Assignment 1 | FPGA Lab

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January 2022

1 Question

Reduce the following Boolean Expression to its simplest form using K-Map :
F(X,Y,Z,W) = $\sum(2, 6, 7, 8, 9, 10, 11, 13, 14, 15)$

2 Solution

2.1 KMAP Implementation

Given SOP expression can be minimized using a KMap (Figure 1).

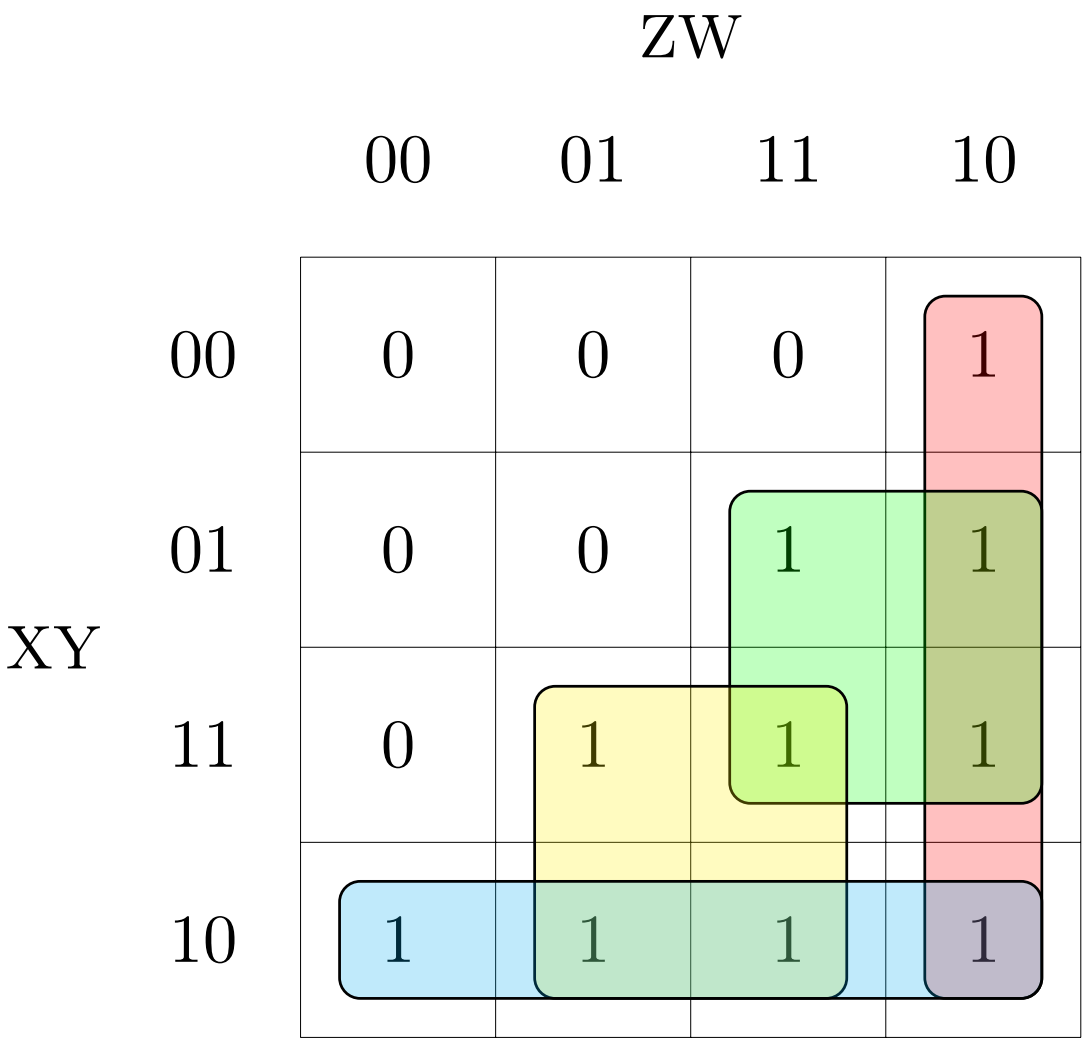


Figure 1: SOP for F

2.2 Minimized SOP Expression

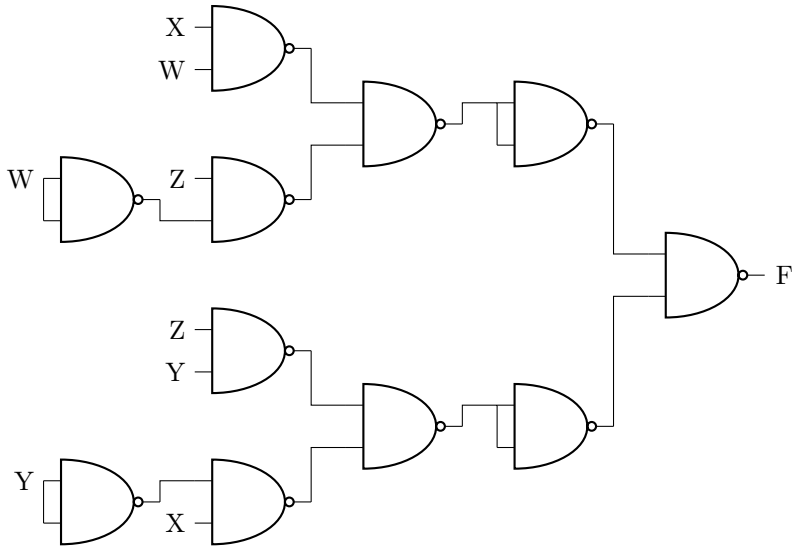
F = $Z.\overline{W} + Y.Z + X\overline{Y} + X.W$

2.3 NAND Logic Implementation

To implement it using NAND Logic, we convert the simplified SOP expression to suite the NAND logic, which gives :

$$F = \overline{\overline{Z.\overline{W} + Y.Z + X\overline{Y} + X.W}}$$
$$F = \overline{\overline{Z.\overline{W}}.\overline{Y.Z}.\overline{X\overline{Y}}.\overline{X.W}}$$

The last expression can be implemented using only two input-NAND Gates.


X
W
W
Z
F
Z
Y
Y
X