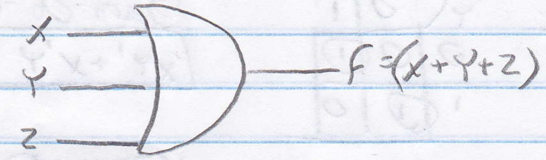
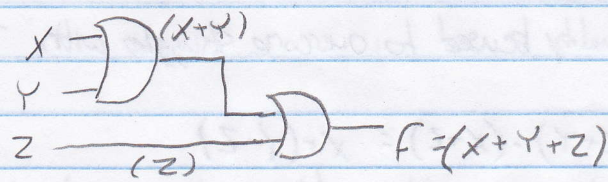
Brian Faure DLD HW#4 RUID:150003563 Oct. 4, 2014

[4.25] n-input OR gate $\rightleftharpoons$ (n-1) 2-input OR gates

3 input OR gate

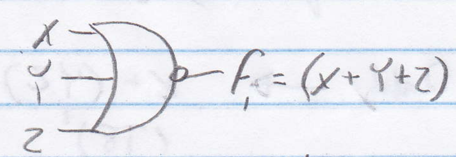


2, 2-input OR gates



* An n-input NOR gate cannot be transformed using the same expression

3-input NOR Gate



2, 2-input NOR Gates

$f_1 = (x+y+z)'$ $\quad$ $f_2 = ((x+y)'+z)'$

$f_1 \neq f_2$

[4.30] Use switching algebra to rewrite the following using as few inversions as possible (complemented parentheses are ok)...

$B' \cdot C + A \cdot C \cdot D' + A' \cdot C + E \cdot B' + E \cdot (A+C) \cdot (A'+D')$

$E(B' + (A+C)(A'+D')) + C(B' + AD' + A')$

$E(B' + \cancel{AA'} + AD' + CA' + CD') + CB' + CAD' + CA'$

$EB' + EAD' + \cancel{ECA'} + ECD' + CB' + CAD' + \cancel{CA'}$

$A'(EC + C) = A'C \rightarrow A'C + EB' + EAD' + ECD' + CB' + CAD'$

$D'(EA + EC) + A'C + EB' + CB' + CAD'$

$\left[D'(EA+EC) + B'(E+C) + A'C + CAD'\right] = 4$ Inversions

[4.35] Exclusive OR = XOR, 2-input gate. Output is one if only one of it's inputs is 1. Write truth table, sum-of-products, and corresponding AND-OR circuit for XOR function

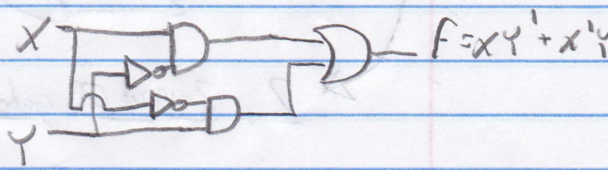
Truth Table

X	Y	XOR
0	0	0
0	1	1
1	0	1
1	1	0

Y \ X	0	1
0	0	1
1	1	0

Sum-of-Products

$\boxed{XY' + X'Y = F}$



[4.46] How can duality be used to overcome struggle with Theorem T8'?

$$(T8') = (X+Y)\cdot(X+Z) = X+(Y\cdot Z)$$

- Because students have no problem utilizing the regular theorem T8 and it's outcome $(X\cdot(Y+Z))$, they can use duality to basically derive the solution to T8' by flipping the Ands and ORs in the regular solution.

$$\underset{T8}{X\cdot(Y+Z)} \longrightarrow \text{Duality} \longrightarrow \underset{(T8)'}{X+(YZ)}$$

- This method will allow students to only need to memorize the original T8 instead of both the original and its complement.

[4.54] $F = \Sigma_{WXYZ}(2,3,8,9)$

YZ \ WX	00	01	11	10
00	0	0	0	1
01	0	0	0	1
11	1	0	0	0
10	1	0	0	0

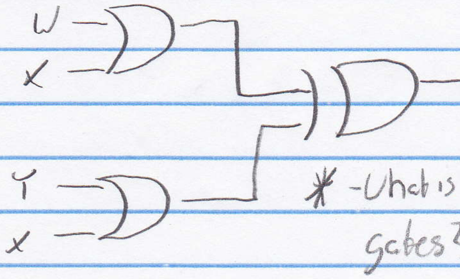
$F = W'X'Y + WX'Y'$

$X'(W'Y + WY')$

$=$

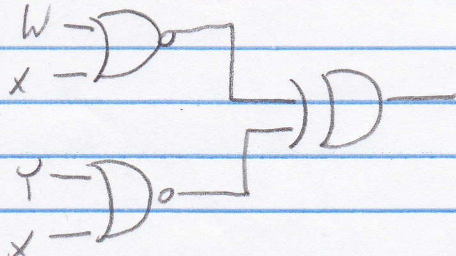
Next Page →

Page Two



$F = X'(W'Y + WY')$

* - What is the solution if the OR gates are changed to NOR gates?



X Y	OR	NOR
0 0	0	1
0 1	1	0
1 0	1	0
1 1	1	0

W X Y	WX NOR	YX NOR	XOR	
0 0 0	1	1	0	
0 0 1	1	0	1	$= W'X'Y(W'X'YZ \,\&\, W'X'YZ')$
0 1 0	0	0	0	
0 1 1	0	0	0	
1 0 0	0	1	1	$= WX'Y'(WX'Y'Z \,\&\, WX'Y'Z')$
1 0 1	0	0	0	
1 1 0	0	0	0	
1 1 1	0	0	0	

$\boxed{\text{The solution is the same}}$

[4.57] Prove whether the following is a minimal sum algebraically

$F = (S'TUVW) + (S'TU'WY) + (S'TVWX'Y)$

$F = (S'TW)(UV + U'Y + VX'Y)$

$F = (S'TW)(UV + U'Y + (U + U')(VX'Y))$

$= (S'TW)(UV + U'Y + UVX'Y + U'VX'Y)$

$= (S'TW)(UV(1 + X'Y) + U'Y(1 + VX'))$

$= (S'TW)(UV + U'Y)$ = minimal sum