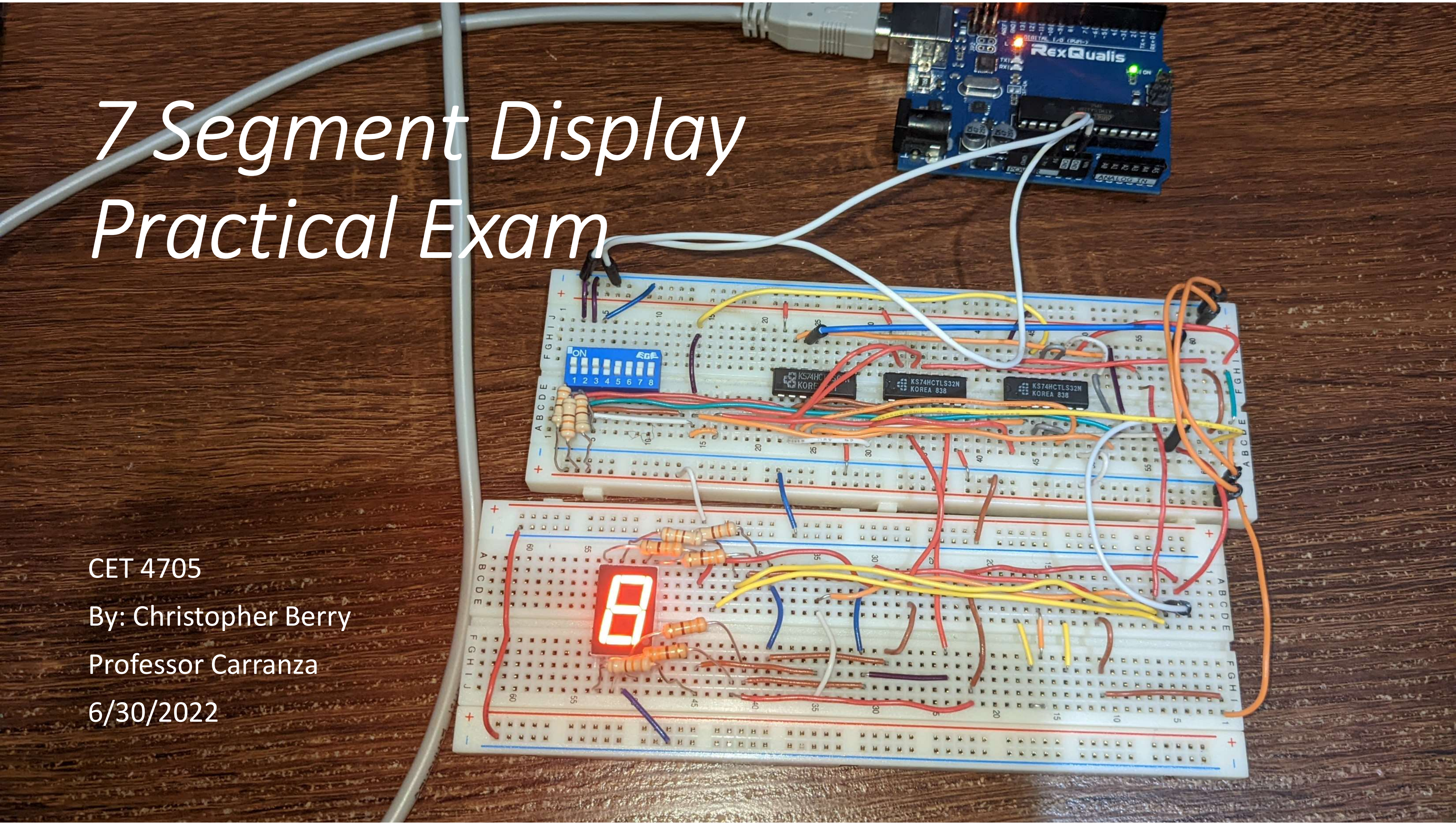
7 Segment Display Practical Exam



CET 4705

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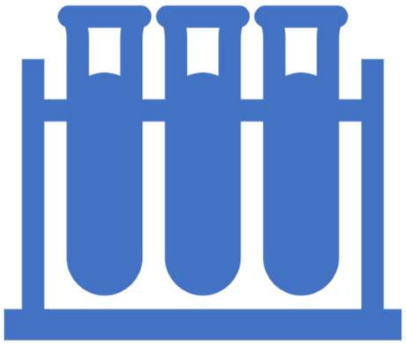
Outline

- Introduction
- Steps taken
- Conclusion
- Reference



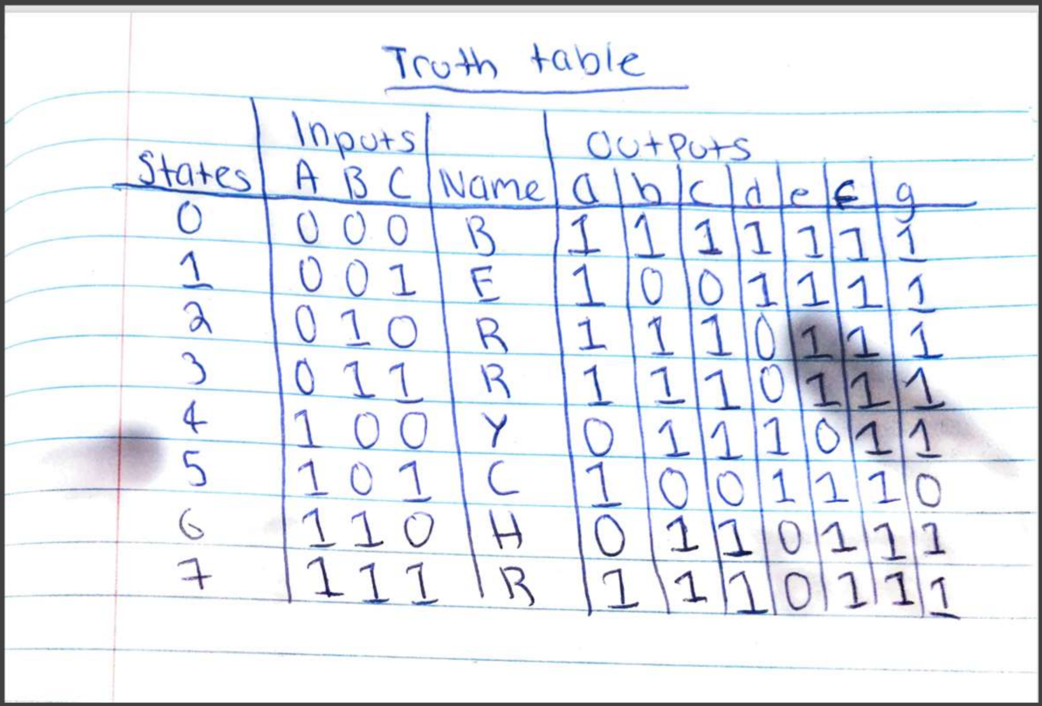
Introduction

- This Laboratory experiment, I was to display my name using a 7-segment display.
- Using knowledge logic gates and truth tables, I was to find the correct Boolean expressions that would fill up the segments for the display to properly display one letter at a time

Logistics

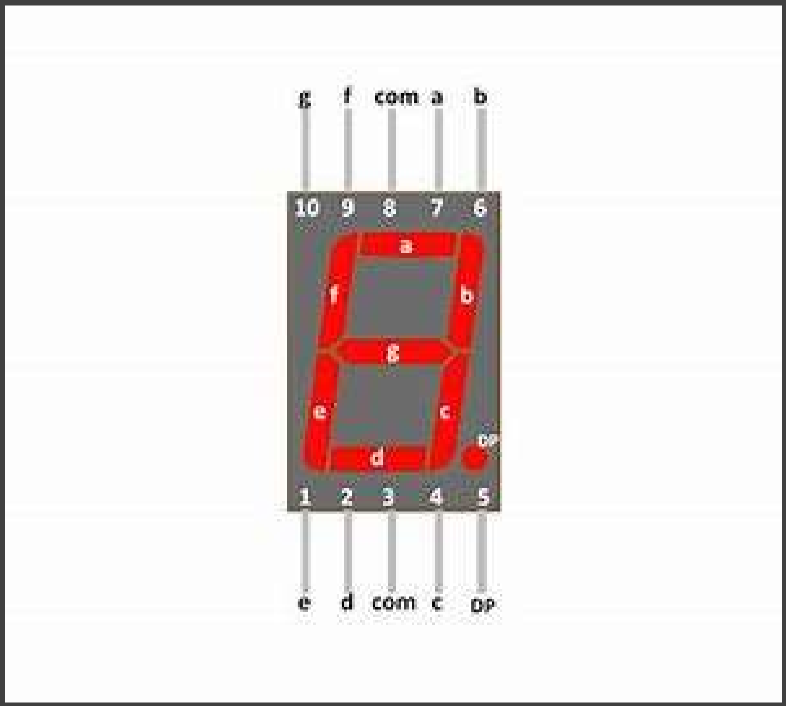
- *First step was to create the truth table.*
- *Once I had the truth table and I knew the output would be accurate, I would need to simplify each segment for the 7-segment display to get the Boolean expression ensuring I get the desired output.*
- *To get accurate Boolean Expressions, I would next have to create the kmaps*
- *Now that I have my Boolean Expressions, I would have to go into design my circuit and simulate it to make that everything is ok before I get my logic gates.*
- *If everything is ok, I could then get my components.*
- *Now and only now do I begin to build the physical circuit.*
- *Last step would be to trouble shoot any issues and make sure that everything is very similar to the simulation that I ran beforehand.*

Truth Table



Truth table

States	Inputs A	B	C	Name	Outputs a	b	c	d	e	f	g
0	0	0	0	B	1	1	1	1	1	1	1
1	0	0	1	E	1	0	0	1	1	1	1
2	0	1	0	R	1	1	1	0	1	1	1
3	0	1	1	R	1	1	1	0	1	1	1
4	1	0	0	Y	0	1	1	1	0	1	1
5	1	0	1	C	1	0	0	1	1	1	0
6	1	1	0	H	0	1	1	0	1	1	1
7	1	1	1	R	1	1	1	0	1	1	1



Simplification

$F_a(A,B,C) = (4,6)$

$F_a = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + ABC$

$= \bar{A}\bar{B}(\bar{C}+C) + \bar{A}B(\bar{C}+C) + AC(\bar{B}+B)$

$\bar{A}\bar{B} + \bar{A}B + AC$

$\bar{A}(\bar{B}+B) + AC$

$\bar{A} + AC = \bar{A} + C$

$\underline{F_a = \bar{A} + C}$

$F_b(A,B,C) = (1,5) =$

$F_b = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + AB\bar{C} + ABC$

$= \bar{A}\bar{C}(\bar{B}+B) + BC(\bar{A}+A) + A\bar{C}(\bar{B}+B)$

$= \bar{A}\bar{C} + BC + A\bar{C}$

$= \bar{C}(\bar{A}+A) + BC = \bar{C} + BC$

$\underline{F_b = \bar{C} + B = F_c}$

$F_d(A,B,C) = (2,3,7) =$

$F_d = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + A\bar{B}C$

$= \bar{A}\bar{B}(\bar{C}+C) + A\bar{B}(\bar{C}+C)$

$= \bar{A}\bar{B} + A\bar{B}$

$= \bar{B}(\bar{A}+A)$

$\underline{F_d = \bar{B}}$

$F_e(A, B, C) = (4)$

$F_e = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$

$= \bar{A}\bar{B}(\bar{C}+C) + \bar{A}B(\bar{C}+C) + AB(\bar{C}+C) + AC(\bar{B}+B)$

$= \bar{A}\bar{B} + \bar{A}B + AB + AC$

$= \bar{A}(\bar{B}+B) + B(\bar{A}+A) + AC$

$= \bar{A} + B + AC = B + \bar{A} + C$

$\underline{F_e = \bar{A} + B + C}$

$F_f(A, B, C) =$

$F_f = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}$

$+ ABC$

$= \bar{A}\bar{B}(\bar{C}+C) + \bar{A}B(\bar{C}+C) + A\bar{B}(\bar{C}+C) +$

$AB(\bar{C}+C)$

$= \bar{A}\bar{B} + \bar{A}B + A\bar{B} + AB$

$= \bar{A}(\bar{B}+B) + A(\bar{B}+B)$

$\bar{A} + A = 1$

$\underline{F_f = 1}$

$F_g(A, B, C) = (5)$

$F_g = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C}$

$+ AB\bar{C} + A\bar{B}C$

$= \bar{A}\bar{B}(\bar{C}+C) + \bar{A}B(\bar{C}+C) + A\bar{C}(\bar{B}+B)$

$+ AB(\bar{C}+C)$

$= \bar{A}B + \bar{A}B + A\bar{C} + AB$

$\bar{A}(\bar{B}+B) + A\bar{C} + B(\bar{A}+A)$

$\bar{A} + AC + B$

$\bar{A} + \bar{C} + B$

$\underline{F_g = \bar{A} + B + \bar{C}}$

K-maps

$F_a =$

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

$= \bar{A} + C$

$F_b =$

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

$= \bar{C} + B$

$F_c =$

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

$F_c = F_b = \bar{C} + B$

$F_d =$

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

$F_d = B$

$F_d =$

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

$F_d = B$

$F_e =$

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

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

$F_e = \bar{A} + B + C$

$F_f =$

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

$F_f = 1$

$F_g =$

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

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

$F_g = \bar{A} + B + \bar{C}$

Boolean Expressions

$F_a = \overline{A} + C$

$F_b = \overline{C} + B$

$F_c = \overline{C} + B$

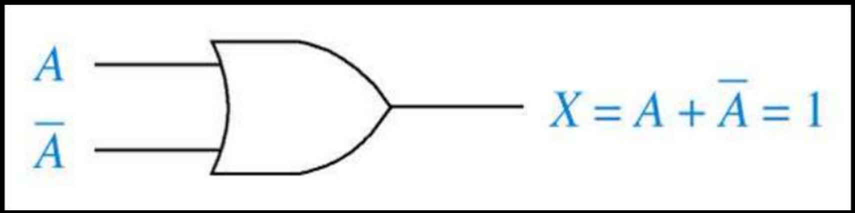
$F_D = B$

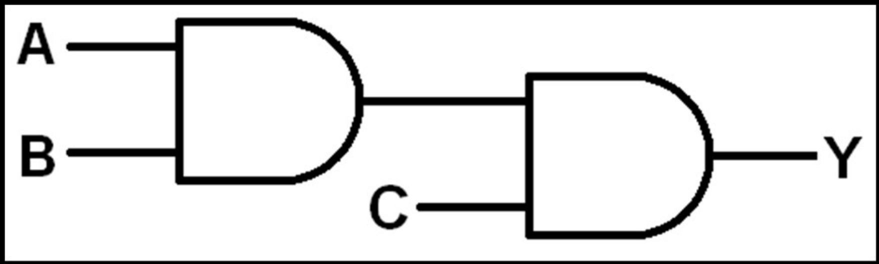
$F_e = \overline{A} + B + C$

$F_f = 1$

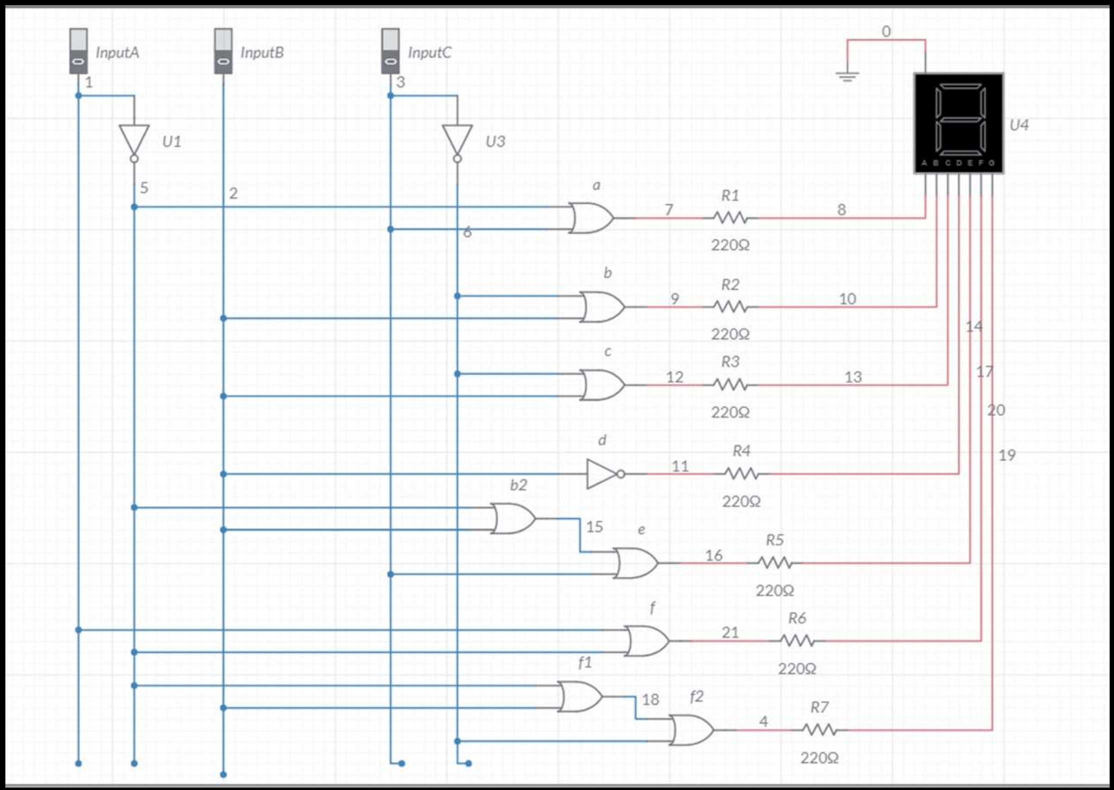
$F_g = \overline{A} + B + \overline{C}$

Logic Gates Operations Used





Multisim Simulation

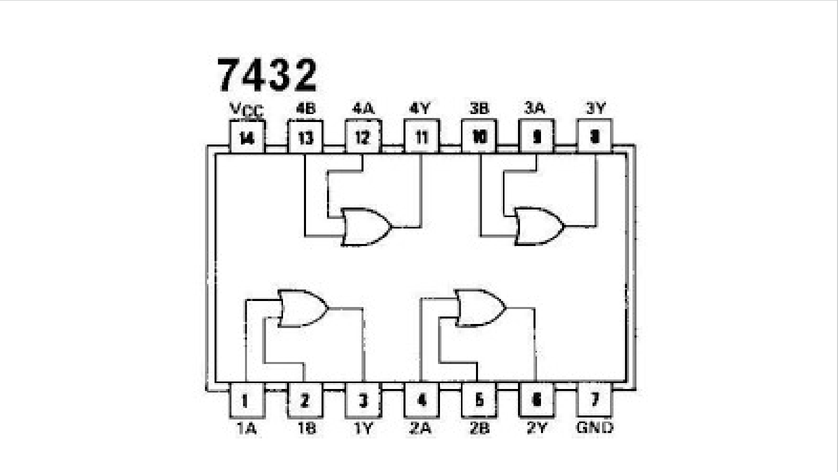


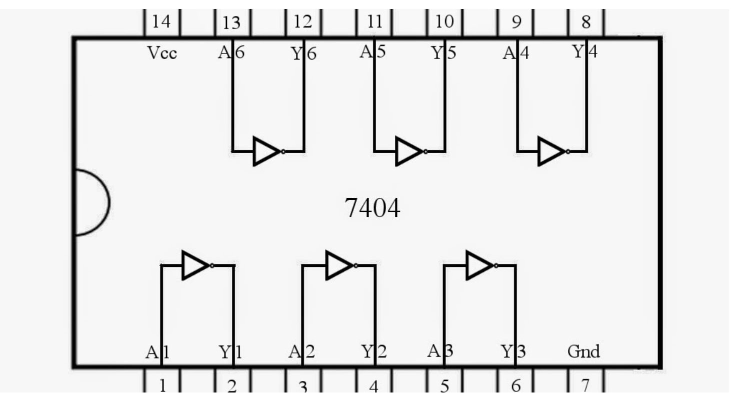
Video of Multisim Simulation

- Here is a quick simulation showing my circuit work with a simulation before I would eventually physically build it.

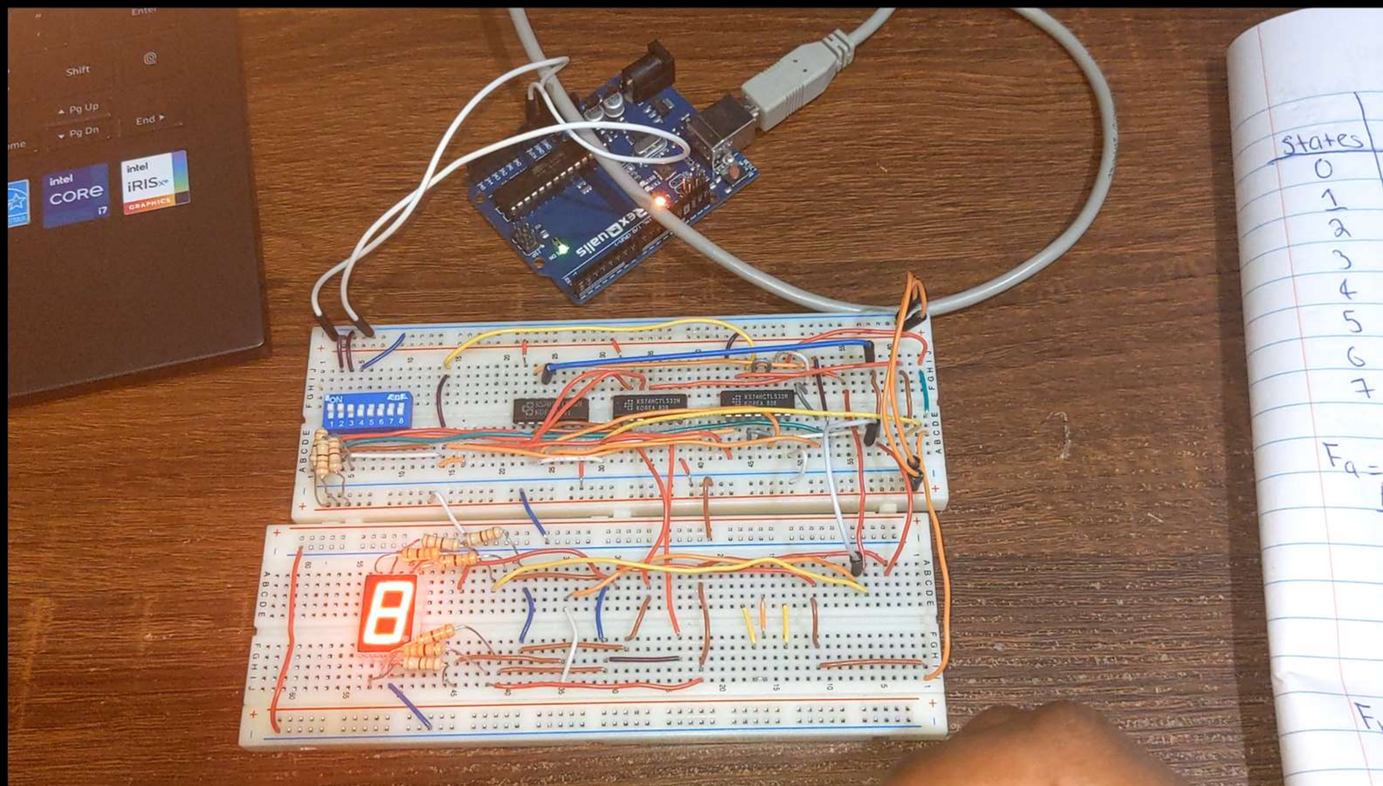
Components Needed

- 3- Inverters(1-7404)
- 8- OR gates(2-7432)





Video


Shift
Pg Up
Pg Dn
End
intel
CORE
i7
intel
iRIS
States
0
1
2
3
4
5
6
7

Conclusion

- *This experiment finally allowed me to implement the knowledge learned from previous classes involving logic gates and truth table.*
- *Finally, I was able to understand how to use a 7-segment display and how to display the proper characters throughout the different states.*

References

- (1720) Designing a 7-segment hex decoder – YouTube
- (1720) How To Drive A 7-segment Display - The Learning Circuit – YouTube
- BCD to 7 Segment LED Display Decoder Circuit Diagram and Working (electronicshub.org)