EE5803 FPGA Lab Assignment 4

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April 16, 2022

1   Question

[CBSE 2018 Q6 (d)] : Reduce the following Boolean Expression to its simplest form using K-map and implement its NAND realisation on an Arduino UNO board using AVR - GCC commands.

$$G(U, V, W, Z) = \sum(3, 5, 6, 7, 11, 12, 13, 15) \tag{1}$$

2   Solution

2.1   Truth table

The truth table for the given boolean expression G is as follows

U	V	W	Z	$G(U, V, W, Z)$
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Table 1: Truth table for Function G

2.2   K-map for simplification

Simplified expression from K-map can be written as

$$G = WZ + VZ + UVW' + U'VW \tag{2}$$

Please refer to Figure 1.

2.3   NAND logic diagram

To realize the above equation using NAND logic, the following steps are followed

$$(G')' = ((WZ + VZ + UVW' + U'VW)')' \tag{3}$$

Figure 1: K-map for given boolean expression
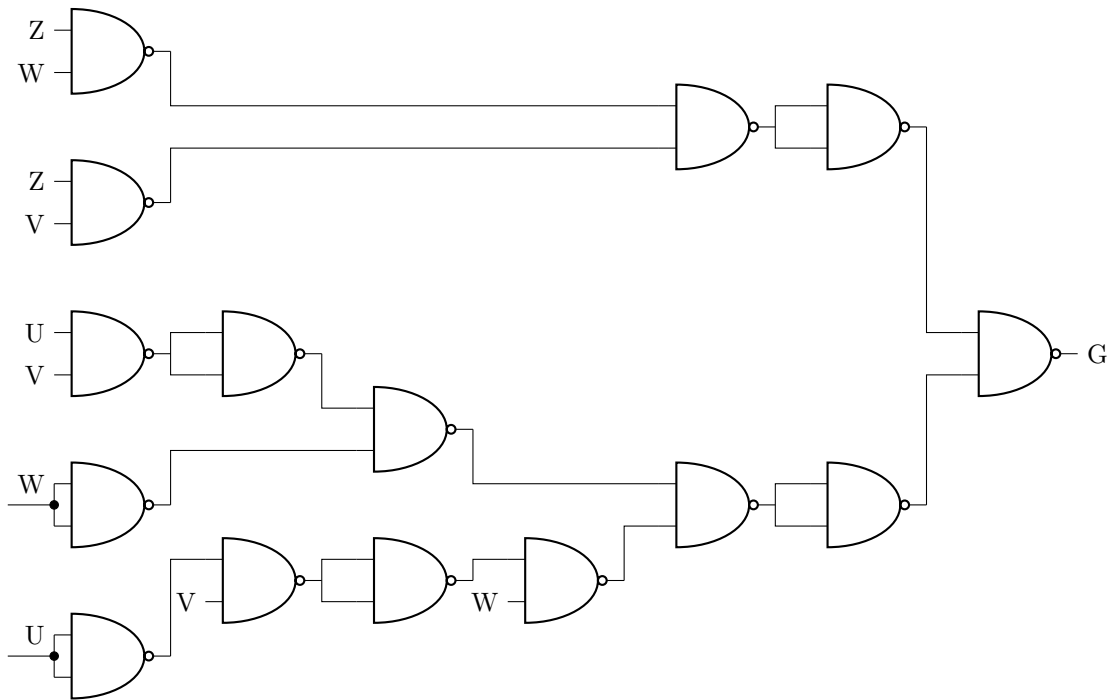
$$G = ((WZ)'(VZ)'(UVW')'(U'VW)')' \tag{4}$$

Please refer to Figure 2.

Figure 2: Logic circuit using NAND gate