\bar{B}CD)+(AB\bar{C}D)+(ABC\bar{D})+(ABCD)$

Problem 21:

Show that the dual of the exclusive-OR is equal to its complement.

Dual of XOR: $= (X+Y')\bullet(X'+Y)$

Complement of XOR (XNOR) $= (X\oplus Y)'$

Solution:

XOR: $X\oplus Y = XY' + X'Y$

Dual of XOR:

$$\begin{aligned}
&= (X+Y')\bullet(X'+Y)\\
&= XX' + XY + X'Y' + YY'\\
&= XY + X'Y'
\end{aligned}$$

Complement of XOR (XNOR)

$$\begin{aligned}
&= (X\oplus Y)'\\
&= (XY' + X'Y)'\\
&= (X'+Y)\bullet(X+Y')\\
&= XX' + XY + X'Y' + YY'\\
&= XY + X'Y'
\end{aligned}$$

Problem 23:
Show that a positive logic NAND gate is a negative logic NOR gate and vice versa.

Solution:

Truth table for a NAND gate:

X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

Truth table for positive logic NAND gate (L = 0   H = 1) with H and L:

X	Y	Z
L	L	H
L	H	H
H	L	H
H	H	L

Truth table for negative logic let L = 1, H = 0

X	Y	Z
1	1	0
1	0	0
0	1	0
0	0	1

This resulting truth table is that of the NOR gate using negative logic.