

# EE5803 FPGA Lab Assignment 4

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## 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.

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

## 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

$$G = WZ + VZ + UVW' + U'VW \quad (2)$$

Please refer to Figure 1.

### 2.3 NAND logic diagram

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

$$(G')' = ((WZ + VZ + UVW' + U'VW)')' \quad (3)$$

		WZ			
		00	01	11	10
UV	00	0	0	1	0
	01	0	1	1	1
	11	1	1	1	0
	10	0	0	1	0

Figure 1: K-map for given boolean expression

$$G = ((WZ)'(VZ)'(UVW')'(U'VW)')' \quad (4)$$

Please refer to Figure 2.

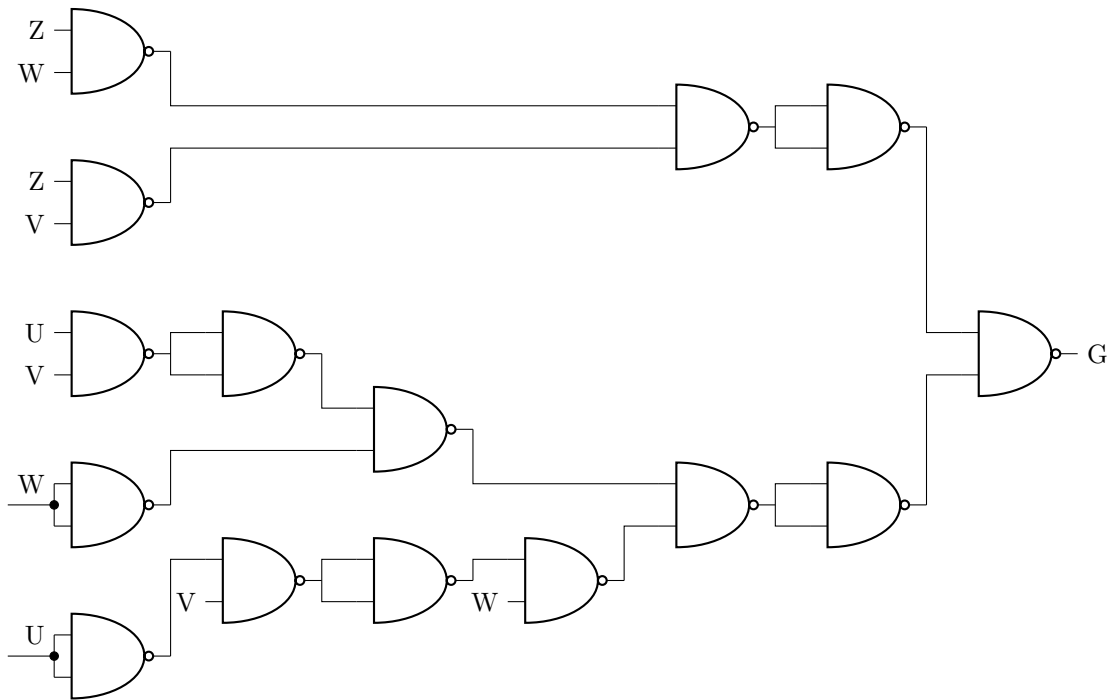


Figure 2: Logic circuit using NAND gate