

• Objectives:

- 1) Building a hex to seven segment display decoder.
- 2) Building a 16 key keypad that outputs the corresponding hex value in binary form on LEDs.

• Components:

- Resistors.
- Capacitors.
- Switches.
- 4 LEDs.
- 7 segment display.

- ICs:

- 35 And gates.
- 7 Or gates.
- 5 Hex inverters.
- 555 Timer.
- 74161 synchronous 4-bit counter.
- 74374 D type Flip Flop Chip.
- 74154 Decoder.

• Procedure:

1) Hex to 7 segment display:

First, we need to design the logic circuit, so we draw a truth table:

Inputs				Segments							
A	B	C	D	a	b	c	d	e	f	g	
0	0	0	0	1	1	1	1	1	1	0	For display 0
0	0	0	1	0	1	1	0	0	0	0	For display 1
0	0	1	0	1	1	0	1	1	0	1	For display 2
0	0	1	1	1	1	1	1	0	0	1	For display 3
0	1	0	0	0	1	1	0	0	1	1	For display 4
0	1	0	1	1	0	1	1	0	1	1	For display 5
0	1	1	0	1	0	1	1	1	1	1	For display 6
0	1	1	1	1	1	1	0	0	0	0	For display 7
1	0	0	0	1	1	1	1	1	1	1	For display 8
1	0	0	1	1	1	1	1	0	1	1	For display 9
1	0	1	0	1	1	1	0	1	1	1	For display A
1	0	1	1	0	0	1	1	1	1	1	For display b
1	1	0	0	1	0	0	1	1	1	0	For display C
1	1	0	1	0	1	1	1	1	0	1	For display d
1	1	1	0	1	0	0	1	1	1	1	For display E
1	1	1	1	1	0	0	0	1	1	1	For display F

The use k-map for each segment, for example section 'a':

		CD			
		C'D'	C'D	CD	CD'
AB	00	0 1	1 	3 1	2 1
	01	4 	5 1	7 1	6 1
11	11	12 1	13 	15 1	14 1
10	10	8 1	9 1	11 	10 1

We do the same for the remaining 7 segments until we reach the following Boolean expressions:

$$a = A'C'D' + A'CD + AC'D + B'C' + B'D'$$

$$b = A'C'D' + A'CD + AC'D + B'C' + B'D'$$

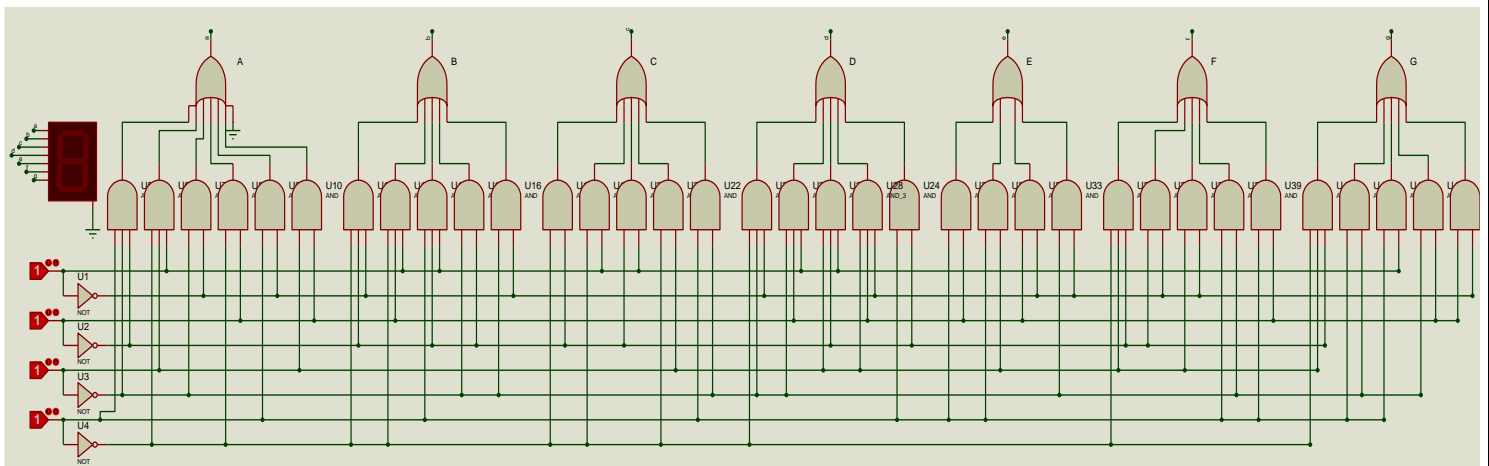
$$c = A'C' + A'D + C'D + A'B + AB$$

$$d = A'B'D' + B'CD + BC'D + BCD' + AC'$$

$$e = B'D' + CD' + AC + AB$$

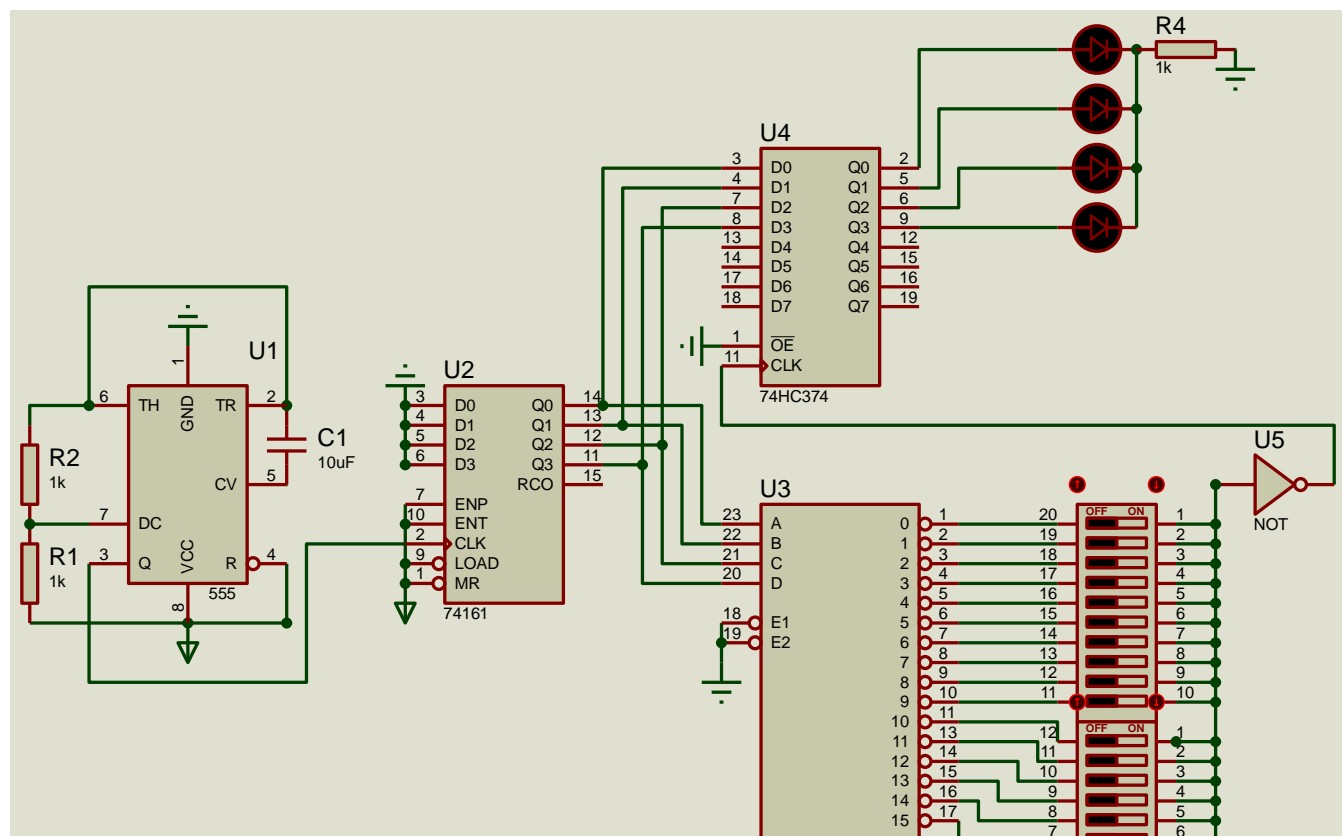
$$f = A'BC' + C'D' + BD' + AB' + AC$$

Now we can connect the components:



We connect the components as follows:

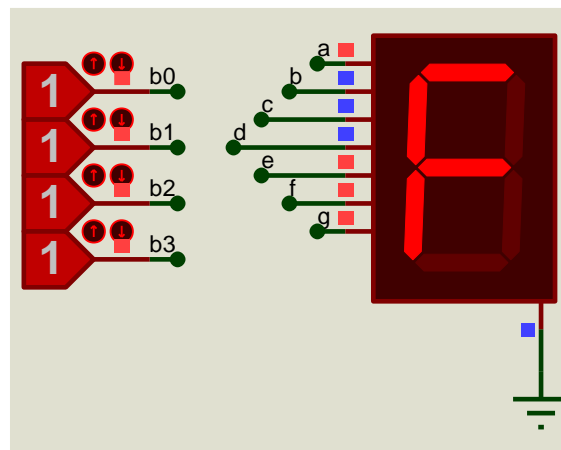
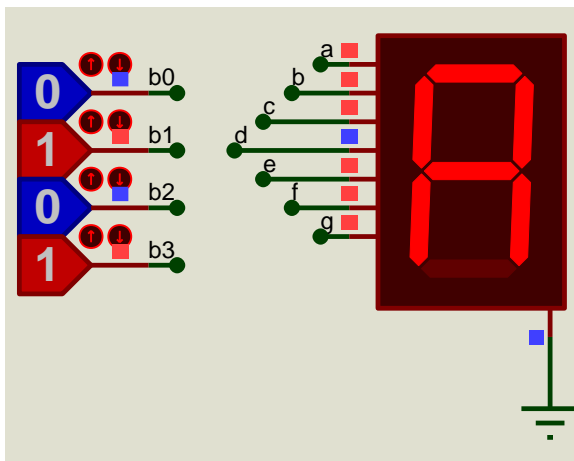
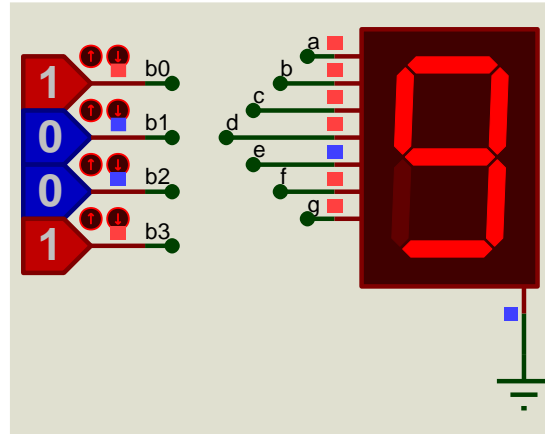
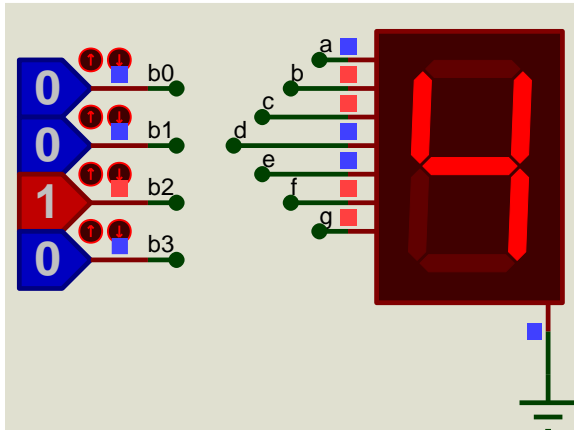
We connect the components as follows:



• Results:

1) Hex to 7 segment display:

We input the desired hex value in binary using the 4-bit input
And the 7-segment display will display said value in hex.



2) 16 input keypad to hex:

We switch on the switch corresponding to the desired hex value and the leds will light up with the corresponding binary value:

