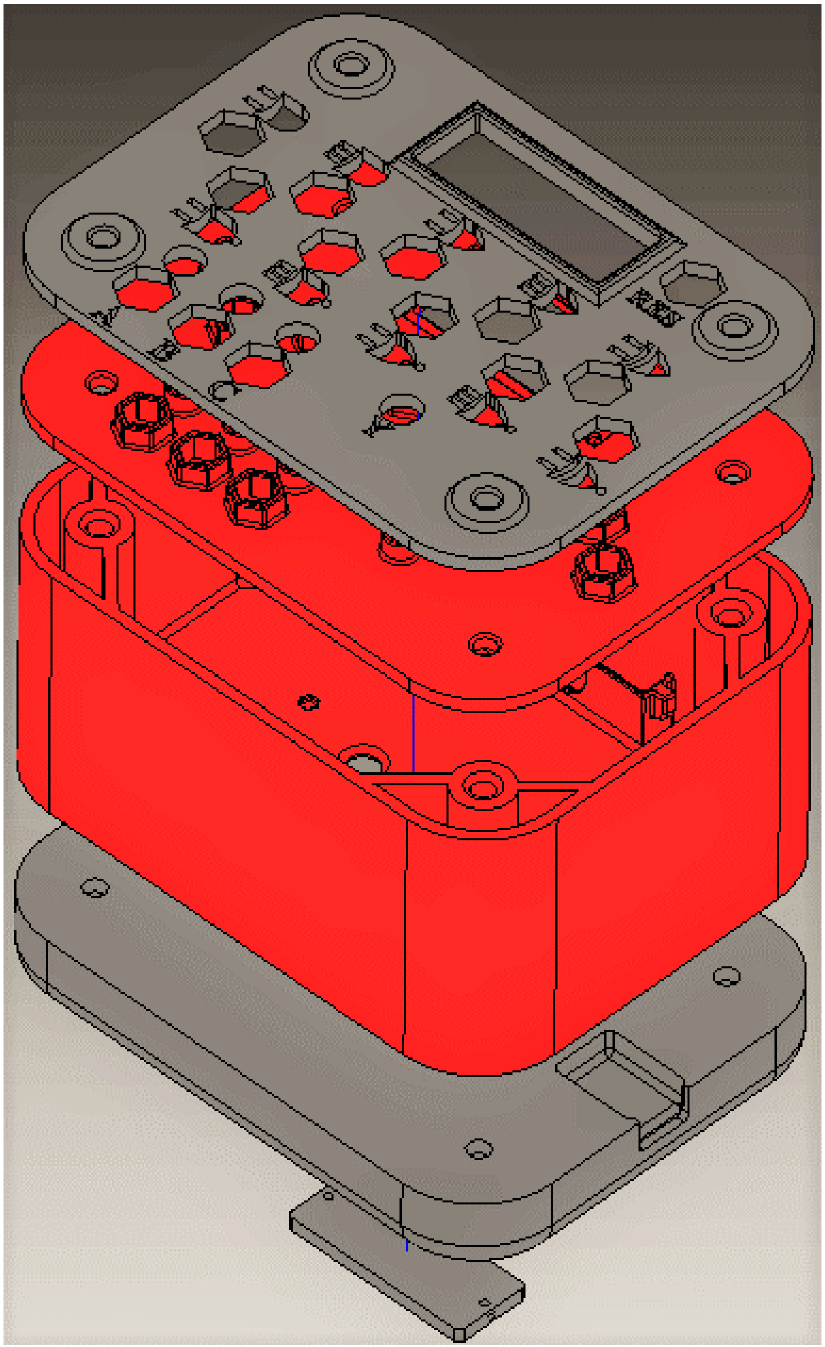
# Name! That! Gate!

*User Manual*



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2022/05/10

**Contents**:

# Introduction

**Name! That! Gate!** is a logic puzzle & game that tests player knowledge of *Digital Logic Gates*. It's modeled after & is a physical representation of the *ETCAI* (software often used throughout Lake Land College – Mattoon, IL electronic engineering studies) *Digital Challenge* "Name that Gate! Two" game.

The objective is to determine the *Digital Logic Gate* being utilized which creates the specific Output (**Y**) condition (red / green – low / high) given the state of the Inputs (**A**), (**B**), and/or (**C**). There are **140pts possible**, each Stage is worth 14pts, there are x10 Stages, each Input toggled deducts x1pt from Stage points, right *Gate* selection rewards all remaining Stage points, and wrong *Gate* selection deducts all remaining points.

**Gameplay**:

1) From startup, x1 *Digital Logic Gate* (of 10 possible) is randomly loaded
   - *Logic Gates* are: 2-Inputs - AND, NAND, NOR, OR, XOR, XNOR
     3-Inputs - AND, NAND, NOR, OR
2) Inputs always start LOW
   - If only a 2-input *Gate* is loaded then Input (**C**) is deactivated & invalid
3) Initial *Gate* Output (**Y**) reflects what is TRUE for the logic of the loaded *Gate*
4) From this point, the player can either toggle any of the Inputs or select a *Gate*
   - If Input toggled: Even if Input (**C**) invalid, x1 Stage Point deducted if any of those 14pts remain
   - If *Gate* right: All remaining Stage points rewarded and next *Gate* (if any) loaded
   - If *Gate* wrong: All remaining Stage points deducted and next *Gate* (if any) loaded
5) Loaded *Gate* Output (**Y**) will dynamically reflect what is TRUE given the supplied Inputs from (**A**), (**B**), and/or (**C**)
6) Once a *Gate* selection is made the Stage is over & a new *Gate* is randomly loaded
   - No same *Gate* encountered twice during a full (Stage 1 - 10) playthrough
7) After Stage over, Inputs are set LOW again & initial *Gate* Output (**Y**) reflects what is TRUE for that *Gate*.
8) Again, player can either toggle any of the Inputs or select a *Logic Gate*.
9) When no new *Gates* (of 10) remain, the game Ends.

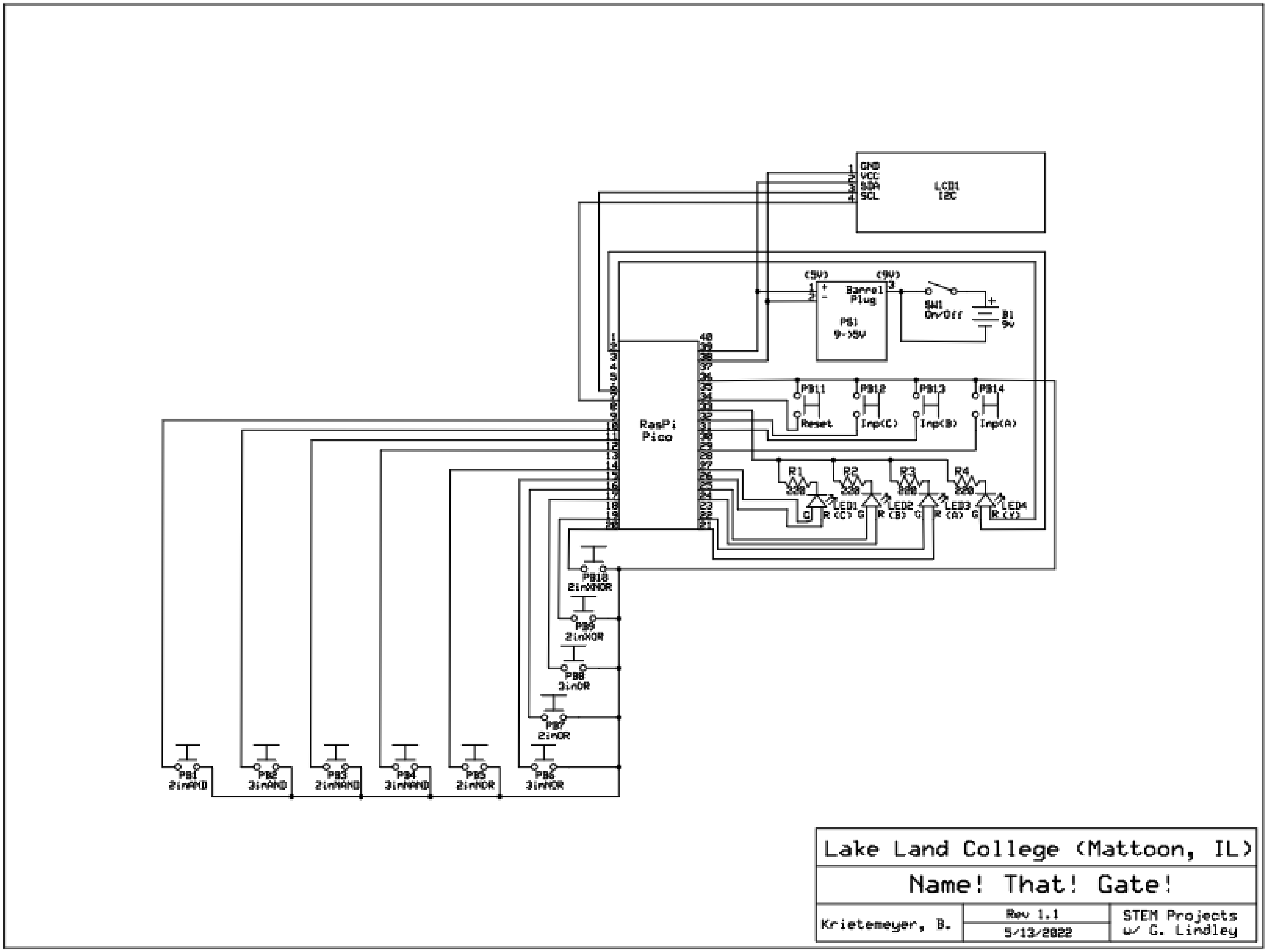
# Special Notes

- When using MicroPython, in order to make code saved to the Raspberry Pi Pico execute upon startup then it must be given the special name: `main.py`
- Protoboard (enclosed) on (4) **Nylon Standoffs** w/ nuts glued into bottom; **fragile**
- DO NOT overtighten any of the (4) **1/4" x 5" Hex Bolts** used to hold enclosure together; just enough to "sandwich" **Power Switch** and make rigid connection w/ all **Bolts** & **Nuts**
- If taking apart remember: **9V Battery** attachment & **Power Switch** wires ran through Base & Middle so DO NOT move too much unless wires disconnected (inside enclosure) to prevent damage
- **LED**s secured by glue (between bottom of LED and recessed hole in Mount)
- **Display** PCB holes were incrementally drilled out in order to fit 3D-printed Mount posts
- **Power Switch** location (3D-print) had to be altered post-print in order to fit hardware
- All enclosed wires connected together by heat shrink & solder combo were applicable
- All connections (male pins to pin headers, female pins to LED posts) reinforced w/ tape
- USB drive w/ all relevant files should be stored inside enclosure
- Thonny IDE used on Windows 10 for programming Raspberry Pi Pico w/ MicroPython
- Helpful websites:
  - https://www.raspberrypi.com/documentation/
  - https://docs.micropython.org/en/latest/library/machine.Pin.html
  - https://simonprickett.dev/buttons-and-leds-with-micropython-for-pi-pico/
  - https://www.tomshardware.com/how-to/lcd-display-raspberry-pi-pico
  - https://forum.micropython.org/viewtopic.php?t=8179

# Parts List

| | |
|---|---|
| 1) Raspberry Pi Pico (2020) | x1 |
| 2) Protoboard (7 x 9cm) | x1 |
| 3) Nylon Standoffs (Protoboard) w/ nuts & screws | x4 |
| 4) Pin Headers (female) | |
| ○ 20-pin | x2 |
| ○ 8-pin | x1 |
| ○ 6-pin | x1 |
| ○ 4-pin | x1 |
| 5) Power Supply (used 9V-to-5V “breadboard” type by “YwRobot”) | x1 |
| 6) 9V Battery | x1 |
| ○ Connector w/ Barrel Plug (Power Supply) | x1 |
| 7) Power Switch | x1 |
| 8) Display (I2C Serial Interface HD44780 LCD) | x1 |
| 9) LEDs (common cathode multicolor RGB) | x4 |
| 10) Resistors (220 Ohm for LEDs) | x4 |
| 11) Pushbuttons (momentary) | |
| ○ White | x1 |
| ○ Yellow | x3 |
| ○ Red | x10 |
| 12) Pin Connectors (male) | |
| ○ Display | x4 |
| ○ LEDs | x12 |
| ○ Pushbuttons | x28 |
| 13) Enclosure (3D-printed) | |
| ○ Base, Middle, Mount, Cover, & Plate | |
| 14) Hex Bolts (1/4” x 5”) w/ Nuts & Washers | x4 |
| 15) Wood Screws (6 x 1/2”) | x2 |
| 16) “Scotch” Bumpers (1/2” ; prevents sliding) | x4 |
| 17) Miscellaneous (Wiring, solder, superglue, etc.) | |

# Schematic


LCD1
I2C
GND
VCC
SDA
SCL
1
2
3
4
(5V)
(9V)
Barrel
Plug
PS1
9->5V
SW1
On/Off
B1
9v
RasPi
Pico
PB11
Reset
PB12
Inp(C)
PB13
Inp(B)
PB14
Inp(A)
R1
220
R2
220
R3
220
R4
220
LED1
R (C)
LED2
R (B)
LED3
R (A)
LED4
R (Y)
G
PB1
2inAND
PB2
3inAND
PB3
2inNAND
PB4
3inNAND
PB5
2inNOR
PB6
3inNOR
PB7
2inOR
PB8
3inOR
PB9
2inXOR
PB10
2inXNOR
Lake Land College (Mattoon, IL)
Name! That! Gate!
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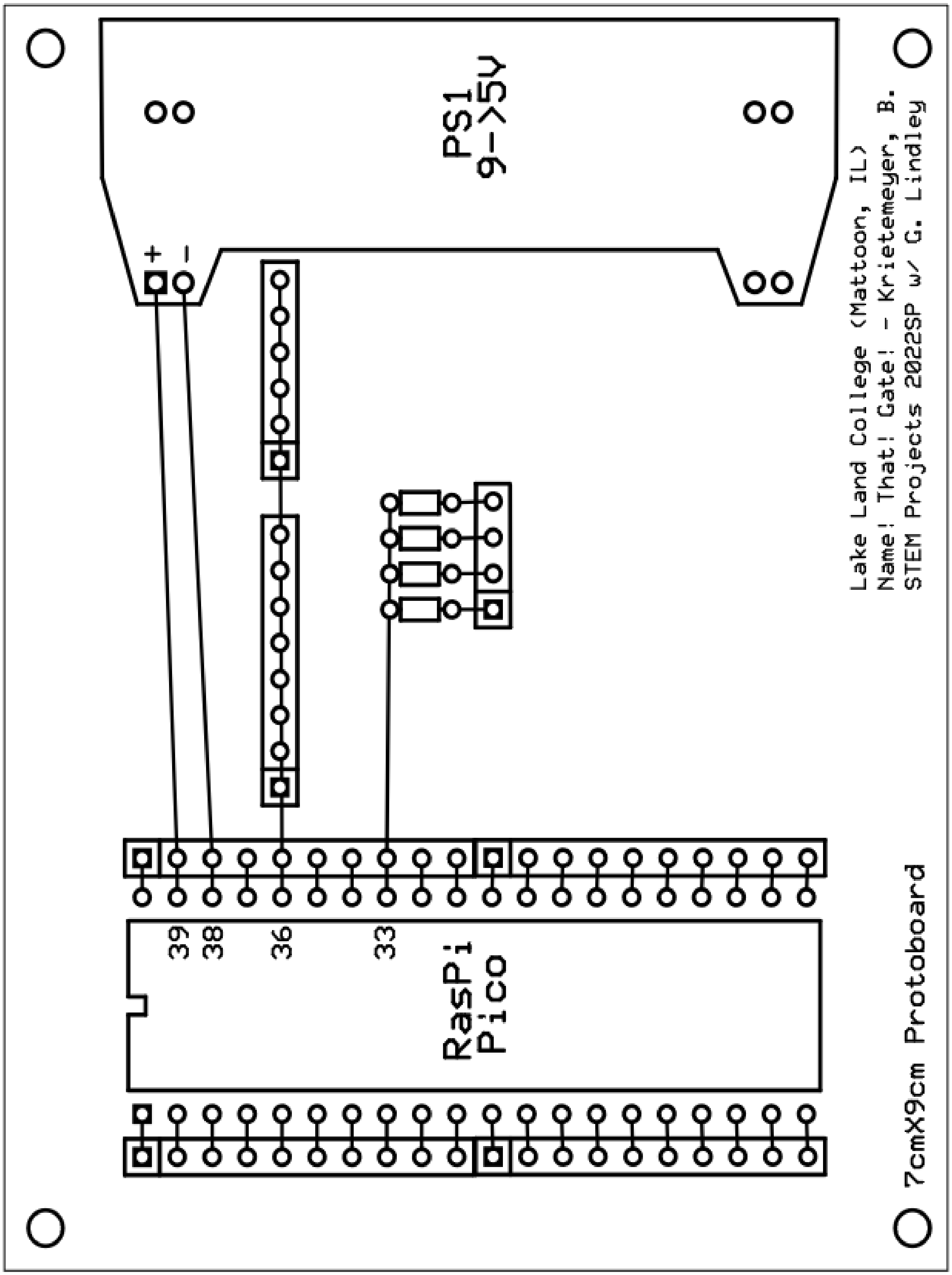
w/ G. Lindley

# Board Layout


PS1
9->5V
+
-
39
38
36
33
RasPi
Pico
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7cmX9cm Protoboard