Royal university of Phom Penh

Faculty of engineering

1st Year

Design 7 segment with logic gate report

Abstact

To begin with, in this project I will show all of you and prompt strategies to design 7 segment circuit,and it is my first project and experiment to do this project.some of you excaltly realize what 7 segment is.so in processing of constructing this project has plenty of steps to make it up successfully.so I am about to illustrate everyone how 7 segment build.firstly,we were neccessary to create one table containing all of the information about your 7 segment's processing such as (Binary code dicimal),Dicimal representation,(1,2,3,4,5,6,7,8,9) and each segment like (a,b,c,d,e,f,g) standing for each segment of 7 segment.secondly, we listed all the item product that had the value is 1 and combine it together.Afterward,we utilized Kanaugh-Map technique to normalize all of expressions in each segment.The last step, we were mixture all expressions of each segment which had already simplified to gether so as to make our desirable result,which our result made it display dicimal number from 0(zero) to 9 (nine).particularly, we used some software to construct and display our project.otherwise,we obviously could not do it.The software that we utilized was Proteus which is very easy to use and so cool for designing 7 segment.

Introduction

As you can see in our daily life everything is almost use technologies and electronical items.especially ,most of our products that always consume everyday come from electronical divices made by logic gate and combine it as a specific circuit to perform a particular task such as representation information of electronical divice so on.I strongly believe that , everyone commonly see all the items made by electronical device consisting 7 segment like traffic light, timer,microwave,calculator,smart watch, car panel control and everything.so what is 7 segment? 7 segment is a electronical digital device that we made it from complicated logic gate(you will learn about it in next section) which played a vital role to represent the number sign or Alphabetical representation in electronical device. Independent on what I have already got you across above.clearly,you will be still unsure how 7 segment works and constructs it. In the following step you are going to get the hang of doing it undoubtedly.

Experiment

Four binary digits				Decimal representation	Illumination of each each segment						
A	B	C	D		a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	1	0	1	1	0	0	0	0
0	0	1	0	2	1	1	0	1	1	0	1
0	0	1	1	3	1	1	1	1	0	0	1
0	1	0	0	4	0	1	1	0	0	1	1
0	1	0	1	5	1	0	1	1	0	1	1
0	1	1	0	6	1	0	1	1	1	1	1
0	1	1	1	7	1	1	1	0	0	0	0
1	0	0	0	8	1	1	1	1	1	1	1
1	0	0	1	9	1	1	1	1	0	1	1
1	0	1	0	A	1	1	1	0	1	1	1
1	0	1	1	B	1	1	1	1	1	1	1
1	1	0	0	C	1	0	0	1	1	1	0
1	1	0	1	D	1	1	1	1	1	1	0
1	1	1	0	E	1	0	0	0	1	1	1
1	1	1	1	F	1	1	1	1	1	1	0

Repeatedly, in this case, we only focus on using 7 segment to display number from (0 -9).

Initially, We listed Product terms of each segment which those Product terms have only value is 1 ,and then we used approach of Disjunctive Normal Form(DNF) to merge those product items of each segment together.

Segment (a) F = A'B'C'D'+A'B'CD'+A'B'CD+A'BC'D+A'BCD'+A'BCD+AB'C'D'+AB'C'D

Segment (b) F= A'B'C'D'+A'B'C'D+A'B'CD'+A'B'CD+A'BC'D'+A'BCD+AB'C'D'+AB'C'D

Segment (c) F= A'B'C'D'+A'B'C'D+A'B'CD+A'BC'D'+A'BC'D+A'BCD'+A'BCD+AB'C'D'+AB'C'D

Segment (d) F= A'B'C'D'+A'B'CD'+A'B'CD+A'BC'D+A'BCD'+AB'C'D'+AB'C'D

Segment (e) F= A'B'C'D'+A'B'CD'+A'BCD'+AB'C'D'

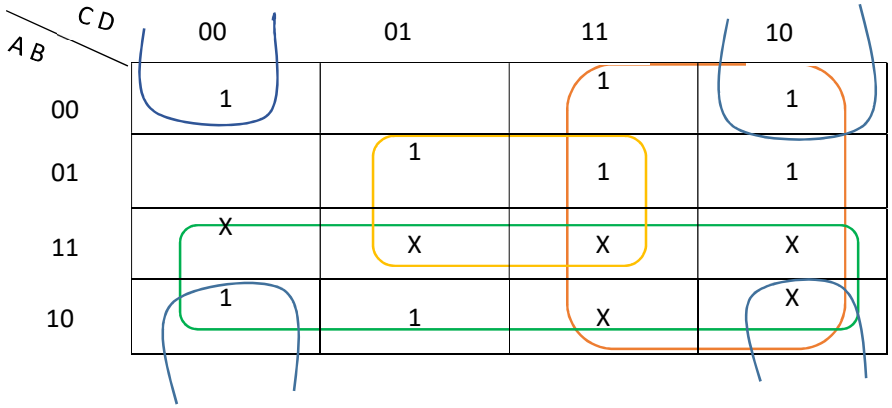
Segment (f) F= A'B'C'D'+A'BC'D'+A'BC'D+A'BCD'+A'B'C'D'+AB'C'D

Segment (g) F= A'B'CD'+A'B'CD+A'BC'D'+A'BC'D+A'BCD'+AB'C'D'+AB'C'D

Since a Boolean Expression of each segment was very complex to build it into a circuit and haa a difficulty to understand about it.therefore we utilized a Knaugh-Map Method to normalize our expression to be a simply expression that we were able to notice it and save up using logic gate to construct it as a particular circuit.

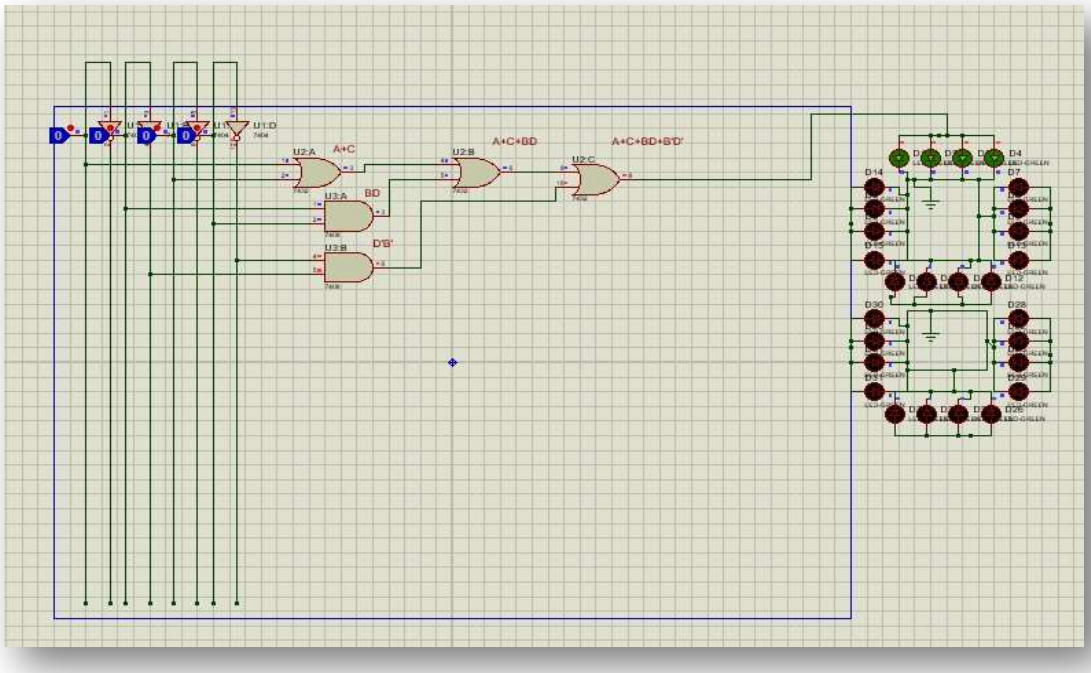
- Simplification by kanaugh Map (K-map) method in the performance following:

  - Segment (a)



Segment (a) F= A + C + BD + B'D'

This is a Verification of segment (a) in Proteus :

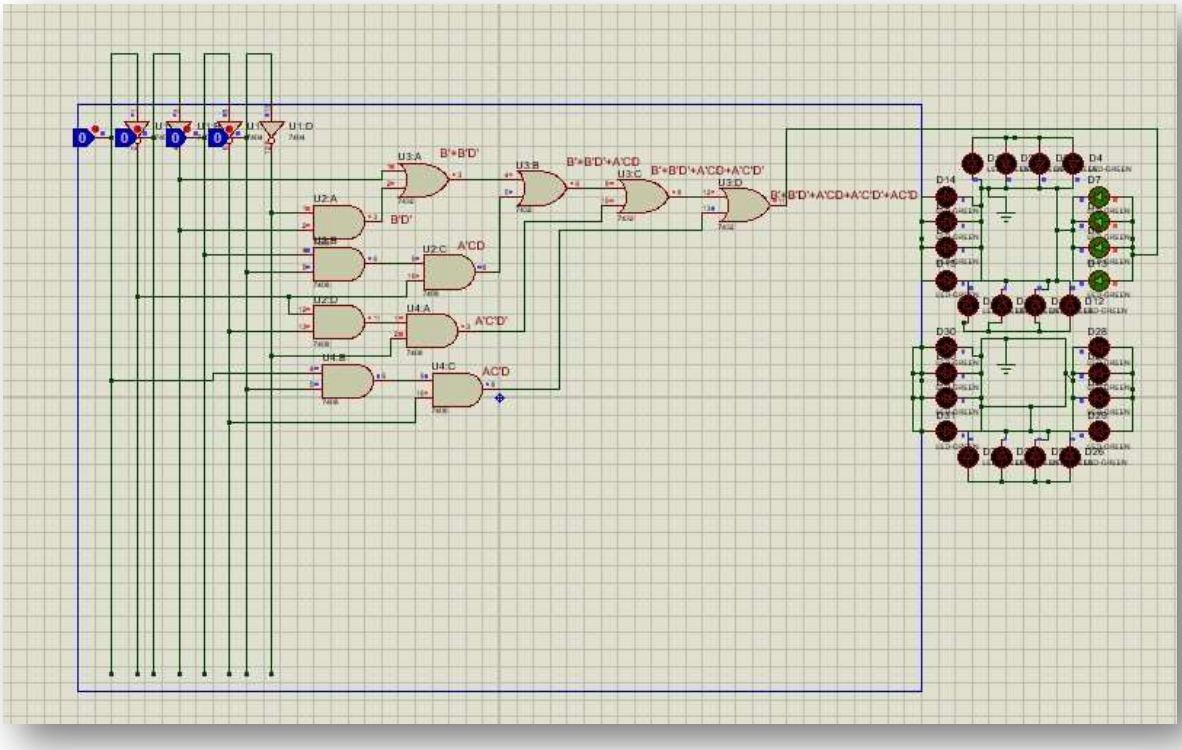


- Segment (b)

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

Segment (b) F=B’+A’C’D’+A’CD+AC’D

This is a verification in proteus :

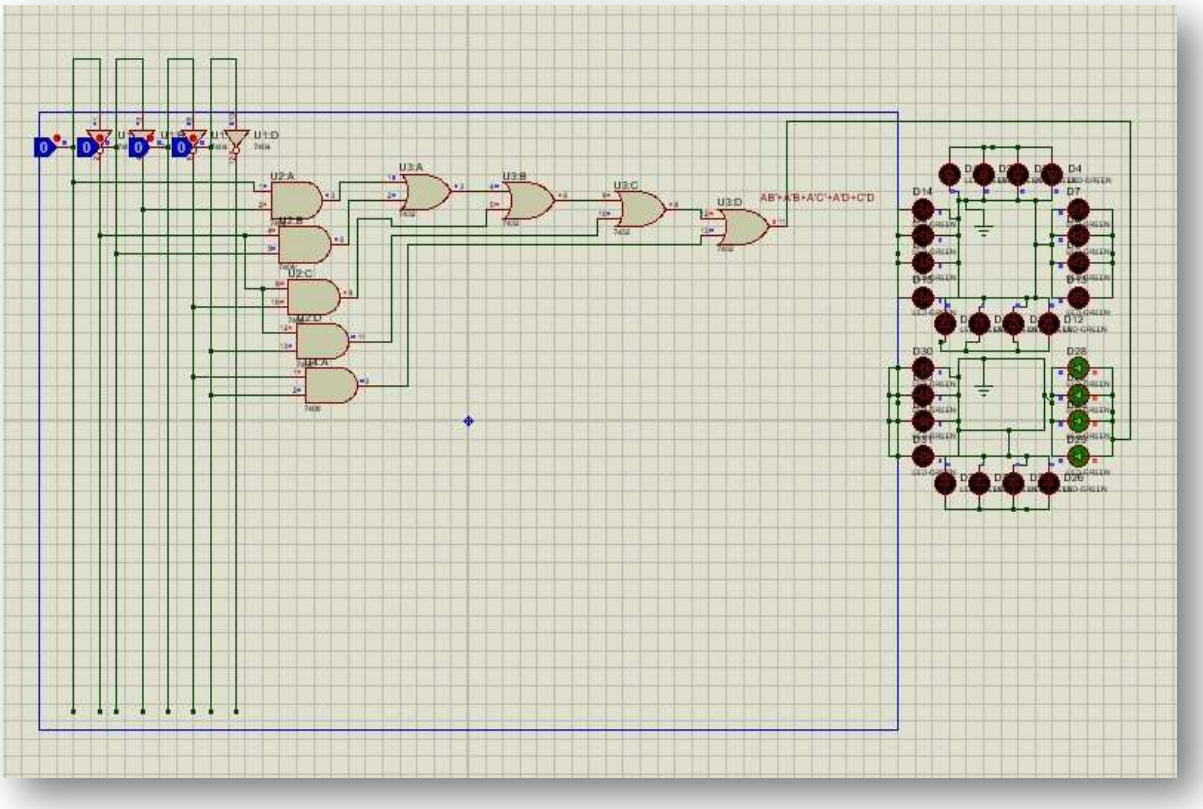


Segment (c)

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

Segment (c) F=AB'A'B+A'C'+A'D+C'D

This is a verification of segment (c) in proteus:

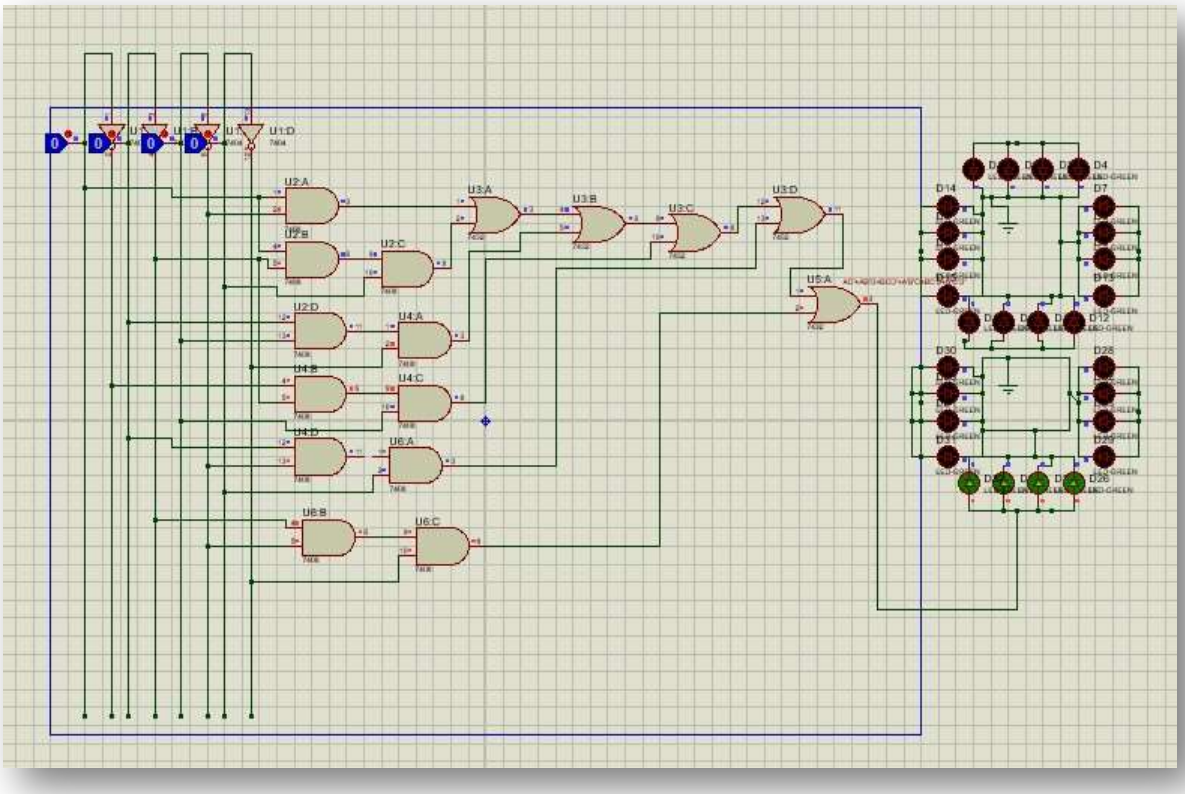


- Segment (d)

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

Segment (d) F=AC'+AB'D+BCD'+A'B'C+BC'D+B'C'D'

This is our a verification of segment(d) in proteus :

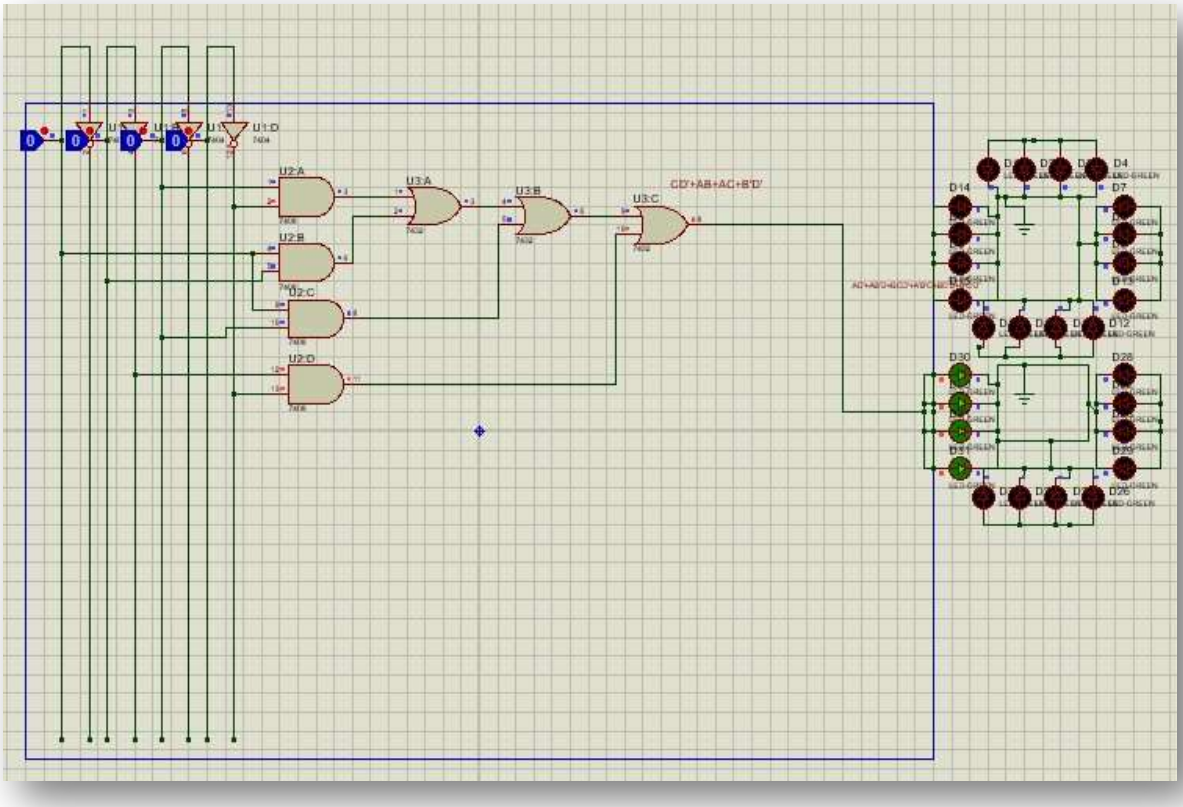


- Segment (e)

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

Segment (e) F= CD'+AB+AC+B'D'

This is a verification of segment (e) in proteus:

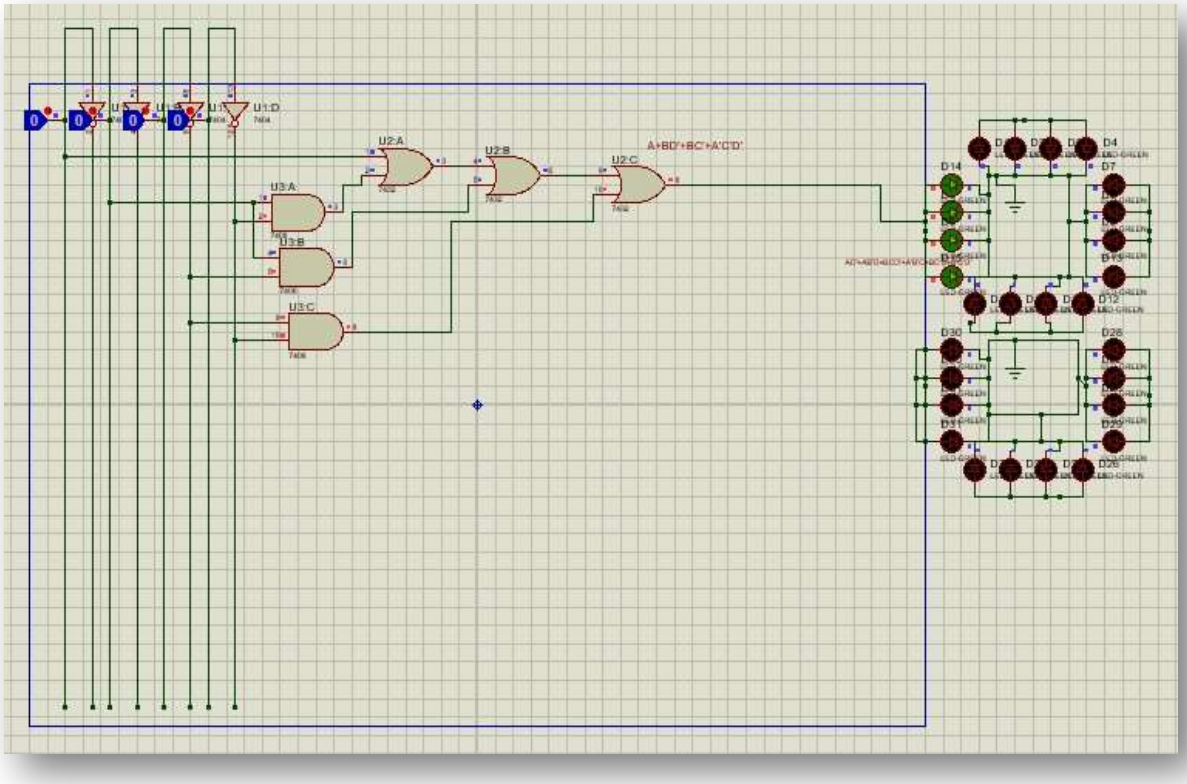


- Segment (f)

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

Segment (f) F= A + BD'+BC'+C'D'

This is a verification of segment

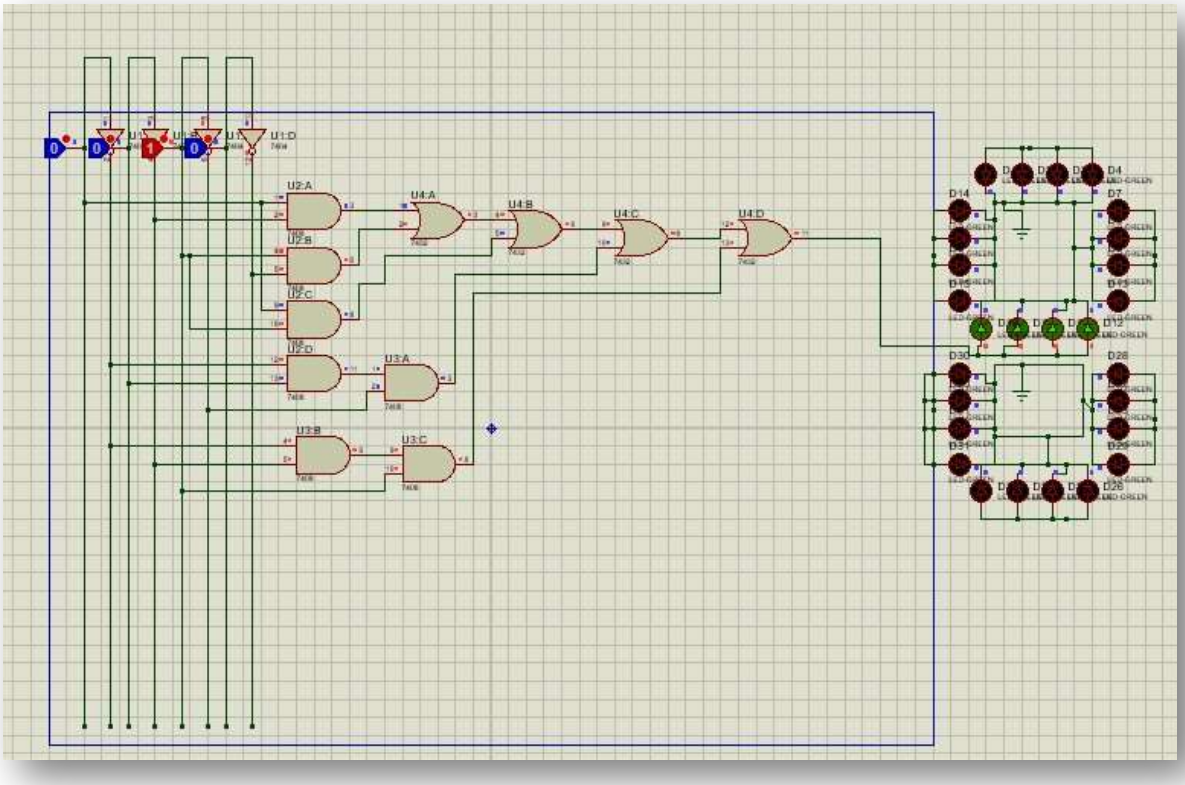


- Segment (g)

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

Segment (g) F=AB'+CD'+AC+A'BC'+A'B'C

This is a verification of segment (g) in proteus :



Results

So I made all of the hypotheses from each segment which had already demonstrated above to collect them to a specific desirable result.

Figure 1 we merged them to represent a number " 1 " as you saw it below:

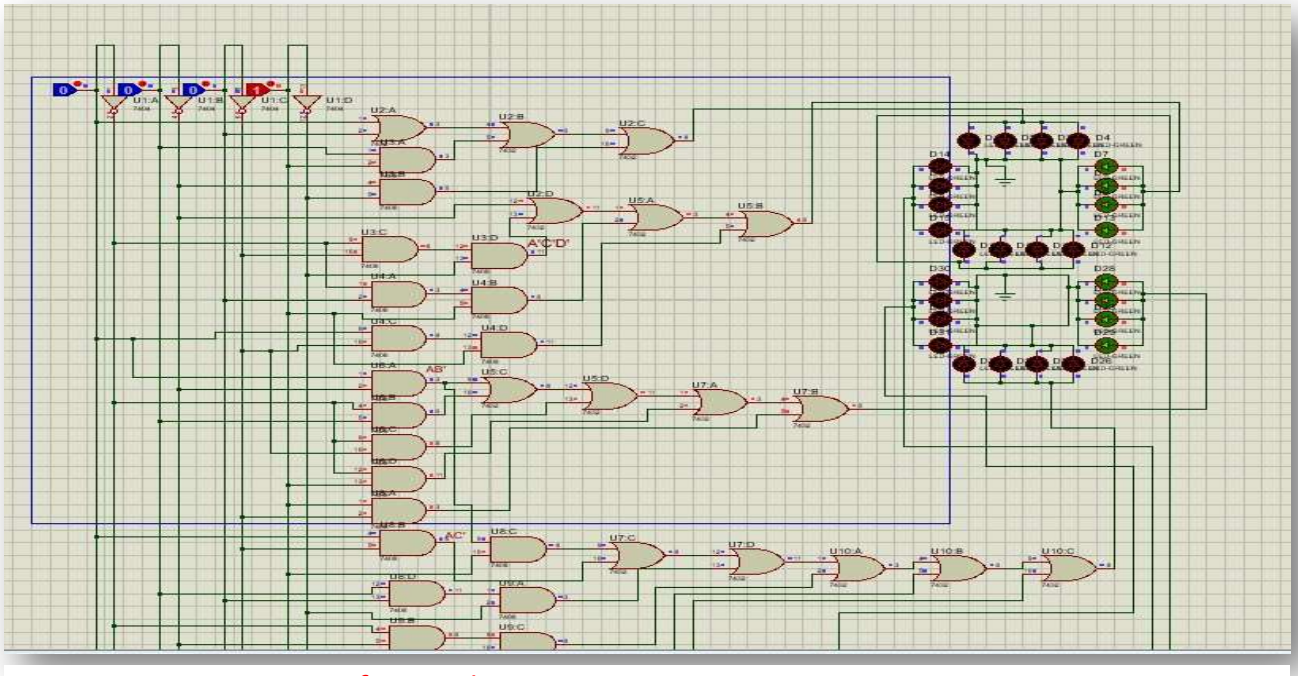


Figure 1: representation for number 1

Figure 2 we merged them to represent a number " 2 " as you saw it below:

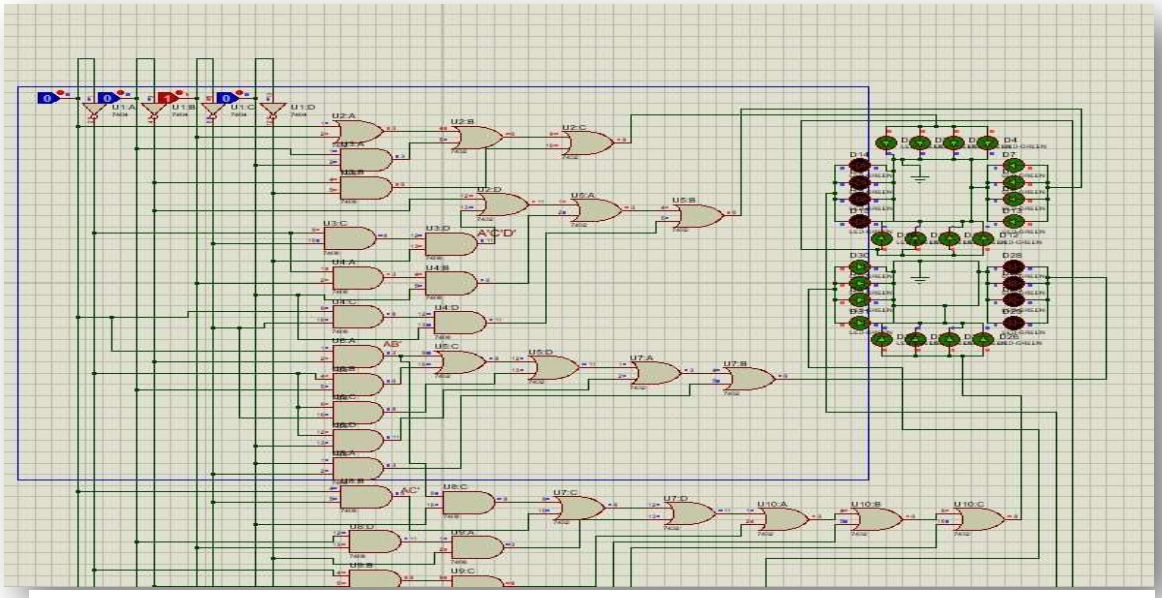


Figure 2: representation for number 2

Figure 3 we merged them to represent a number " 3 " as you saw it below:

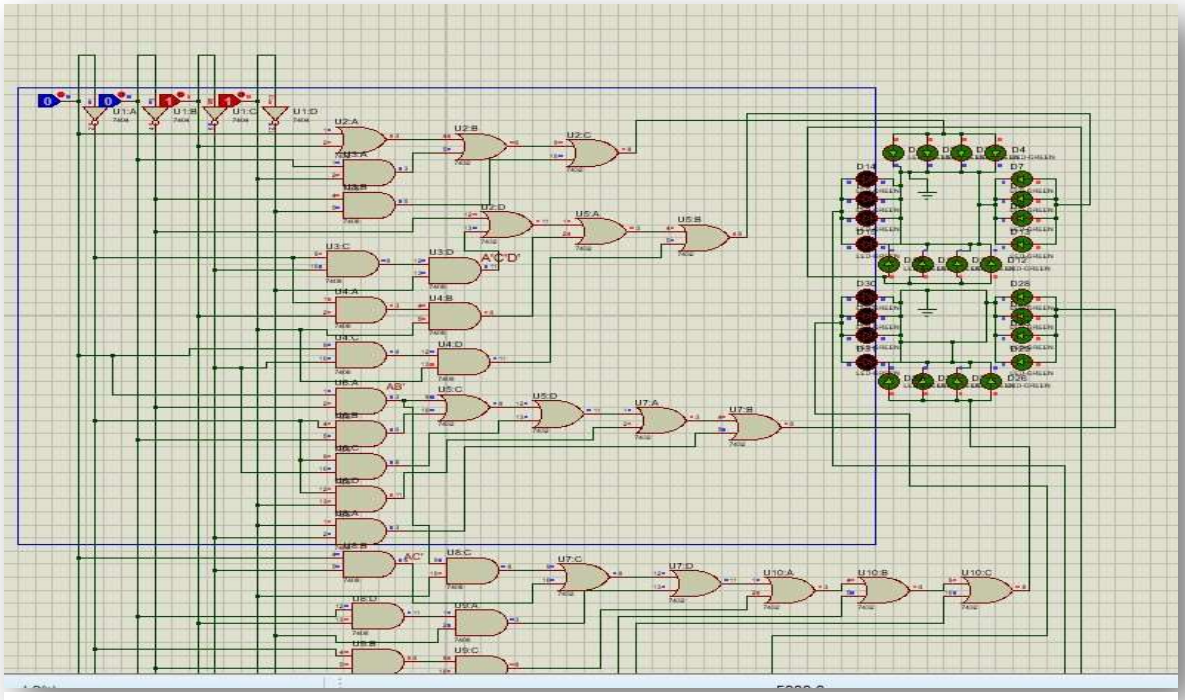


Figure 3: representation for number 3

Figure 4 we merged them to represent a number " 4 " as you saw it below:

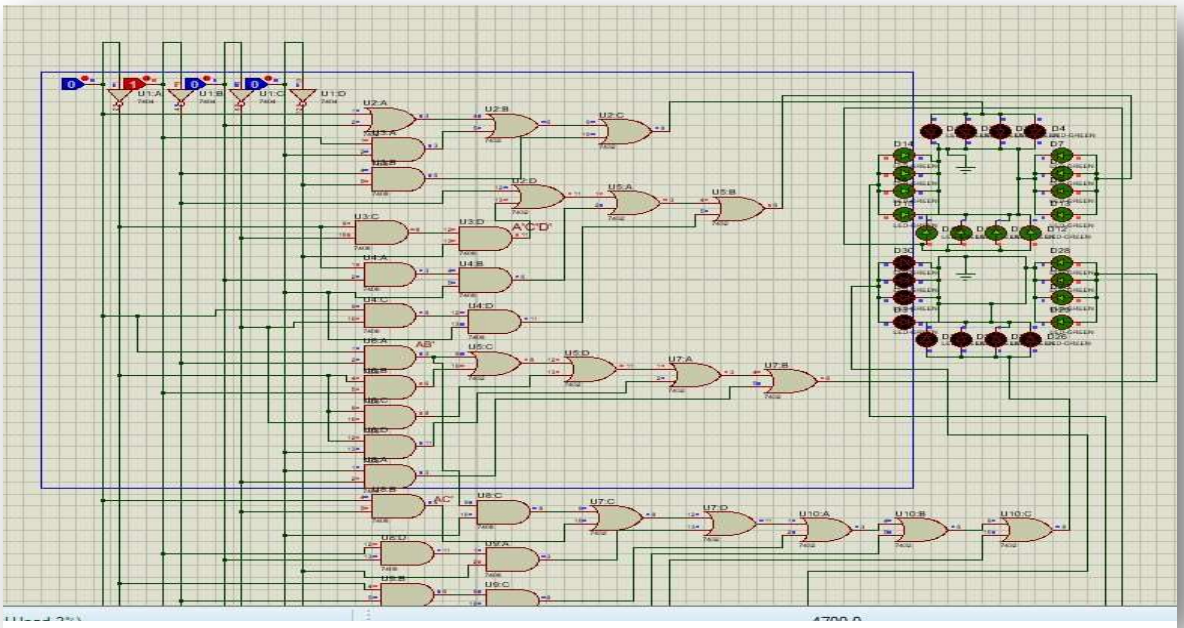


Figure 4: representation for number 4

Figure 5 we merged them to represent a number " 5 " as you saw it below:

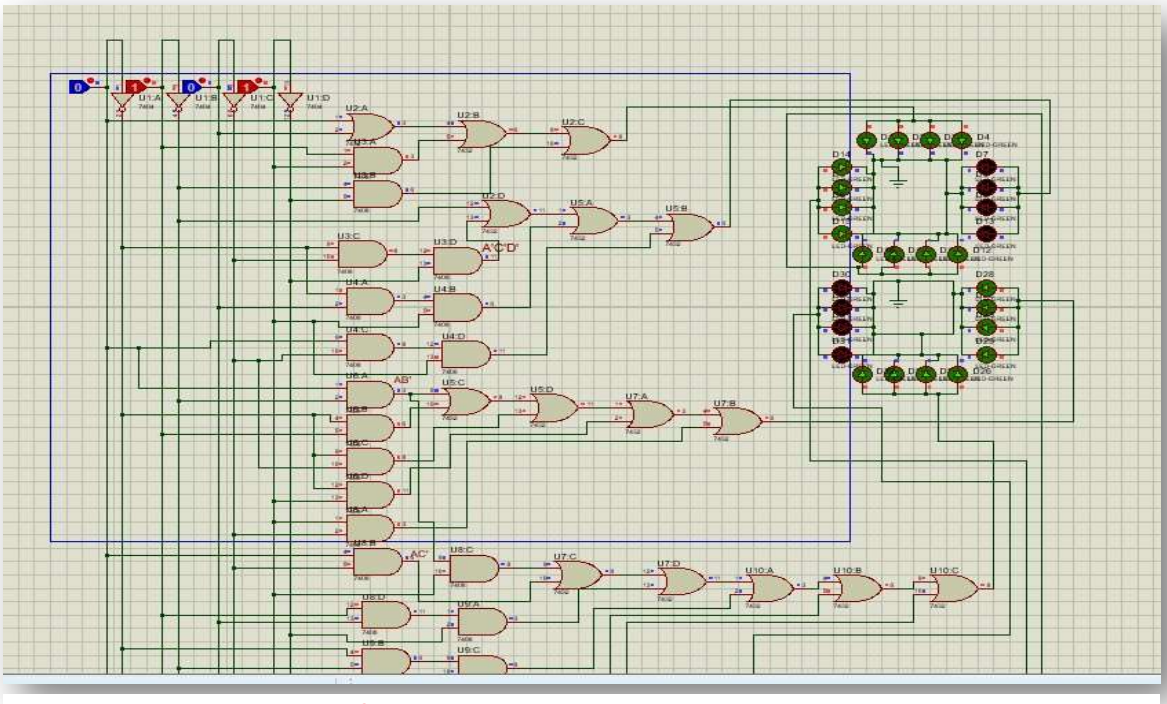


Figure 5: representation for number 5

Figure 6 we merged them to represent a number " 6 " as you saw it below:

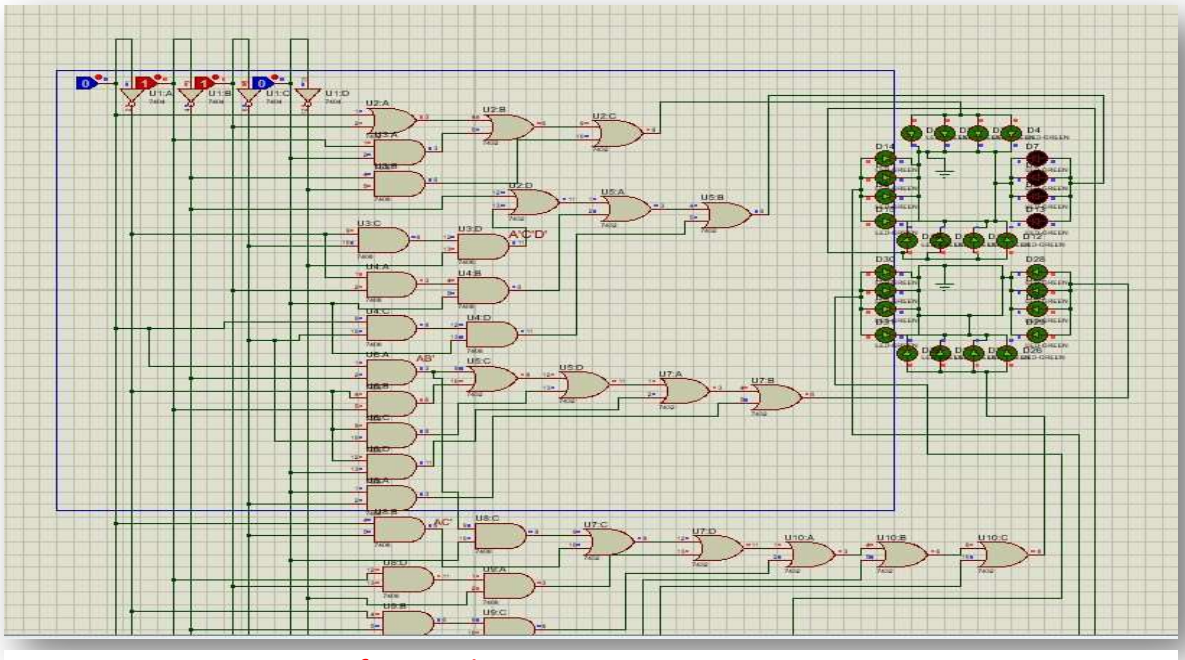


Figure 6: representation for number 6

Figure 7 we merged them to represent a number " 7 " as you saw it below:

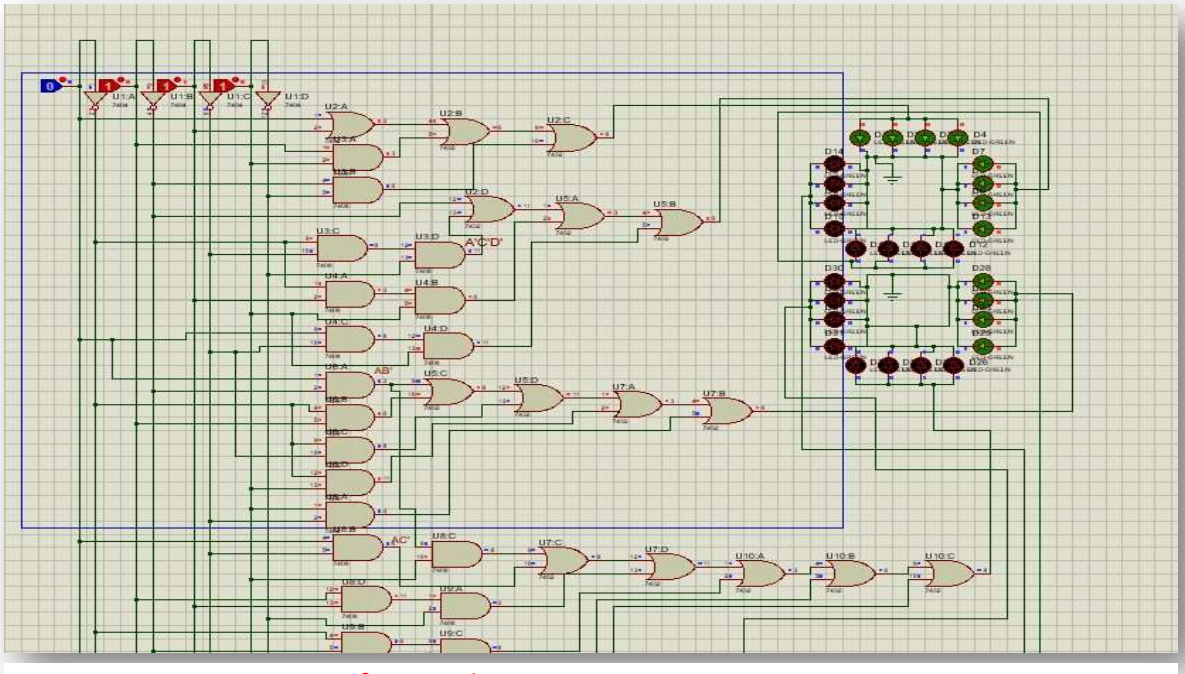


Figure 7: representation for number 7

Figure 6 we merged them to represent a number " 6 " as you saw it below:

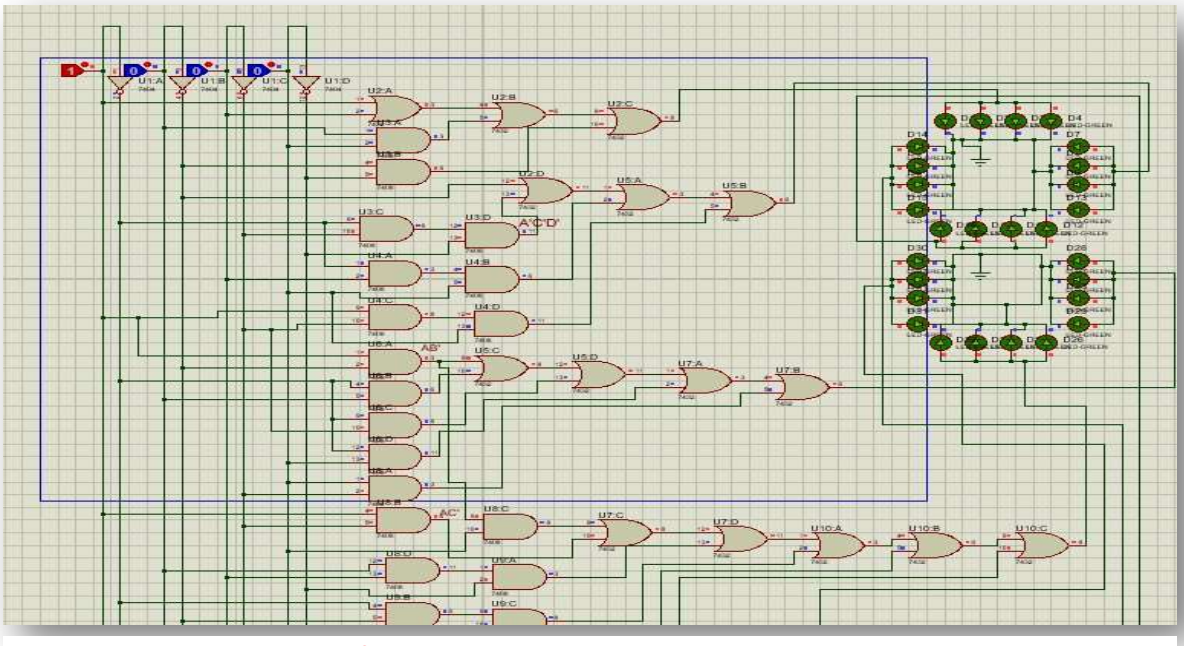


Figure 8: representation for number 8

Figure 9 we merged them to represent a number " 9 " as you saw it below:

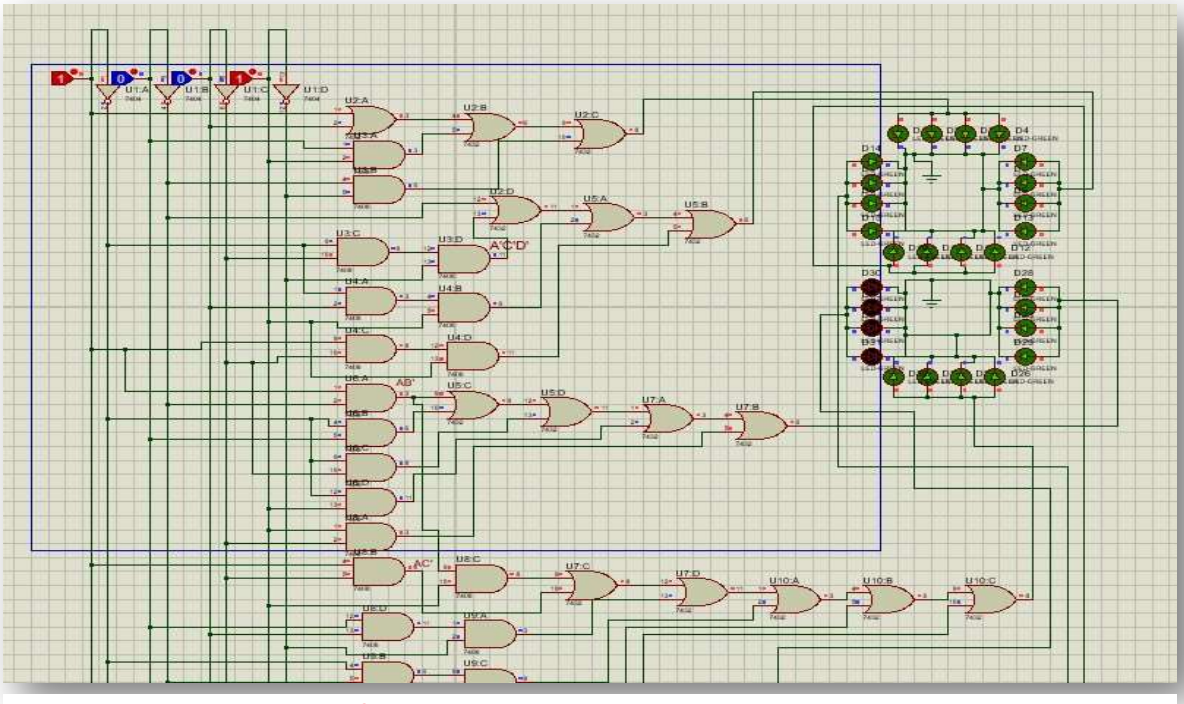


Figure 9: representation for number 9

Discussion

In this experiment, firstly , we created one table containing the elements of 7 segment such as , *Binary code decimal* (BCD) which meant we used four binary bits to stand for decimal digits(a *nibble* represent for one decimal digit).in fact, the real experiment we utilized four switches to represent for a nibble that had state as binary if it turned on or(true) , it shown us that it had a value" 1".otherwise , it had the value "0" when it turned off (false).we,furthermore, had to have a part that represented for decimal numbers like 1,2,3.....,9 which it made us easy to trace and understand of processing between the nibble representation and decimal representation and ensure that both of them were matched when started our binary code decimal,It absolutely output the decimal number which was symethric.For instance, when we wanted to display number "1" in decimal number , you had to generate binary code decimal as 0 0 0 1 so on.Beside, we had 7 colunms that standed for each segment namely, segment a , segment b,.....until segment g.

Each segment storing a vulue of a product term, which had only two value of them 1 and 0. In this case, It was able to be complex a bit owing to the value of each product term. You could not assign the value to each segment by your own.contrarily,you obserb of each segment that required to illuminate.For example to easily understood of it, when we wanted number 1 display , so which segments that were combined together in order to produce number 1 display? The answer is that there were only two segments that had to mix each other so as to generate number 1 are segment b and segment c.therefore when segment b and segment c required to process to illuminate two segment to be light appearing number 1 in decimal number, a couple of product term were assign the value 1 which meant that they had to turn on to collect two segments each other to produce output number 1,and other numbers representation also follow this method.secondly,we collasped all of expressions that required each segment to dispaly to one expression which meant that one segment could represent different numbers in decimal number ,for example segment "a" it take charge of representing all the time when number 0 , 2 , 3 , 5,6,7,8 9 needed to dispaly, so it had a lot of cases that were essential segment "a " to display.In general ,The best ways to adjuct this problem we combined to one expression, also other segments had to be mixture of thier expressions each other as we explained you above.Remind that each segment that required to combine is boolean expresion.

Boolean expression come from collection of boolean variable.you must notice that whichever segments needed to combine to an expression you combine which their expressions had the value of product term is 1 .otherwise we didn't need them.As you could see in above table we chose which product term that had the value 1 to make an expression and then we merged all of the expressions containing the value 1 totherger (we implemented this method all of segments (1-7)). You would see "+" sign in our boolean expression showing that we used *disjunctive normal form operator* to combine all of expressions in a particular segment.

The last part , we could not use the whole of expressions to construct each segment

Because it had plenty of boolean expressions that we were difficult to build it,and it also required many logic gates.accordingly, we had two methods to make it convernient for understanding all of expressions.we simplified it by boolean algebra law and K-naugh Map (K-Map).in this case, we normalized it by K-map because K-map is very powerful to perform with simplifying of boolean expressions.so, we followed this approach for segments" a" till the last segment.in the end,we took the result in each segment to build it up in proteus.undoubtedly,we got the desirable result as we had expected(1,2,3.....,9).consequently, if we switched on 0 0 0 1 in (BCD) It produced number 1, 0 0 1 0 it produed number 2 ,.....1 0 0 1 it produced number 9.

conclusion

in summary, what we wanted 7 segment to display is decimal number that could represent from number 1 to number 9, and each segment of 7 segment

had to illuminate when it met the cases that required to display.espcially, binary code decimal representation must be matched with decimal representation.in brief, you can play your own style by using 7 segment to display any case that you want such as , alphabets and some of special symbols so on. Keep up with your project .

Reference

Book reference : Mathematic of electronical engineering

Source reference:
https://www.tutorialspoint.com/digital_circuits/digital_circuits_k_map_method.htm

Video demo : https://www.youtube.com/watch?v=OhArQhoHQJA&t=6s