

CPIT210

Assignment 1

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Section: VAR

Problem 1

Given the Boolean function:

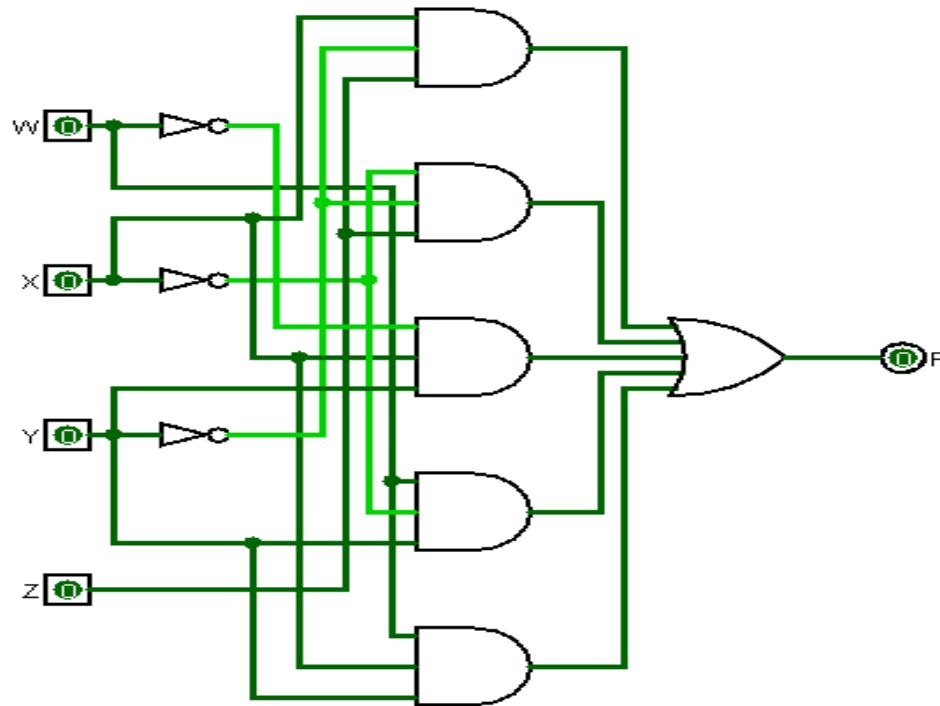
$$F(w,x,y,z) = xy'z + x'y'z + w'xy + wx'y + wxy$$

- Obtain the truth table of the function.

The indices respectively: {13,5,9,1,7,6,11,10,15,14}.

W	X	Y	Z	$XY'Z$	$X'Y'Z$	$W'XY$	$WX'Y$	WXY	F
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	1	0	0	0	1
0	0	1	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	0	1	0	0	1
0	1	1	1	0	0	1	0	0	1
1	0	0	0	0	0	0	0	0	0
1	0	0	1	0	1	0	0	0	1
1	0	1	0	0	0	0	0	0	1
1	0	1	1	0	0	0	1	0	1
1	1	0	0	0	0	0	0	0	0
1	1	0	1	1	0	0	0	0	1
1	1	1	0	0	0	0	0	1	1
1	1	1	1	0	0	0	0	1	1

- Draw the logic diagram using the original Boolean expression using the simulator.



- Simplify the function to a minimum number of literals using Boolean algebra. (If simplification done using simulator and algebra 1point bonus)

- $XY'Z + X'Y'Z + W'XY + WX'Y + WXY + WXY$
- $Y'Z(X + X') + XY(W + W') + WY(X + X')$
- $Y'Z.1 + XY.1 + WY.1$
- $Y'Z + XY + WY$

- Obtain the truth table of the function from the simplified expression and show that it is the same as the one in part (a)

The indices are the same. {13,5,9,1,7,6,11,10,15,14}

W	X	Y	Z	Y'Z	XY	WY	F
0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	1
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	1	0	0	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	1
1	0	0	0	0	0	0	0
1	0	0	1	1	0	0	1
1	0	1	0	0	0	1	1
1	0	1	1	0	0	1	1
1	1	0	0	0	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	0	1	1	1
1	1	1	1	0	1	1	1

F in table (A) is the same as F in the simplified expressions table

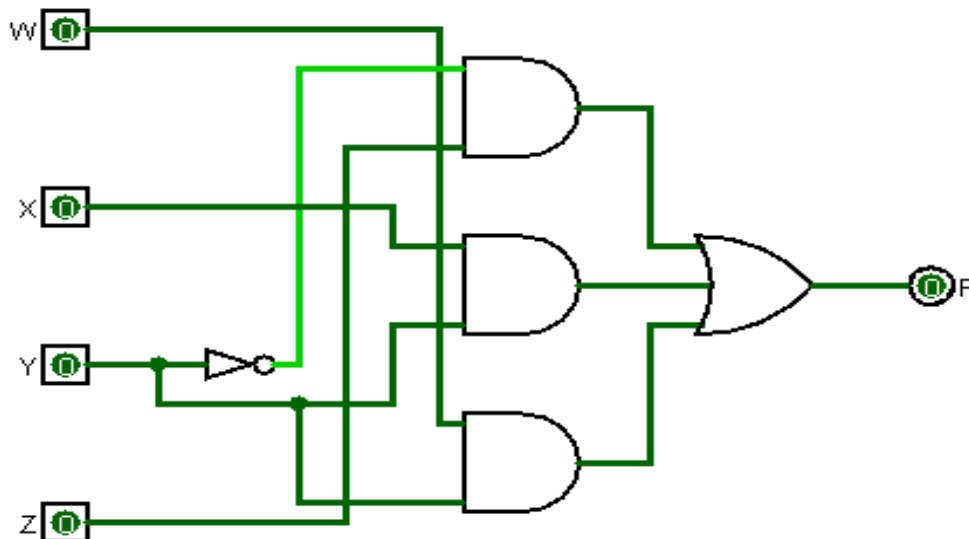
Simplified Expression

$$Y'Z + XY + WY$$

- Draw the logic diagram, using simulator from the simplified expression and compare the total number of gates with the diagram of part (b).

The original function: has 9 gates 5 AND gates, 3 NOT gates and one OR gate.

The simplified function: has 5 gates 3 AND gates, 1 NOT gate and one OR gate.



Problem 2

1. Consider the following circuit: $F = X'Y' + YZ' + XYZY'$

a. Represent the circuit as Sum Of Product.

$$\begin{aligned} &= X'Y' + YZ' \\ &= X'Y' (Z+Z') + YZ' (X+X') \\ \Sigma(0,1,2,6) &= + X'Y'Z' + X'Y'Z + X'YZ' + XYZ' \end{aligned}$$

b. Represent the circuit as Product Of Sum

$$\begin{aligned} &= X'YZ + XY'Z' + XY'Z + XYZ \\ \Pi(3,4,5,7) &= (X+Y'+Z') (X'+Y+Z) (X'+Y+Z') (X'+Y'+Z') \end{aligned}$$

c. Find the complement of the circuit.

$$= (X+Y) (Y'+Z) (X'+Y'+Z'+Y)$$

2. Convert each of the following to the other canonical form:

a. $F(x,y,z) = \Sigma(1,3,6)$

$$F(x,y,z) = \Pi(0,2,4,5,7)$$

b. $F(A, B, C, D) = \Pi(0,2,4,7,9,13)$

$$F(x,y,z) = \Sigma(1,3,5,6,8,10,11,12,14,15)$$