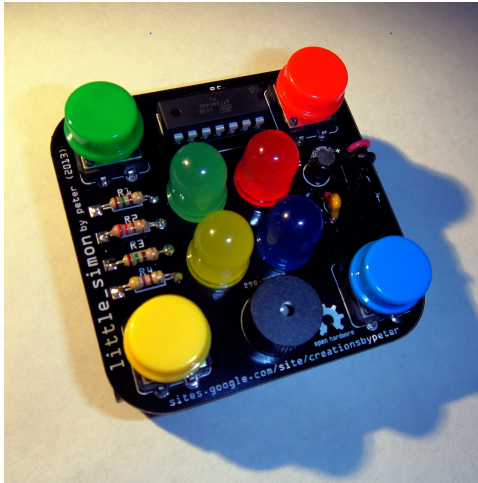# *little_simon* Assembly Guide

Illustration 1: little_simon *as assembled*

Introduction

Thank you for purchasing a *little_simon* kit from Creations by Peter! *little_simon* is a simplified version of the classic 1978 game from Milton Bradley. These are hand-made and programmed by the creator in Gilbert, AZ.

Gameplay is simple; just repeat each sequence that *little_simon* plays you using the colored buttons. Another step is added to the sequence each time you get it right. If you get it wrong *little_simon* will play a 'raspberry' noise and flash the step you got wrong twice. If you make it all the way to the end, *little_simon* plays a little light show to congratulate you! A new game then begins. *little_simon* is programmed to go up to 14 steps, which was the intermediate level in the original game.

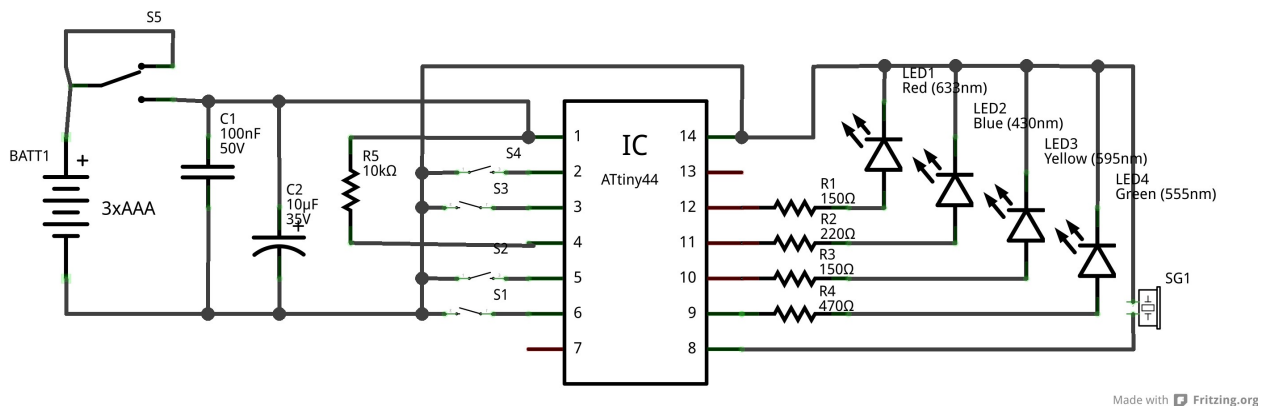The circuit for *little_simon* is fairly straightforward, as shown in the illustration 2.

Illustration 2: schematic diagram of little_simon

Soldering Skill

You'll need some basic soldering skills in order to assemble little_simon. Don't be intimidated if this is your first time soldering, as it just requires a little attention to detail and some patience. Great soldering tutorials online at places like www.Sparkfun.com, www.Adafruit.com, and even NASA has a tutorial at radiojove.gsfc.nasa.gov/telescope/soldering.htm.

Things You'll Need

You'll need some basic soldering and hand tools to complete *little_simon*. Many of these items can be acquired for very little cost at big-box discount stores, well stocked craft centers, and electronic stores. The hot-glue gun, for example, can be found in the craft section of big 'mart' style stores for under $3!

Here are some things to have on hand when you begin assembly:

Safety glasses	Small needle-nose pliers	Paper towels
Soldering iron or station	63-37 flux core solder, 0.025"	Hot-glue gun (high-temp)
Tip-cleaning sponge	Flux-pen (optional)	Hot-glue sticks (multi-temp)
Flush-cut wire cutters	Rubber Band	Panavise Jr. or similar (optional)
Wire stripping tool	Rubbing alcohol	3 AA batteries
Cotton swabs	Multimeter (optional)	Green Scotch-Brite pad (optional)

Parts List

Check the contents of the kit against Table 1.

Quantity	Part	Description
1	BATT1	3xAA Battery-holder
1	C1	0.1 µF Ceramic Capacitor
1	C2	10 µF Electrolytic Capacitor
4	Key Caps	Red, Blue, Yellow, Green
1	LED1	Red LED - 10mm
1	LED2	Blue LED – 10mm
1	LED3	Yellow LED – 10mm
1	LED4	Green LED – 10mm
1	PCB1	little_simon circuit board
2	R1, R3	150 Ω Resistor
1	R2	220 Ω Resistor
1	R4	470 Ω Resistor
1	R5	10k Ω Resistor
4	S1, S2, S3, S4	12mm Tactile Switch
1	S5	Slide Switch
1	SG1	12mm Buzzer
1	U1	Preprogrammed ATtiny44A micro-controller
1	U1_SOCKET	Socket for U1

Table 1: parts list

Before you begin…

Here are a few things you might find helpful:

- ✓ Read the entire guide before you start. E-mail if you have any questions.

- ✓ Cleaning all the component leads with a cotton-swab and rubbing alcohol helps reduce the likelihood of soldering problems.

- ✓ Use good quality solder. Consider the 'no-clean' type so you can skip cleaning the flux from the bottom of the board. Good solder costs a little more, but the results are worth it. MG Chemicals 63/37 flux core solder (cat. no. 4884) was used in the development of *little_simon*.

- ✓ You don't need the most expensive tools to get great results. Simple equipment from a discount 'Mart' type store or Harbor Freight will be more than adequate. Check the craft aisle for small pliers and wire cutters.

- ✓ Use a 25-40watt soldering iron. Again, you don't need a super-expensive iron.

- ✓ Figure 3 is a picture of PCB1 included for your reference
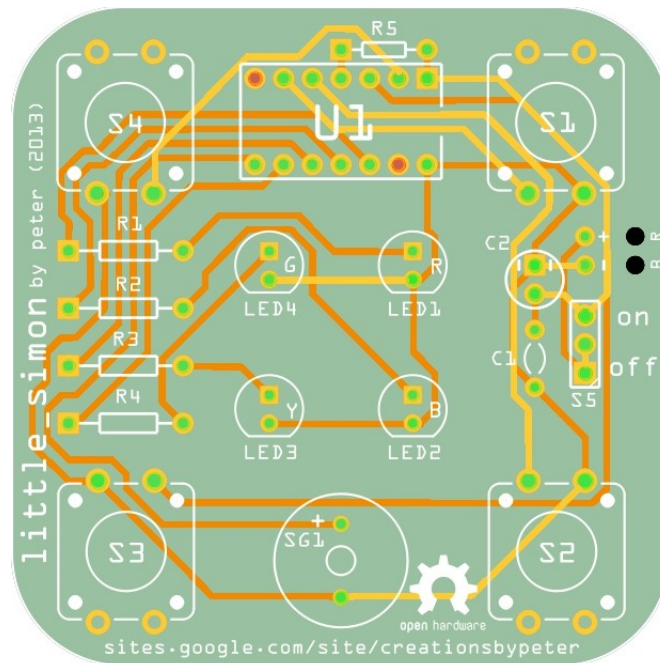
Illustration 3: PCB1

Assembly

1. Clean both sides of PCB1 with a paper towel and some rubbing alcohol.

2. Insert LED1 (red), LED2 (blue), LED3 (yellow) and LED4 (green) onto PCB1 while being careful to observe polarity—the longer lead is the anode and goes into the square solder-pad of each LED position marked on the board[1]. Spread the leads apart to keep the LEDs in place for soldering. Solder the LEDs in place and trim the excess from the leads.

3. Insert R1 through R4 into PCB1 as marked. Use Table 2 as a reference.

Part	Value	Color Code
R1	150 Ω	Brown-Green-Brown-Gold
R2	220 Ω	Red-Red-Brown-Gold
R3	150 Ω	Brown-Green-Brown-Gold
R4	470 Ω	Yellow-Violet-Brown-Gold

4. Bend the leads of the resistors R1 through R4 outwards slightly to keep them in place for soldering. Solder the resistors in place and trim the excess from the leads.

5. Insert the U1_SOCKET into PCB1 so the indentation on one end is closest to notch (gap) on the right side of the U1 outline. Use the rubber band to hold the socket in place. Solder two socket pins on opposite corners (doesn't matter which corners) of U1_SOCKET in place. Remove the rubber band and solder the rest of the pins in place and clip the excess from the pins.

   o OPTIONAL: You can solder U1 directly into the board if you don't want to use the U1_SOCKET. Be sure to orient U1 properly on the board with the silver dot closest to the notch marking on the board. Using the U1_SOCKET is recommended as it will help prevent heat-damage to U1 and will also aid in troubleshooting.

6. Insert R5 (the tiny resistor) into PCB1 as marked. Bend the leads outwards slightly to hold it in place. Solder R5 in place and clip the excess from the leads.

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1   While the outlines on the board show a flat-side marking the cathode, the LEDS themselves do NOT have a flat side. The anode is the longer lead. Trim the leads only AFTER you are certain that the LEDs are soldered in place correctly.

7. Insert the buzzer SG1 into PCB1 as marked making sure it is flush against the board. Be sure to observe polarity—the longer lead is positive (+). Hold SG1 in place with a rubber-band and solder the leads. Trim the excess

8. Now it's time to install BATT1 battery-holder. You may want to shorten the leads a bit (try 2" or so). Strip ¼" from the ends of the leads and tin the bare wire with solder.

9. Thread the BATT1 leads through the top of the PCB into the two holes located on the far right-side of the board. Make sure the red (+) lead goes through the hole nearest S1 and the black (-) lead through the hole nearest C2.

10. Now insert the tinned ends of the BATT1 leads up through the corresponding BATT1 holes located on the lower-right side of the board. Be careful to observe polarity. Solder the BATT1 leads from the top side of the board. Clip the excess from the leads.

11. Now pull the slack wire back through the holes so they are flush against the bottom of the board.

12. Insert U1 into the socket on the PCB, making sure the silver dot is closest to the notch at one end of the socket. Double check that U1 is inserted correctly and completely into the board.

13. It's time to test *little_simon* for the first time! Make sure the switch S1 is in the 'off' position. Insert three AA batteries into the battery holder. IT'S VERY IMPORTANT TO TEST *LITTLE_SIMON* BEFORE YOU GLUE IT TO THE BATTERY HOLDER! It will be much easier to correct any problems if you have access to the solder joints on the back of the board!

14. Slide switch S1 to the 'on' position. There will be a short 'roulette' display with sound, a pause, then gameplay will start. If you're having any difficulties check the troubleshooting section of this guide.

15. Now that your *little_simon* is working, you can glue the battery holder to the bottom of PCB1 with a hot-glue gun. While you're heating up the glue gun, clean the top of the battery holder with some rubbing alcohol and a paper towel. Scuffing the top surface of the battery holder with a green Scotch-Brite pad will help the hot-glue stick <u>much</u> better.

16. Apply two generous globs of hot-glue to the top of the battery holder on either side of the wire running across the top of the battery holder. Don't get too much on the wire. Now press PCB1 onto the glue and hold it down on the battery holder, aligning the battery-holder so it's edges are flush with the sides and centered between the top and bottom of PCB1 before the glue sets.

17. Your *little_simon* is finished! Turn it on and and start having fun!

Troubleshooting Tips

Here's a few thing to check if little_simon doesn't work when you turn it on:

- ✓ Make sure the batteries are fresh and inserted correctly.

- ✓ Make sure U1 is inserted with the correct orientation

- ✓ Double check the polarity of the LEDs and C2.

- ✓ Double check the polarity of the BATT1 battery holder leads.

- ✓ Check to see if you missed any soldering joints.

- ✓ Check for cold soldering joints. Use a cotton swab soaked in alcohol to clean away the flux on any suspect joints when checking.

- ✓ If you have a multimeter, check that there is about 4.5 volts DC at the BATT1 soldering joints on the PCB1. If not, remove and re-insert the batteries and check again.

- ✓ Rubbing alcohol can be used to release the hot glue after it's cooled if you need to remove the battery holder. Just drizzle some on and start to gently pull the holder away from PCB1, adding more alcohol as needed. Be gentle and persistent and the battery holder will come off. Be sure to let the excess alcohol dry before re-installing the battery holder.

Contact

If you have questions about the instructions or if you find any errors you can send e-mail to petercriddell@me.com. For additional information about *little_simon* please visit https://github.com/petercriddell/little_simon.   You can also see more pictures and a video of *little_simon* in action at https://sites.google.com/site/creationsbypeter/.