Assignment 1 — FPGA Lab

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1 Question

Reduce the following Boolean expression to its simplest form using K-Map

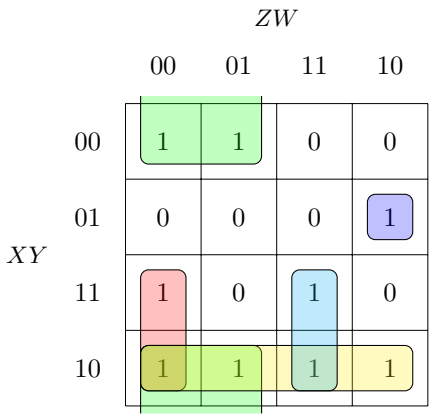
$$F(X,Y,Z,W) = \sum(0,1,6,8,9,10,11,12,15) \tag{1}$$

2 Solution

- Step1 : Enter ones in the cells of the K-Map denoting the product terms of the give sum of products (SOP) form. Enter zeros in the remaining cells of the K-Map

XY \ ZW	00	01	11	10
00	1	1	0	0
01	0	0	0	1
11	1	0	1	0
10	1	1	1	1

- Step2 : From the groups in the K-Map.



- Step3 : Write down the Boolean expression for each of the group in the K-Map

$$F(X,Y,Z,W) = \overline{Y}.\overline{Z} + X.\overline{Y} + X.\overline{Z}.\overline{W} + X.Z.W + \overline{X}.Y.Z.\overline{W} \tag{2}$$

3 Implementation using NAND gate

$$F(X,Y,Z,W) = \overline{\overline{\overline{Y}.\overline{Z} + X.\overline{Y} + X.\overline{Z}.\overline{W} + X.Z.W + \overline{X}.Y.Z.\overline{W}}} \tag{3}$$

$$F(X,Y,Z,W) = \overline{(\overline{\overline{Y}.\overline{Z}})} \ . \ \overline{(X.\overline{Y})} \ . \ \overline{(X.\overline{Z}.\overline{W})} \ . \ \overline{(X.Z.W)} \ . \ \overline{(\overline{X}.Y.Z.\overline{W})} \tag{4}$$

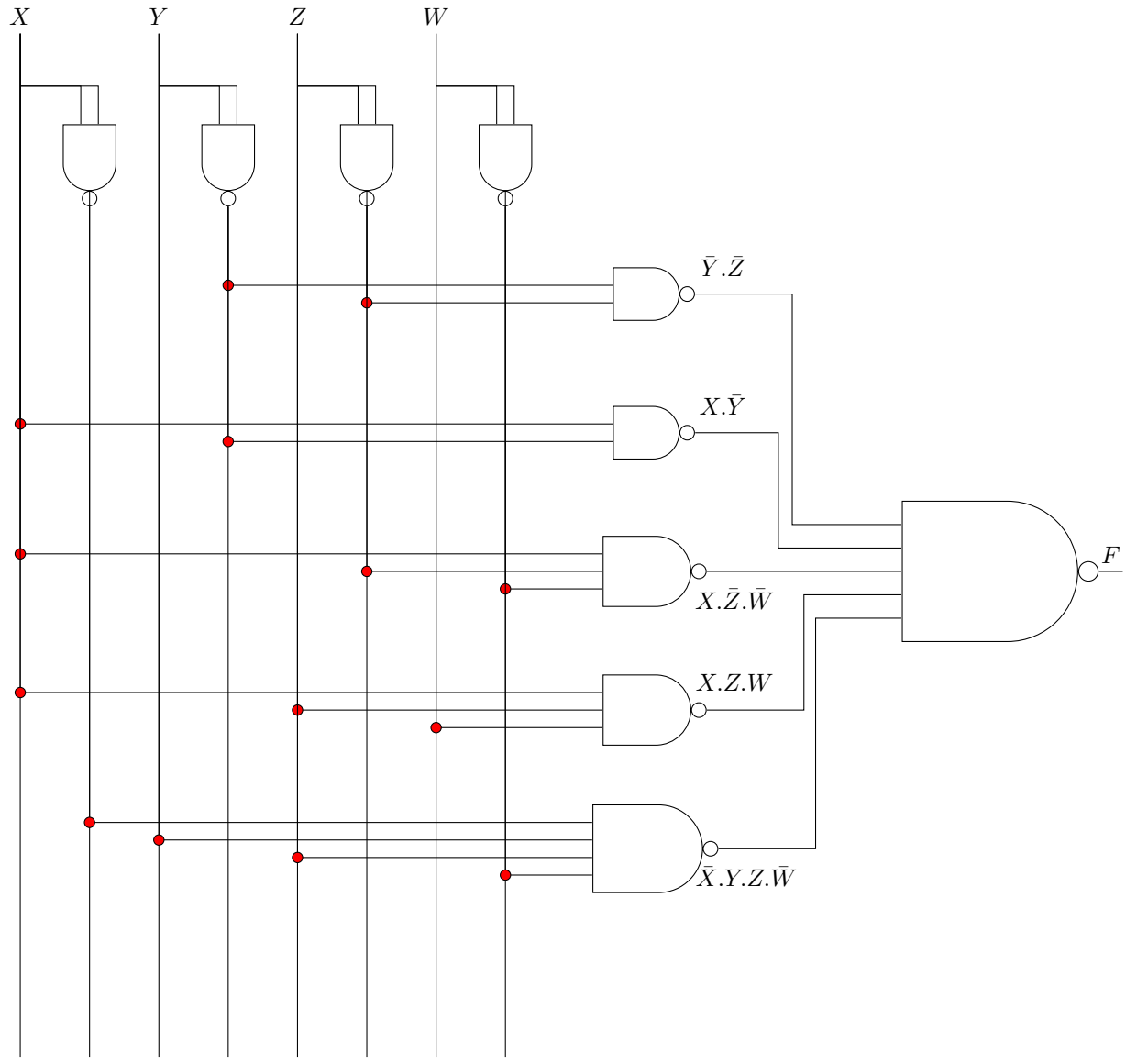


Figure 1: Circuit Diagram for the simplified Boolean expression using NAND gate