



2/21/2024

Design Brief:

I will design, build, and test a logic system that uses 3 inputs to display my D.O.B. on a single 7-segment display in the following pattern: MM-DD-YY. (04-18-06) The system will be built constrained to a 4" x 6" MyDAQ board. Using Multisim and Tinkercad as simulators, and wire, AND chips, OR chips, inverter chips, NAND chips, and NOR chips for building. The project will be completed on or before Thursday, March 14, 2024.

2/22/2024

Define Variables:

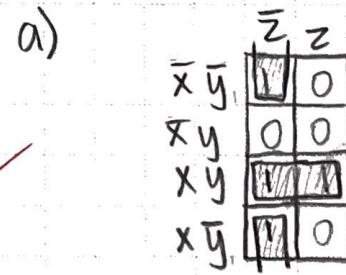
S_2, S_1, S_0 - switches at the bottom of the MyDAQ board, inputs
(0 = off, 1 = on)

$$S_2 = x, S_1 = y, S_0 = z$$

a,b,c,d,e,f,g - outputs on the 7-segment display
(0 = off, 1 = on)

Truth Table:

x y z	a b c d e f g	7-seg
0 0 0	1 1 1 1 1 1 0	1
0 0 1	0 1 1 0 0 1 1	1
0 1 0	0 0 0 0 0 0 1	1
0 1 1	0 1 1 0 0 0 0	1
1 0 0	1 1 1 1 1 1 1	1
1 0 1	0 0 0 0 0 0 1	1
1 1 0	1 1 1 1 1 1 0	1
1 1 1	1 0 1 1 1 1 1	1

Karnough Mapping:

$$a = \bar{y}\bar{z} + xy$$

AW

DESIGNED BY:

Audrey Wiele

WITNESSED BY:

CM

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2/22/2024

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3/14/24

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Karnaugh Mapping:

b)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy
\bar{z}	1	1	0
z	0	0	1
$\bar{x}\bar{y}$	1	0	0

c)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy	\bar{z}	z
\bar{z}	1	1	0	1	1
z	0	0	1	1	0
$\bar{x}\bar{y}$	1	0	0	1	0

d)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy	\bar{z}	z
\bar{z}	1	0	0	0	1
z	0	0	1	1	0
$\bar{x}\bar{y}$	1	0	0	1	0

$$b = \bar{x}\bar{y} + \bar{x}z + x\bar{z}$$

$$c = xy + \bar{y}\bar{z} + \bar{x}z$$

$$d = xy + \bar{y}\bar{z}$$

e)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy
\bar{z}	1	0	0
z	0	0	1
$\bar{x}\bar{y}$	1	0	0

$$e = xy + \bar{y}\bar{z}$$

f)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy	\bar{z}	z
\bar{z}	1	0	0	1	1
z	0	0	1	1	0
$\bar{x}\bar{y}$	1	0	0	1	0

$$f = \bar{x}\bar{y} + xy + x\bar{z}$$

g)

$\bar{x}\bar{y}$	$\bar{x}y$	$x\bar{y}$	xy	\bar{z}	z
\bar{z}	0	1	0	0	1
z	1	0	0	1	0
$\bar{x}\bar{y}$	1	0	0	1	0

$$g = \bar{x}y\bar{z} + x\bar{y} + xz + \bar{y}z$$

✓

Unsimplified Expressions:

$$\left. \begin{matrix} a \\ d \\ e \end{matrix} \right\} = xy + \bar{y}\bar{z}$$

✓

$$b = \bar{x}\bar{y} + \bar{x}z + x\bar{z}$$

$$c = xy + \bar{x}z + \bar{y}\bar{z}$$

$$f = xy + \bar{x}\bar{y} + x\bar{z}$$

$$g = \bar{x}y\bar{z} + x\bar{y} + xz + \bar{y}z$$

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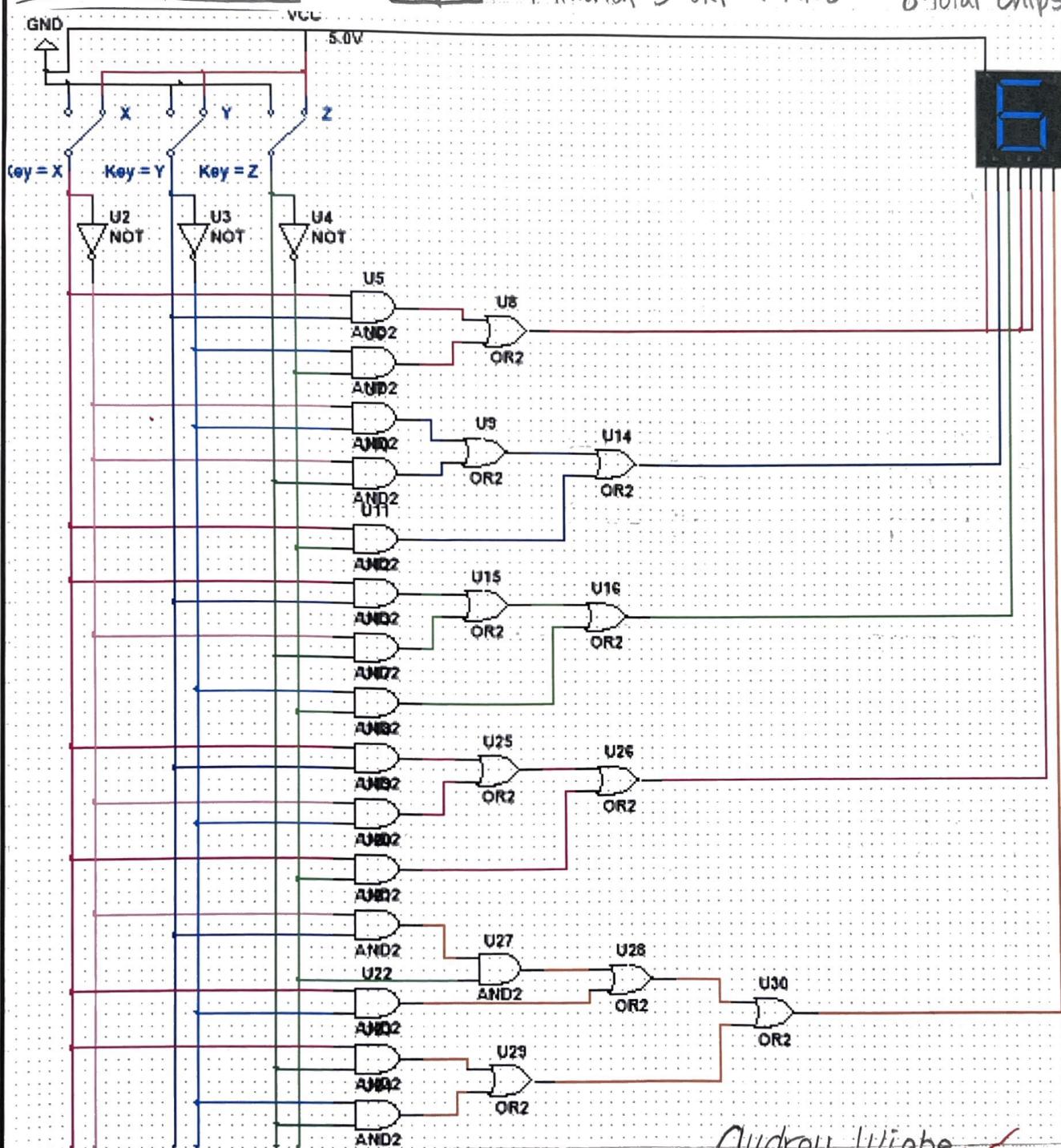
Date of Birth Project (3)

67

2/26/2024

AOI Simulation:

gates: 3 inverter, 10 OR, 16 AND ✓ 29 total gates
chips: 1 inverter, 3 OR, 4 AND 8 total chips



Audrey Wiebe ✓

I tested every input and each one produced the same output on the 7-seg display as represented in the truth table. ✓

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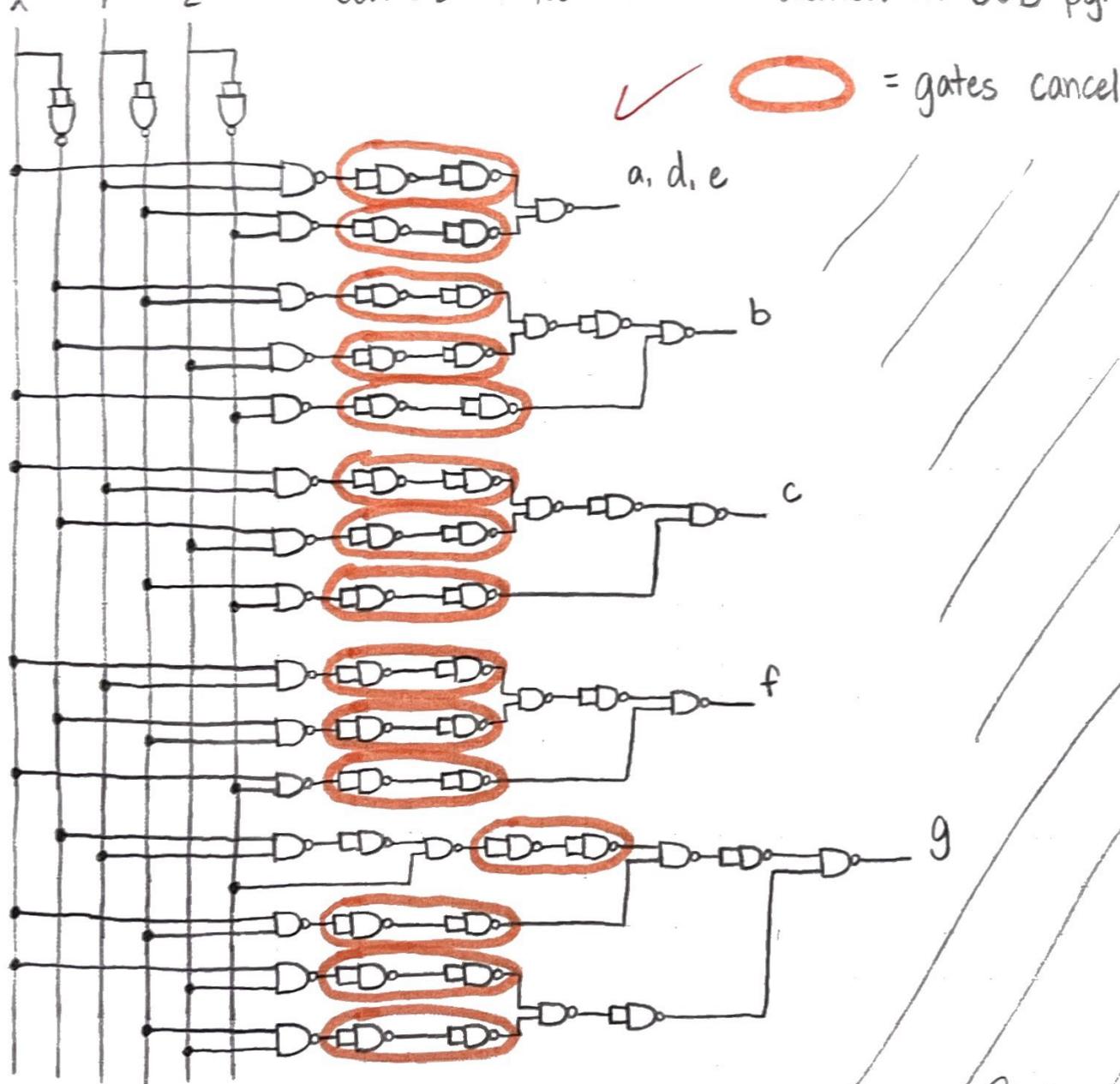
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NAND Circuit:

x y z

conversion from AOI simulation on DOB pg. 5 →

gates: 35 NANDchips: 9 NAND chips

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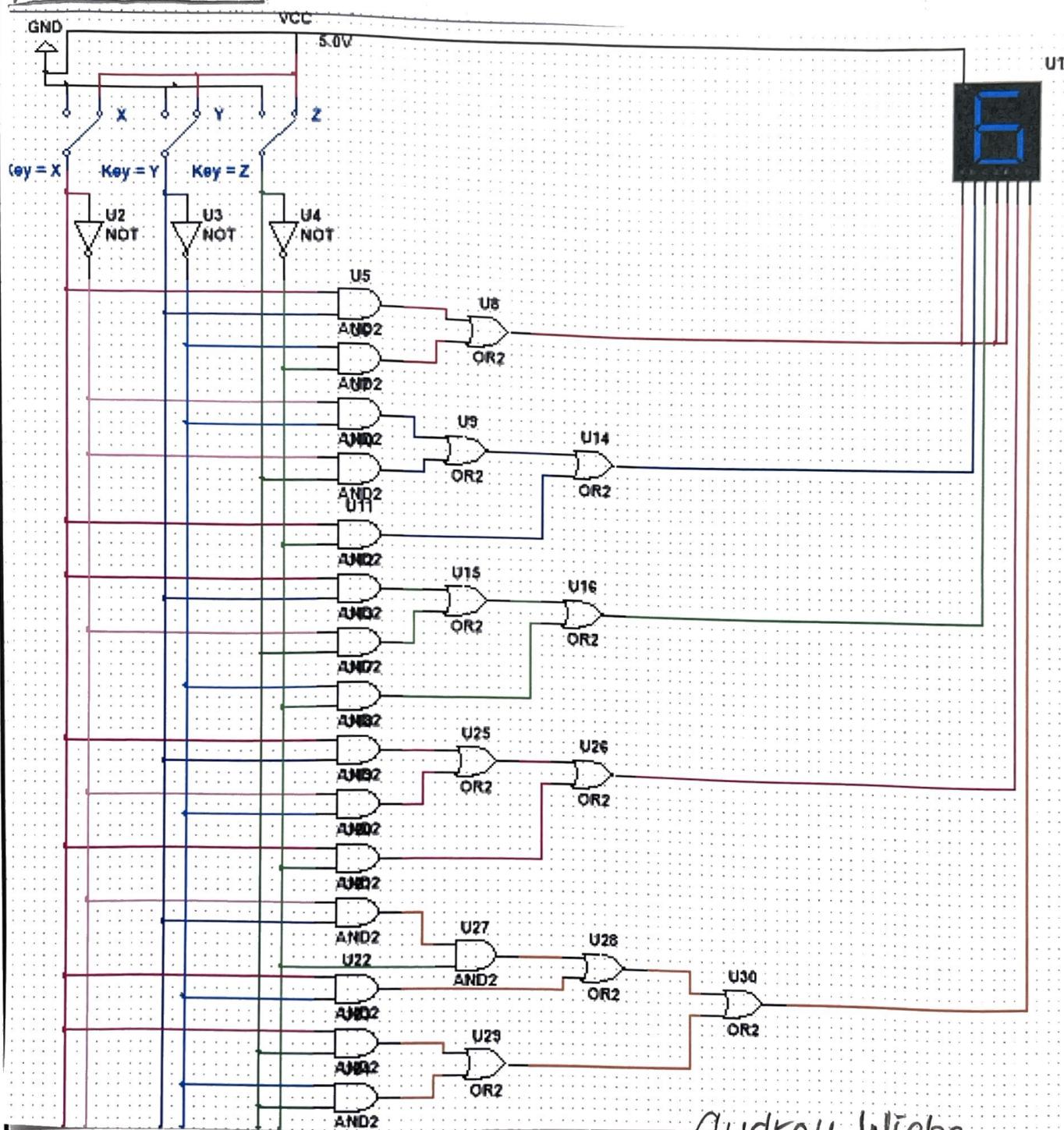


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Date of Birth Project (5)

69

AOI Simulation:



Audrey Wiebe

DESIGNED BY:

Audrey Wiebe

WITNESSED BY:

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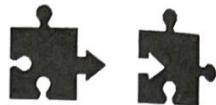
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TITLE

Date of Birth Project (b)

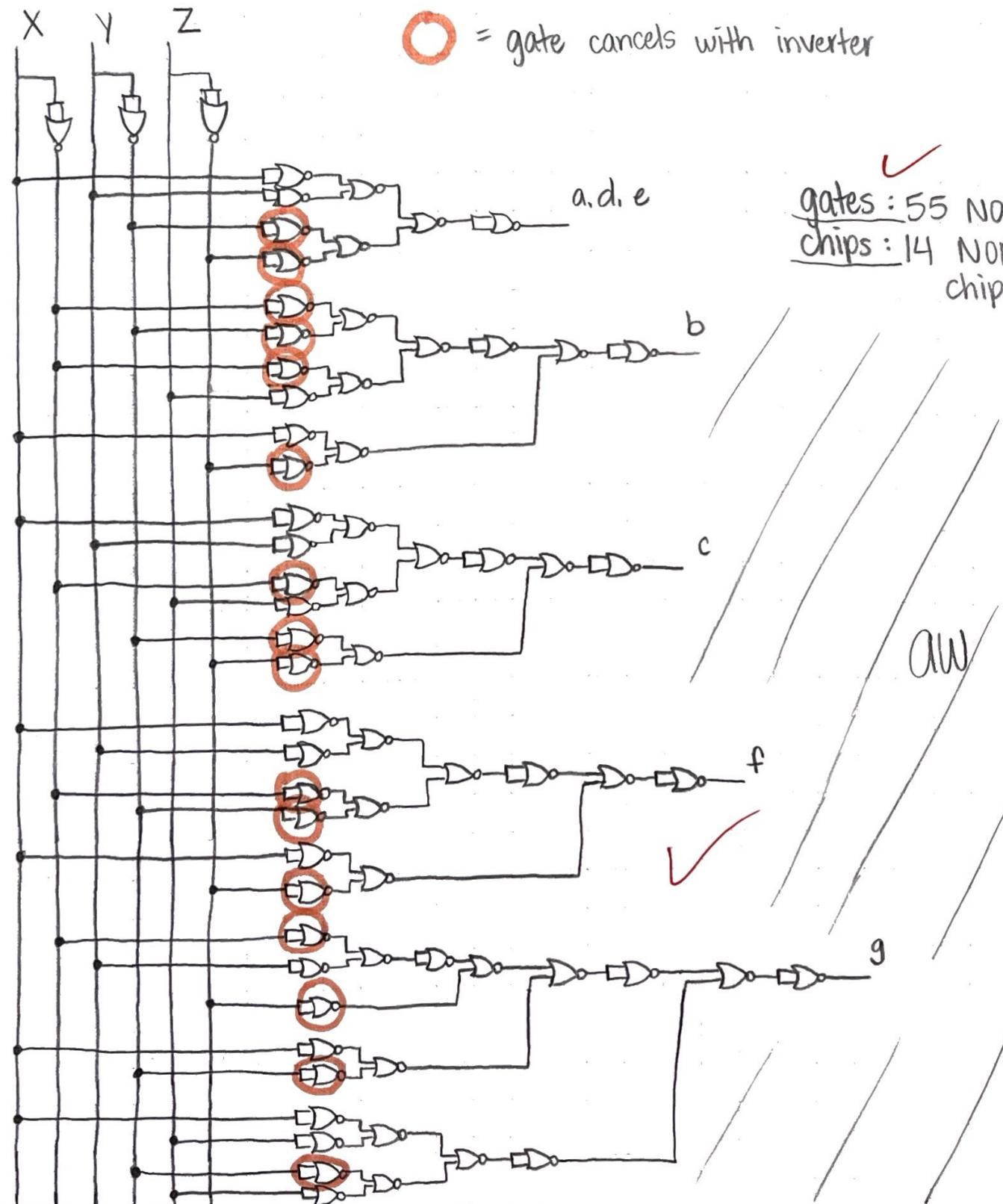


2/28/2024

NOR Circuit:

conversion from AOI simulation on DOB pg 7 →

X Y Z



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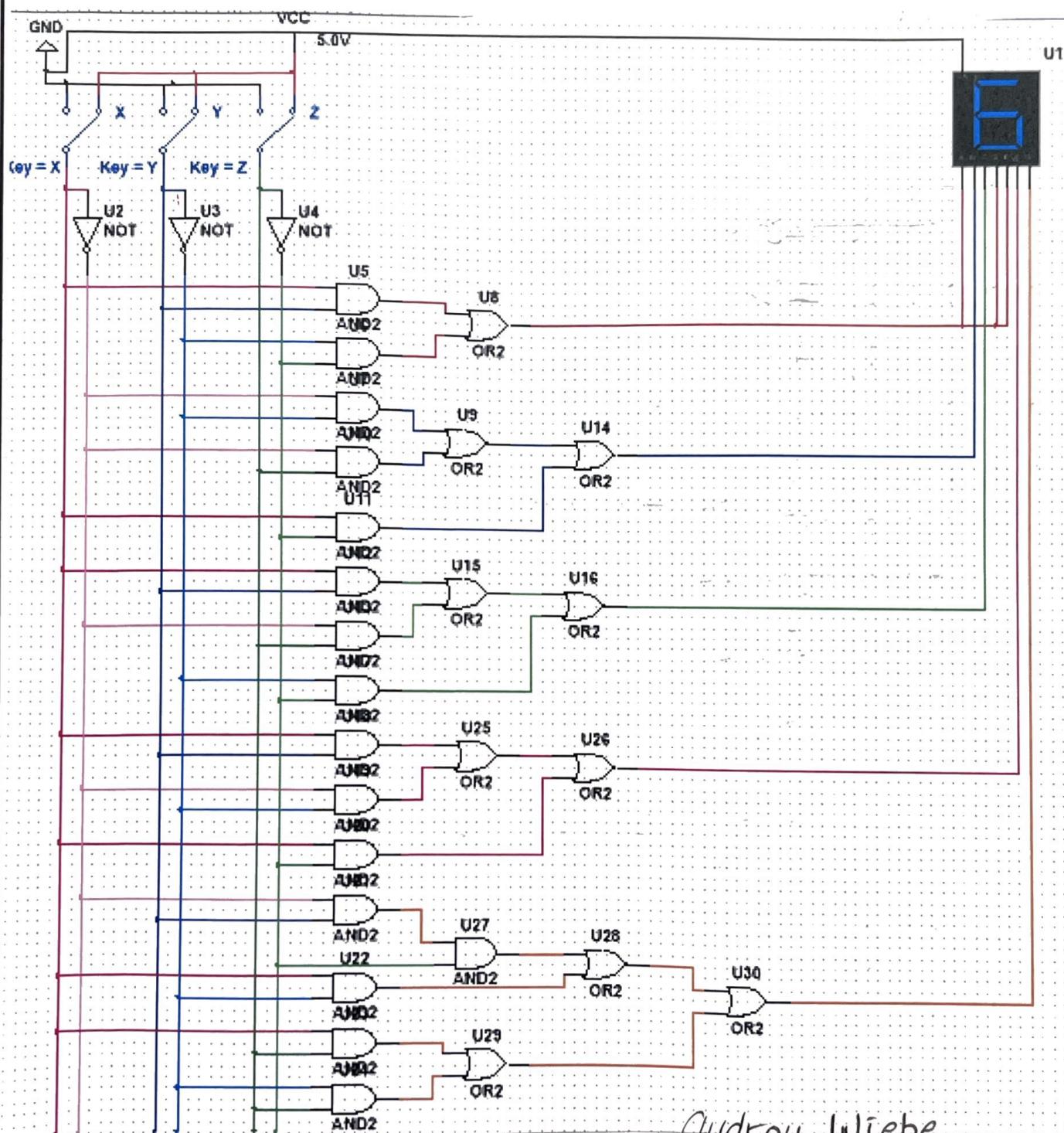


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Date of Birth Project (7)

71

AOI Simulation:



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DESIGNED BY:

Audrey Wiebe

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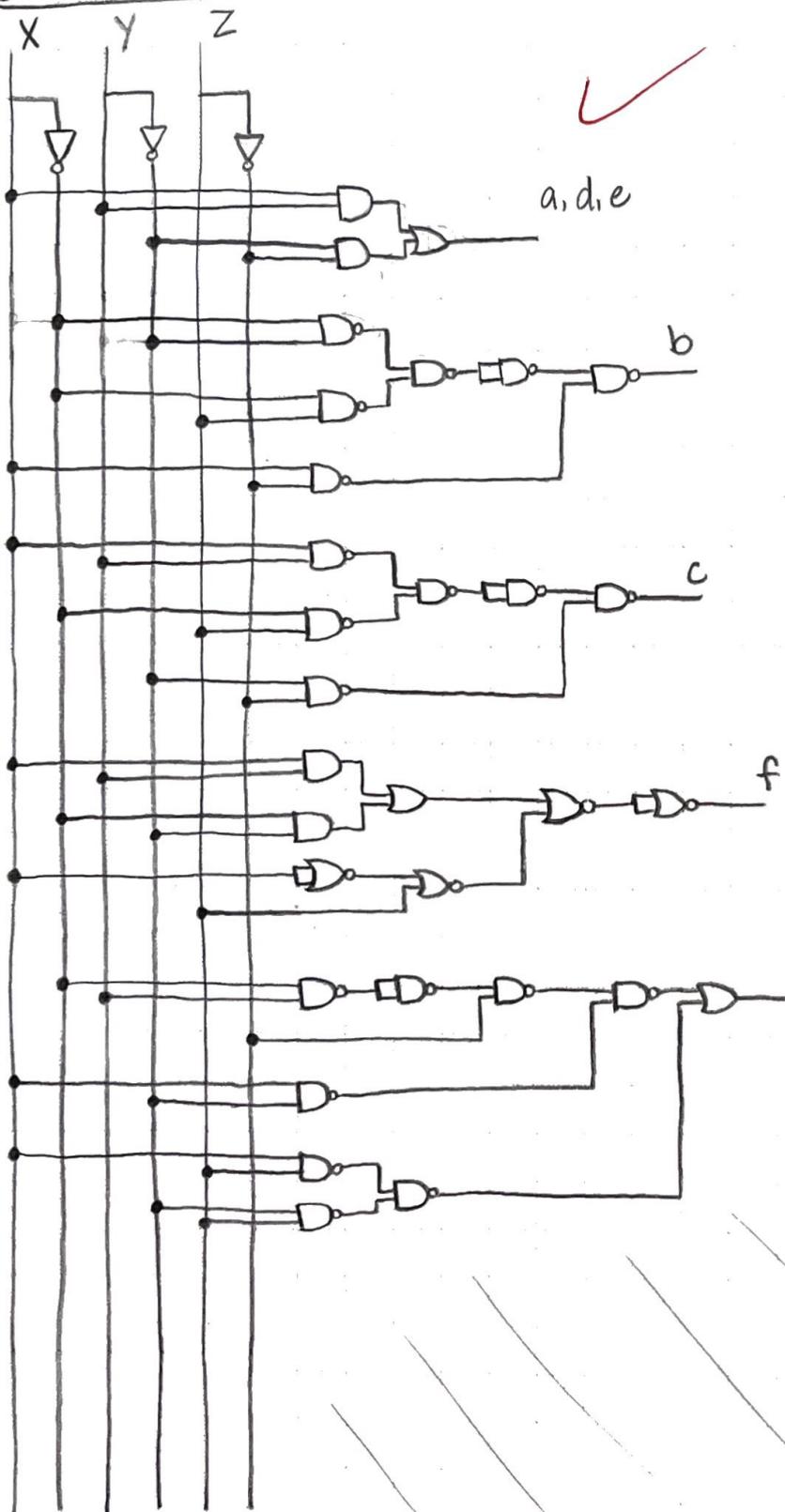
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2/29/2024

Combined Circuit:Gates:

- 3 inverter
- 4 AND
- 3 OR
- 20 NAND
- 4 NOR

total : 34 gates

Chips:

- 1 inverter
- 1 AND
- 1 OR
- 5 NAND
- 1 NOR

total : 9 chips

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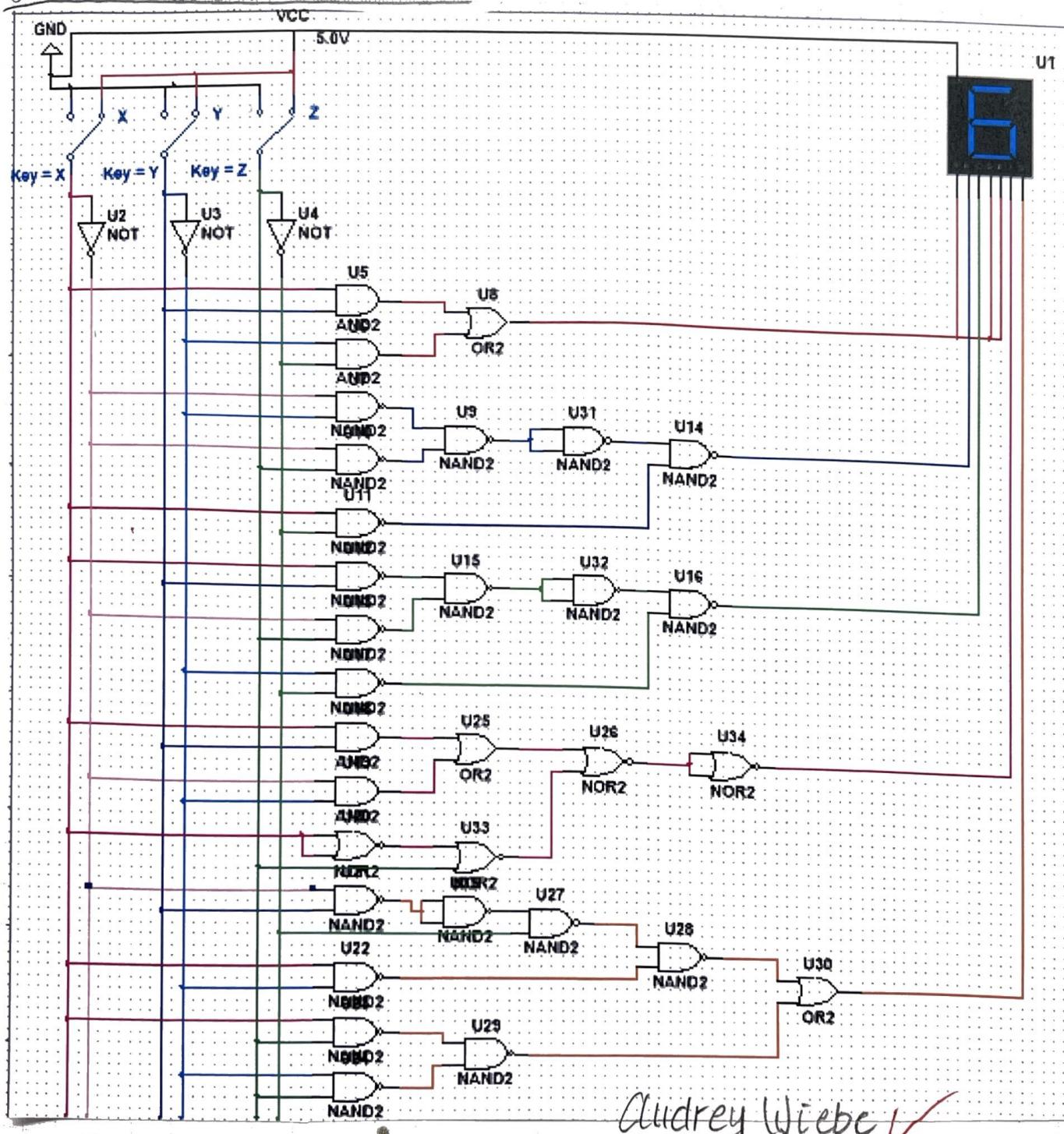
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Date of Birth Project (9)

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3/4/2024

Combined Circuit Simulation:



Audrey Wiebe ✓

I tested each input and they lit up the correct segments on the 7-seg display as shown in the truth table. ✓

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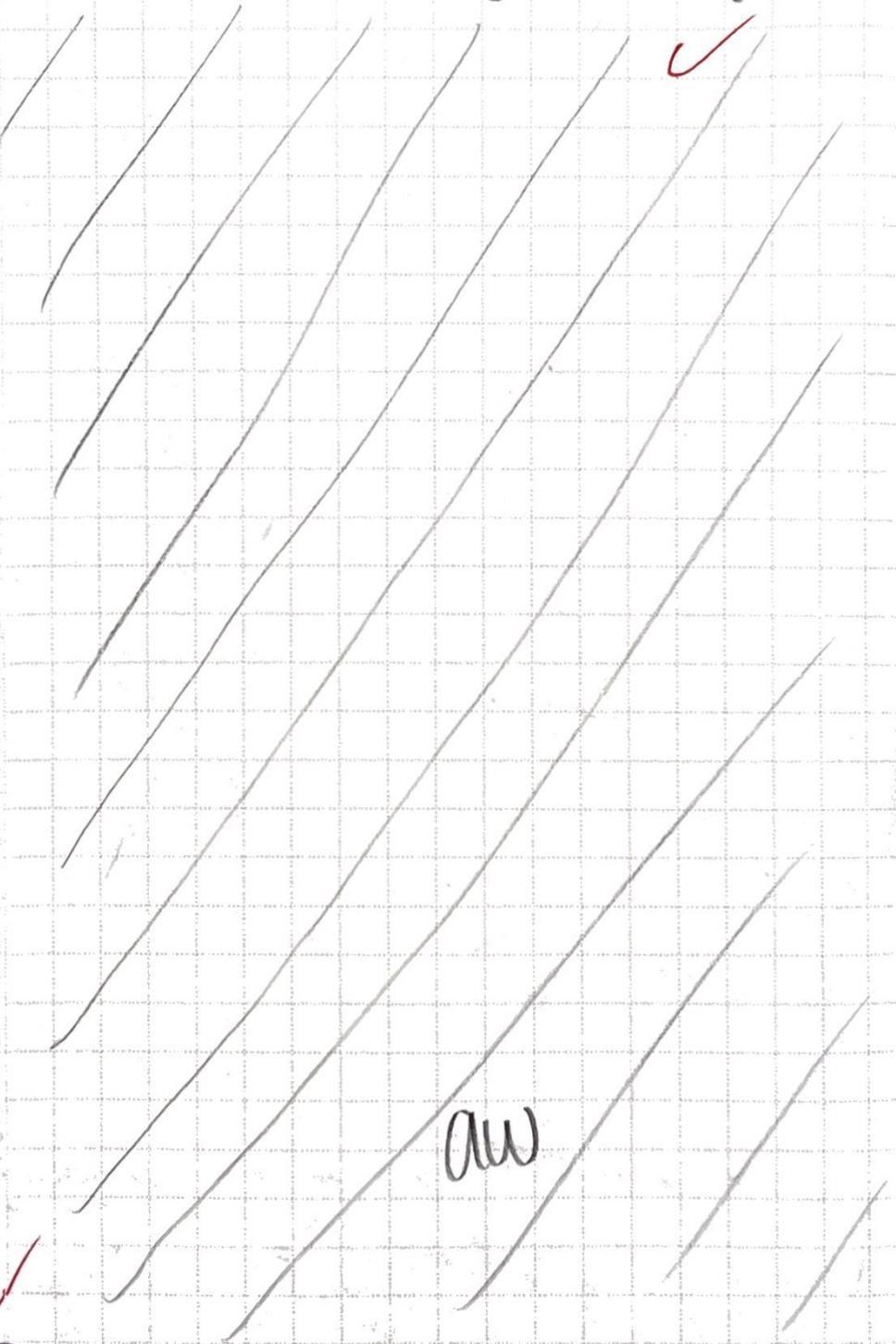
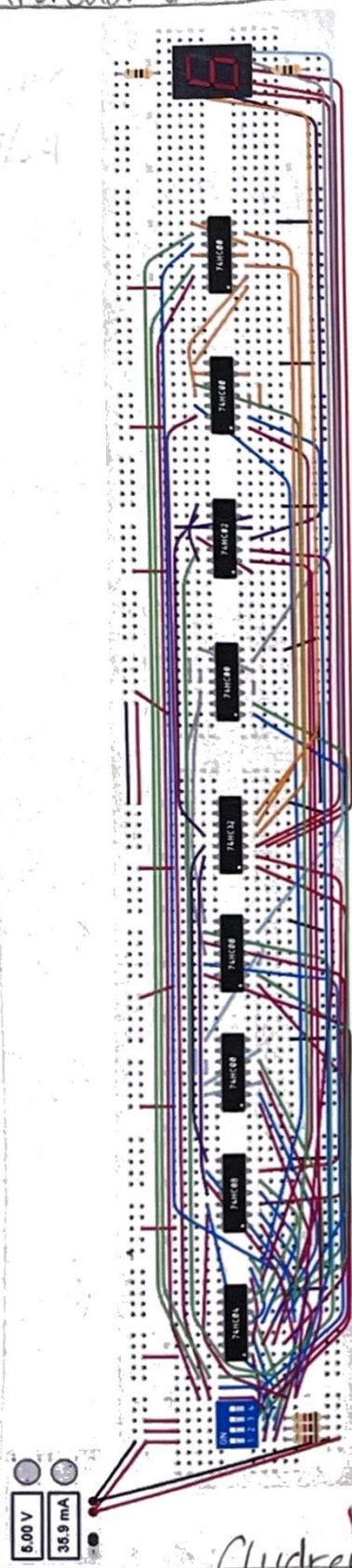
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Date of Birth Project (10)Tinkercad Build:

3/7/2024

I tested all inputs with the switches on Tinkercad and they all produced the correct outputs and displayed the correct numbers on the 7-Segment display.



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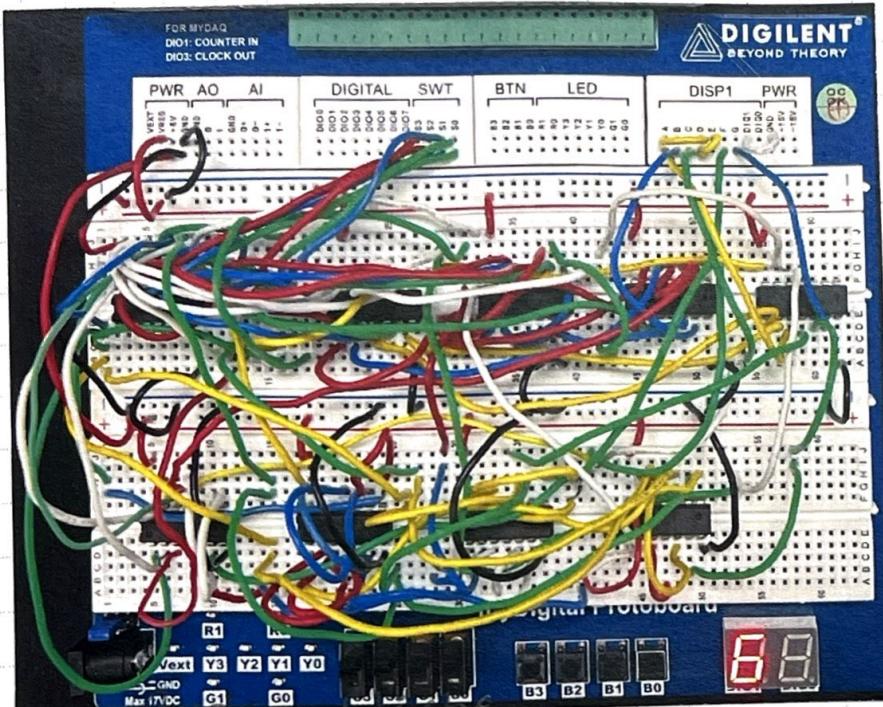
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Build Notes:

Audrey Wiebe

Conclusion: I designed, simulated, built, and tested a circuit using AOI, NAND, and NOR chips to display my birthday (04-18-06) on a 7-segment display. With a partner, I built the circuit on a MyDAQ board using 9 chips (1 inverter, 1 AND, 1 OR, 5 NAND, and 1 NOR). The 7-segment display successfully showed my birthday in Multisim, Tinkercad, and on the MyDAQ board. The circuit had the fewest amount of chips in all AOI, but due to the purpose of the project, I had to use all 3 types of chips. This increased my circuit from 8 to 9 chips, which created more complexity. While building on the MyDAQ board, the "g" segment didn't work properly; so, we took out all the corresponding wires and rewired the "g" segment. It worked after wiring it a second time, but this added extra time to the project. If given more time, we would rewire the circuit with more organization and color-code each segment. Then, it would be easier to take out wires corresponding with a segment that isn't working.

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- We built and tested the circuit on a MyDAQ board.
- We used the S0, S1, and S2 switches on the board in place of the X, Y, and Z variables. ✓
- All switch inputs produced the correct numbers on the 7-seg display.

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