

Assignment -2

1) Introduction

In this lab we have basically written VHDL code for BCD/H to 7 Segment Decoder conversion, which is finally feed to 7 Segment LED Display which then represents 0 – 15 value.

4 Switches are used to represent 4 bit values.

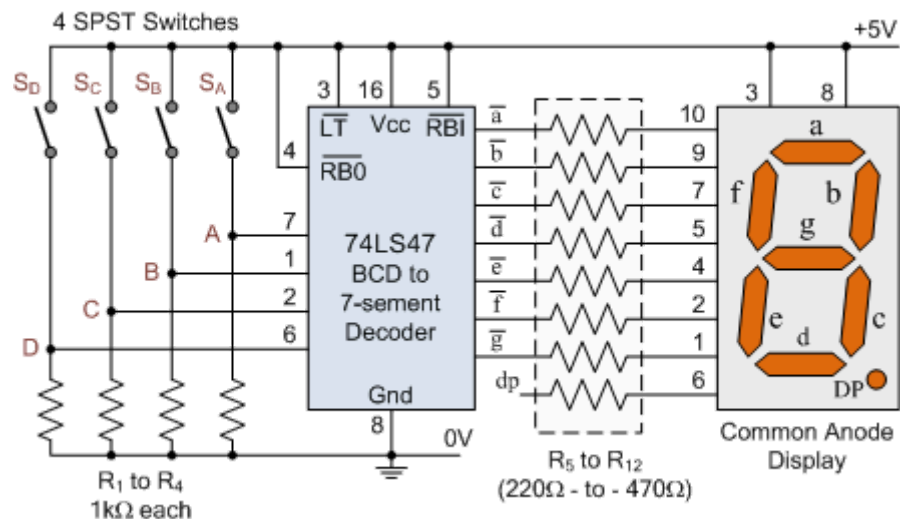


Fig 1: Common Anode type 7 Segment Display

In Common Anode type all anodes of & LED's are connected to + Vcc/ground and LED's show a digit when "LOW" signal is supply to individual cathodes.

Here we have used 7 segment display to represent Hexadecimal value (0 to 15) for given input bit (4 bit value).

2) Derivation of boolean expression using K map reduction

Boolean Expression for 7 segment decoder output.
Using K-Map

1)

AB \ CD	00	01	11	10
00	0	0	0	1
01	0	0	0	0
11	0	1	0	0
10	1	0	1	0

$$a = \bar{A}\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D}$$

2)

AB \ CD	00	01	11	10
00	0	0	1	0
01	0	0	1	1
11	0	1	1	0
10	0	0	0	1

$$b = ABC + \bar{A}BC + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD$$

3)

AB \ CD	00	01	11	10
00	0	0	1	0
01	1	0	1	0
11	0	0	1	0
10	0	0	0	0

$$c = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{C}D + BCD$$

4)

AB \ CD	00	01	11	10
00	0	0	0	1
01	0	1	0	0
11	0	0	1	1
10	1	0	0	0

$$d = ABC + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}\bar{C}D$$

5)

BC \ AB	00	01	11	10
00	0	0	0	1
01	0	0	0	0
11	1	0	0	1
10	1	1	0	1

$$e = \overline{A}\overline{D} + A\overline{B}\overline{C} + \overline{B}C\overline{D}$$

6)

CD \ AB	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	0	0	1
10	1	0	1	0

$$f = A\overline{B}CD + B\overline{C}\overline{D} + A\overline{C}\overline{D} + AB\overline{D}$$

7)

CD \ AB	00	01	11	10
00	1	0	1	0
01	0	0	0	0
11	0	0	0	1
10	1	0	0	0

$$g = \overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}CD + AB\overline{C}\overline{D}$$

Fig 2: K map reduction for a, b, c, d, e, f and g LED segments

3) Simulation Waveform for 7 segment Display

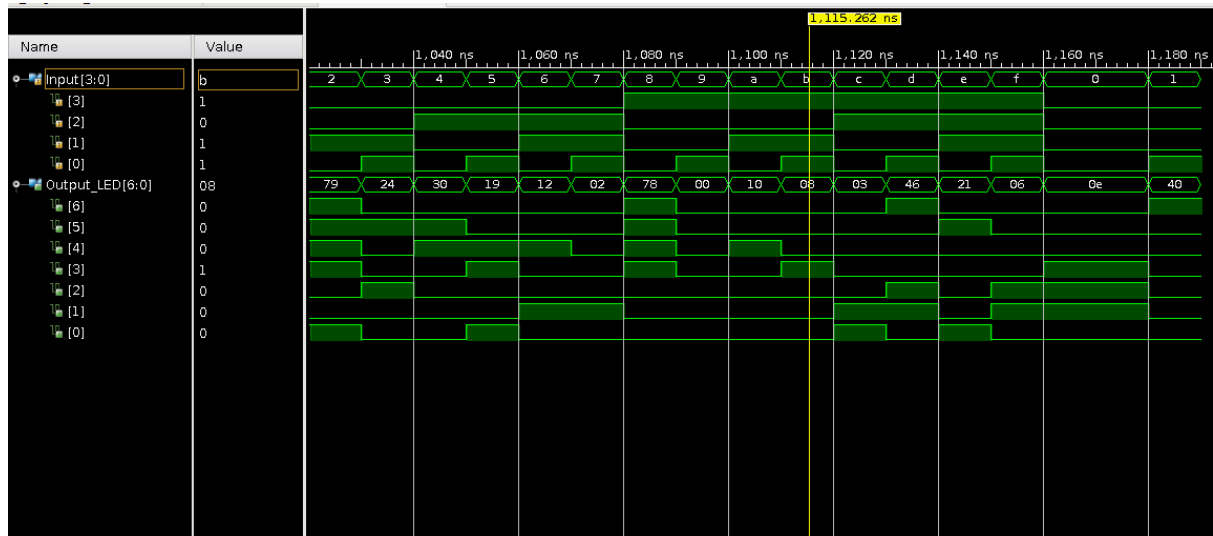


Fig 3 : Waveform of Input and Output of 7 segment display

4) Digital Circuit for 7 Segment Display for displaying hexadecimal value

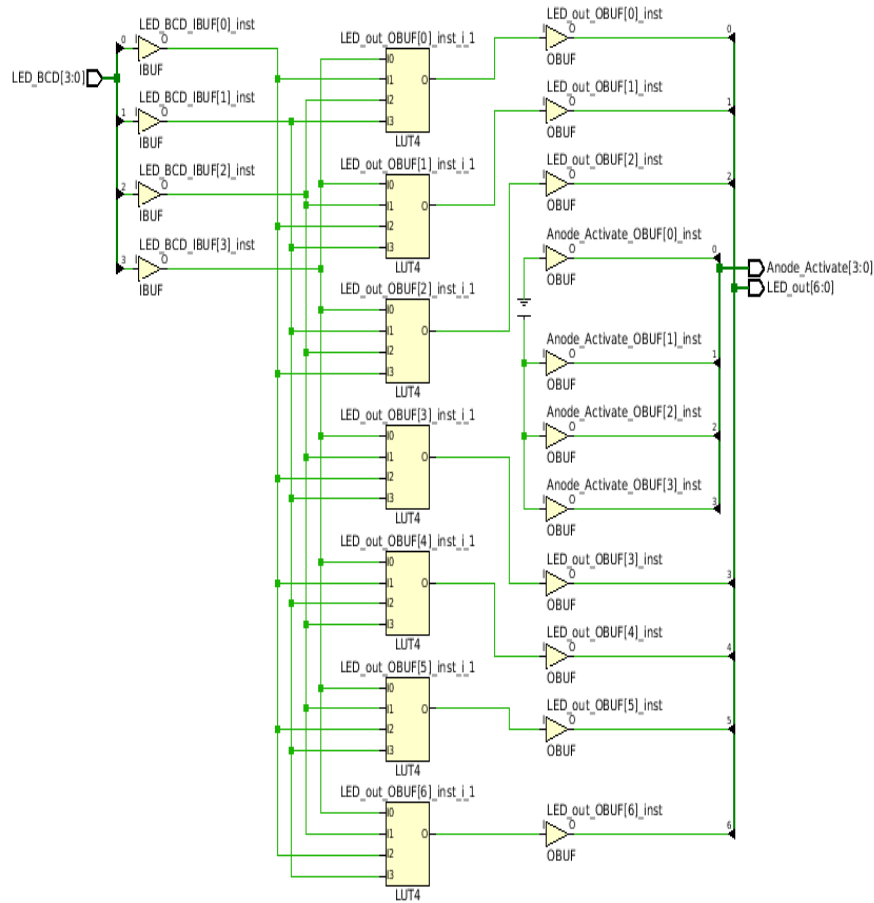


Fig 4: Digit Circuit of 7 segment display for hexadecimal value (0 – 15)

5) Resource Utilisation

- a) LUT Memory =0
- b) LUT logic = 7
- c) DSP =0
- d) Flip Flops =0
- e) BRAM = 0

6) Some other relevant diagram for resource utilisation

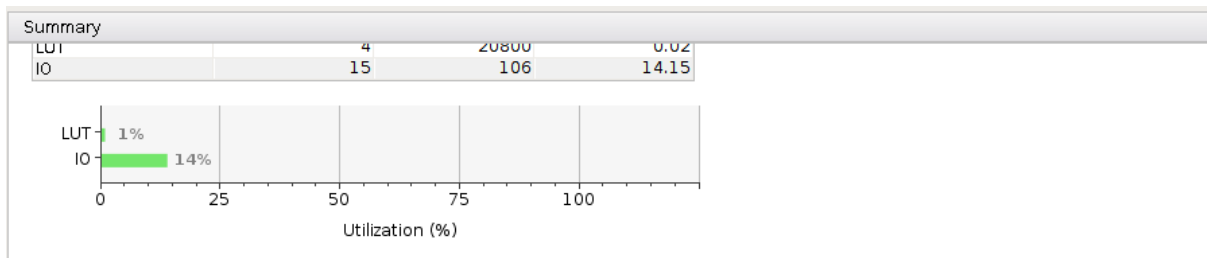


Fig 5 : Summary

Primitives		
Ref Name	Used	Functional Category
OBUF	11	IO
LUT4	7	LUT
IBUF	4	IO

Fig 6: Primitives