

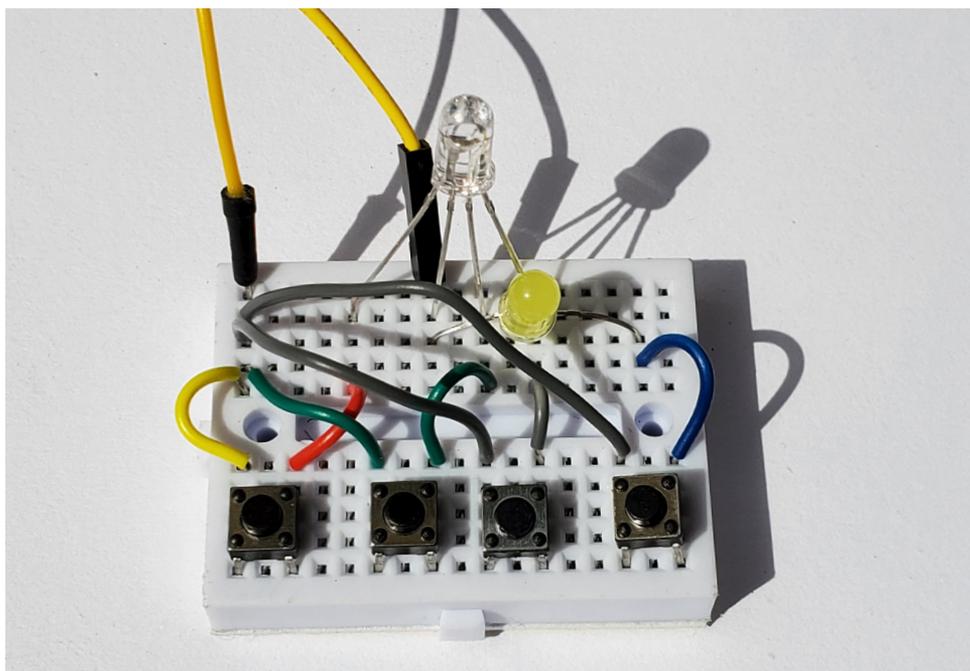
TAKE & MAKE KIT

3 Light Circuit

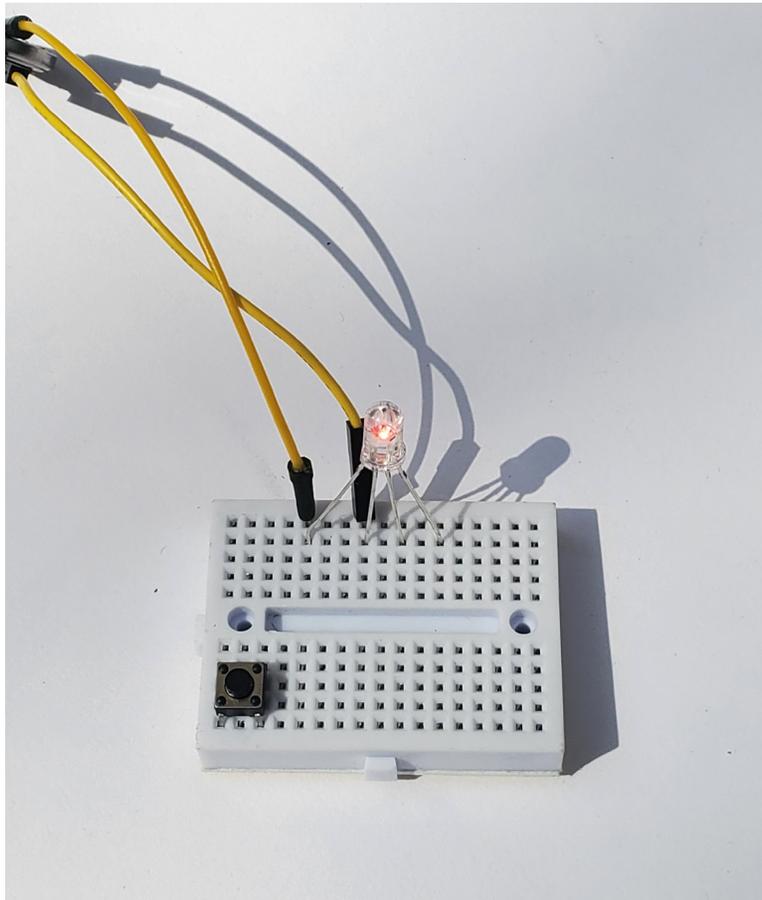
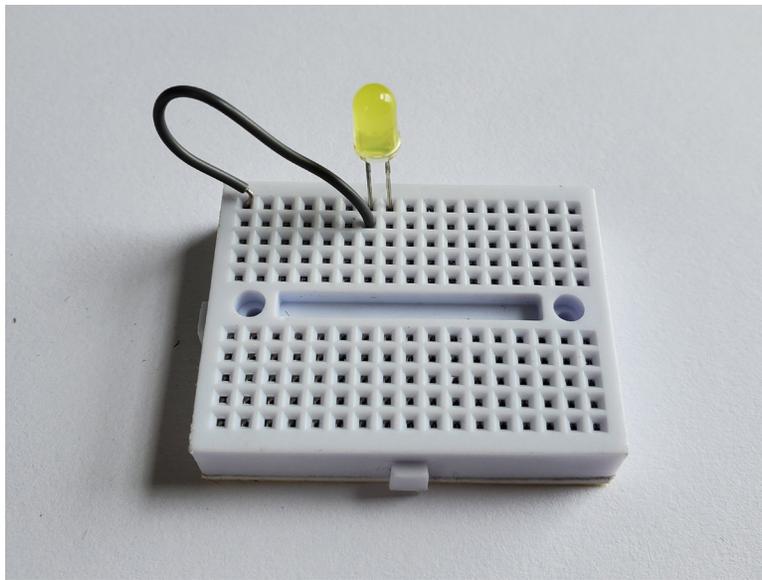
TIME: 45 min

CONTAINS SMALL PIECES

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What's in this kit?

Have you ever wondered how a traffic light works? Learn to make your own 3 light circuit using wires, lights, batteries, and buttons. Explore circuits and buttons to make a real functioning 3 light traffic light by pressing buttons to activate the circuit.

You will learn:

- Basic Circuitry

Let's Get Started!

Materials

- 5 short wires
- 5 long wires
- 4 buttons
- 1 single-color LED
- 1 three-color LED
- 1 piece of duct tape
- 1 piece of copper tape
- Battery
- 1 plastic breadboard
- 3 pieces of transparency

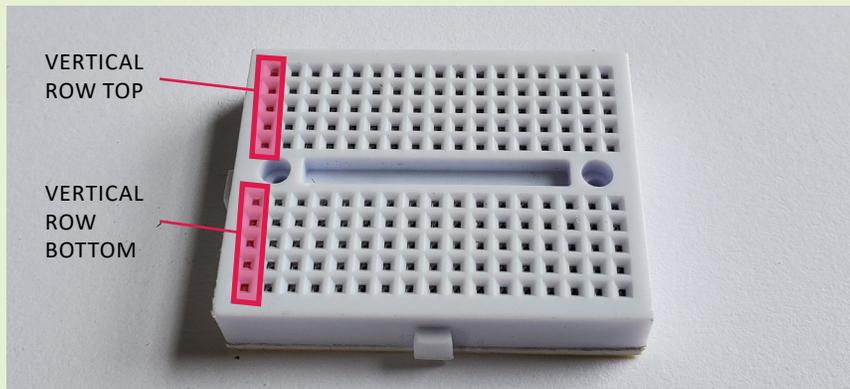
Tools

No additional tools required

INTRODUCTION TO THE BREADBOARD

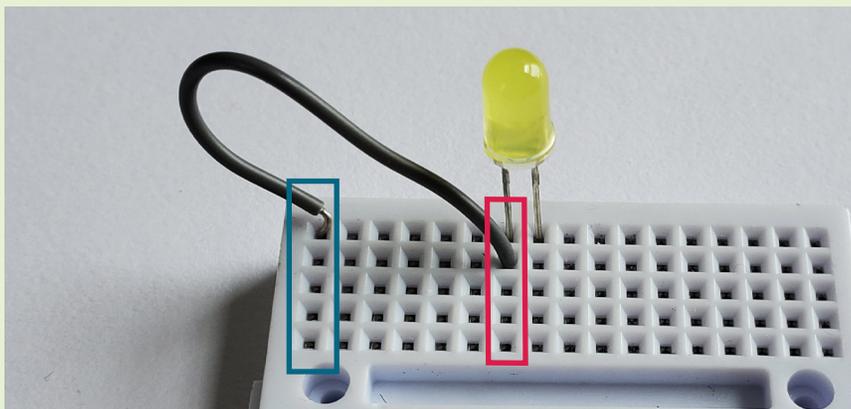
This device is known as a breadboard. It's made of plastic and has holes that can connect electronic components like buttons and batteries with wires. A breadboard is used to experiment and test circuits before making a final design.

The breadboard might look intimidating at first. Here are some things to know when getting started. Take note: When viewed as shown all the holes in the vertical rows are connected. The top and bottom are not connected.



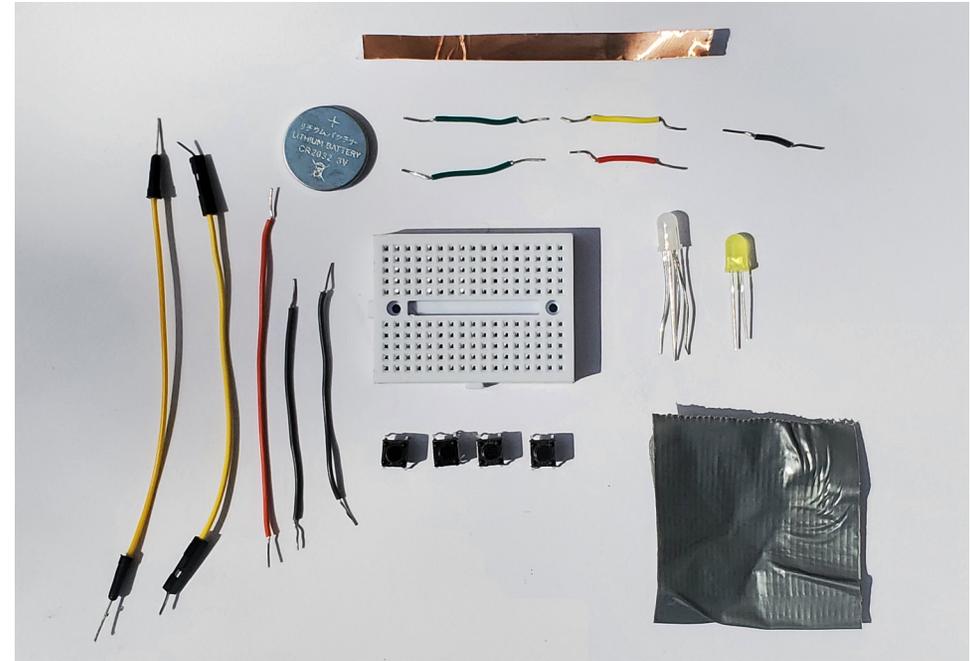
This means when these instructions say to “connect the left prong of this LED” to a wire, you can put the wire into any of the holes in the vertical row where the LED is positioned.

When these instructions read, “connect to a wire on the far left” you can use any of the open holes in that vertical row.



Step 1 - Organize your materials and inspect your LEDs

Separate the long wires from the short wires. Set aside your breadboard and LEDs. Ensure you have all the pieces necessary to complete this project.



Vocabulary

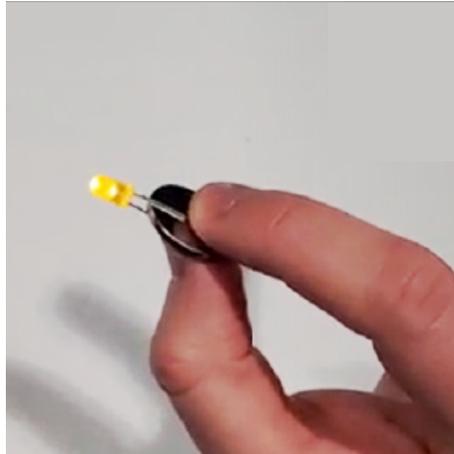
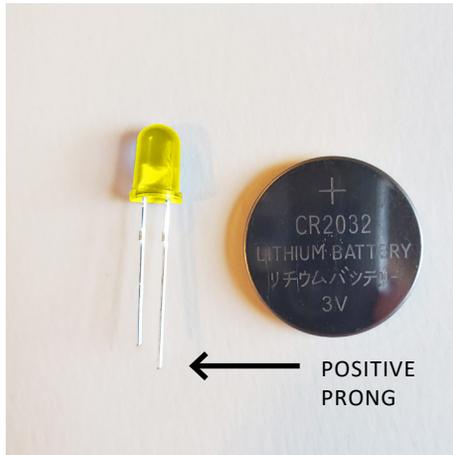
Breadboard - a device for making an experimental model of an electric circuit.

Circuit - a path in which electrons from a voltage or current source can flow through.

LED - (a light-emitting diode) a semiconductor diode which glows when voltage is applied. These are the bulbs that light up in your circuit.

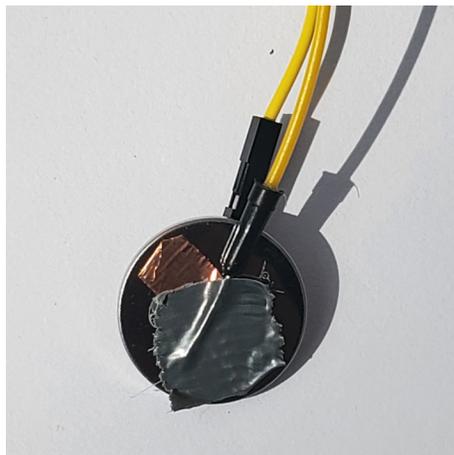
Step 2 - Begin with light

Take your battery which comes wrapped in tape and unwrap it. Take your single colored LED and place the prongs on both sides of the battery. Take note the LED has a slightly longer prong - this is the positive prong. To light up your LED you must have the longer, positive prong touching the side of the battery with a '+' sign.



Step 3 - Prepare the battery

Use your two longest pieces of wire and attach them to the battery on both ends. Use the copper tape to secure the wires. Then use a small piece of duct tape over the copper tape to fully secure the wires in place.



Predictions

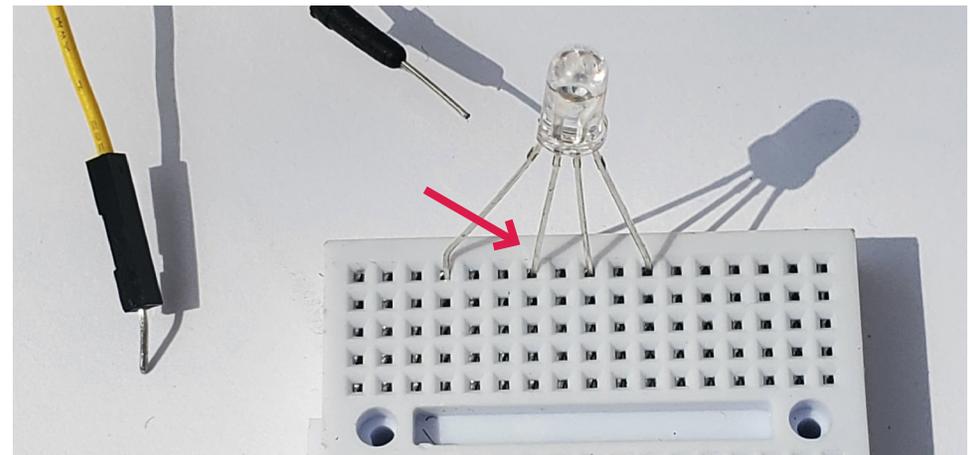
Will you be able to activate more than one light at the same time?

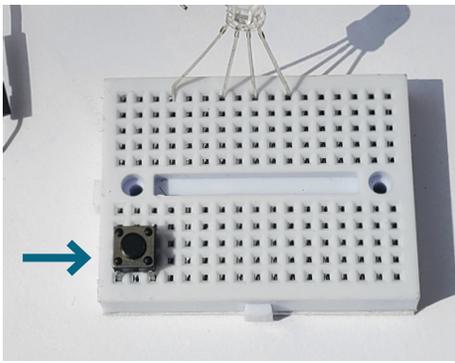
How will switching the placement of the wires affect the circuit?

Step 4 - Insert LED and button

Take your 3 light LED and notice that there are 4 prongs coming out of it. One of these prongs is longer than the others. This one will attach to the positive side of your battery through the breadboard. Gently bend the prongs apart from each other so they can fit into the breadboard as shown below.

Take note of where your longer, positive prong is and make sure it is the second prong on the breadboard.

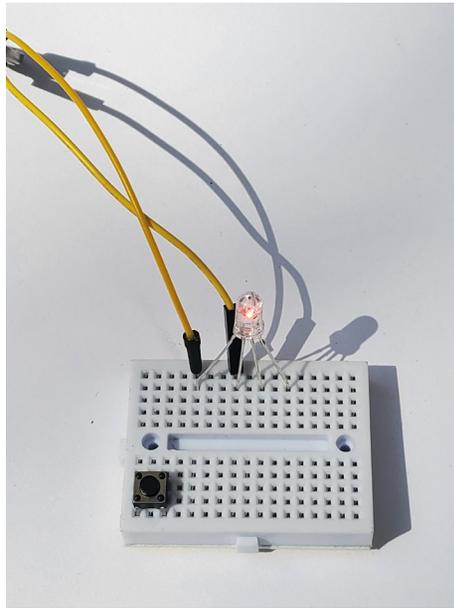




Place a button as shown in the lower right.

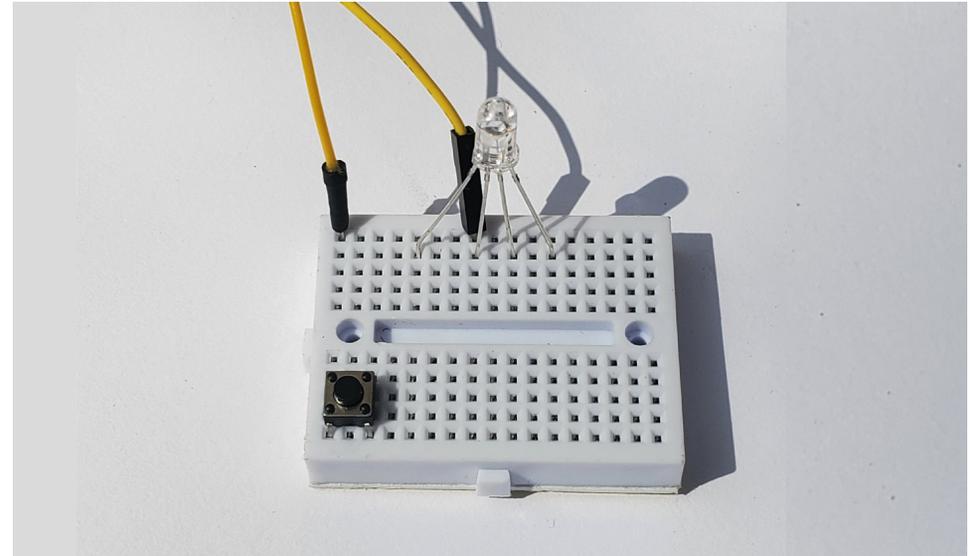
Step 5 - Experiment with the light!

Just for fun, you can attach one wire from the positive end of your battery to the longest prong of your LED. Then experiment with taking turns attaching the battery wire that is attached to the negative battery side, to one of the other 3 LED prongs. When you do this, you should be able to individually light up the LED light to be red, blue or green. If this does not work, try switching the placement of the wires.



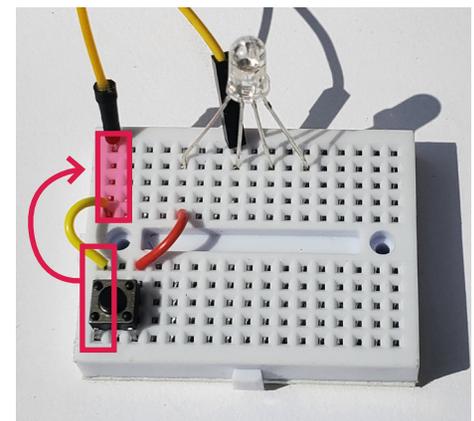
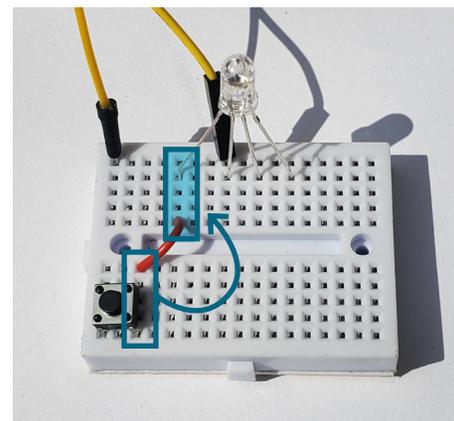
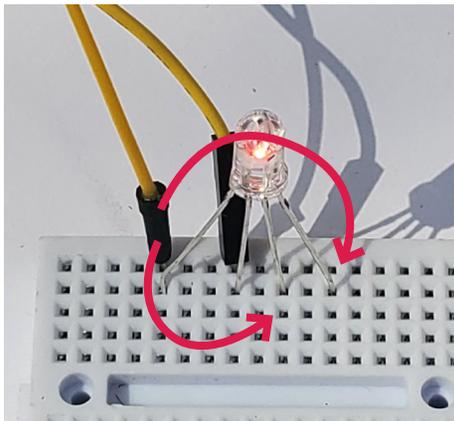
Step 6 - Use your wires

Place the wire that is not attached to the longer, positive charge of the LED to the upper right as shown.



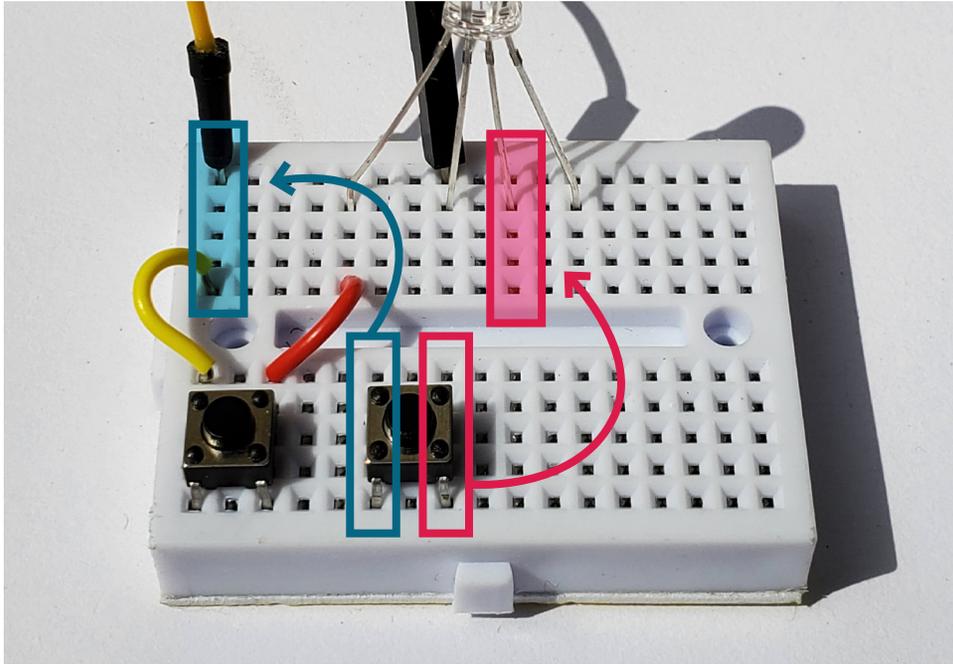
Step 7 - Short wire

Attach the upper right prong of the button to the far left prong of the 3 Light LED. Then attach the upper left of the button to the far left wire. Test it! If it doesn't work, try making sure your wires are matching up to the prongs. Also try rotating the buttons 90 degrees. The curved ends of the button should not be facing the viewer.



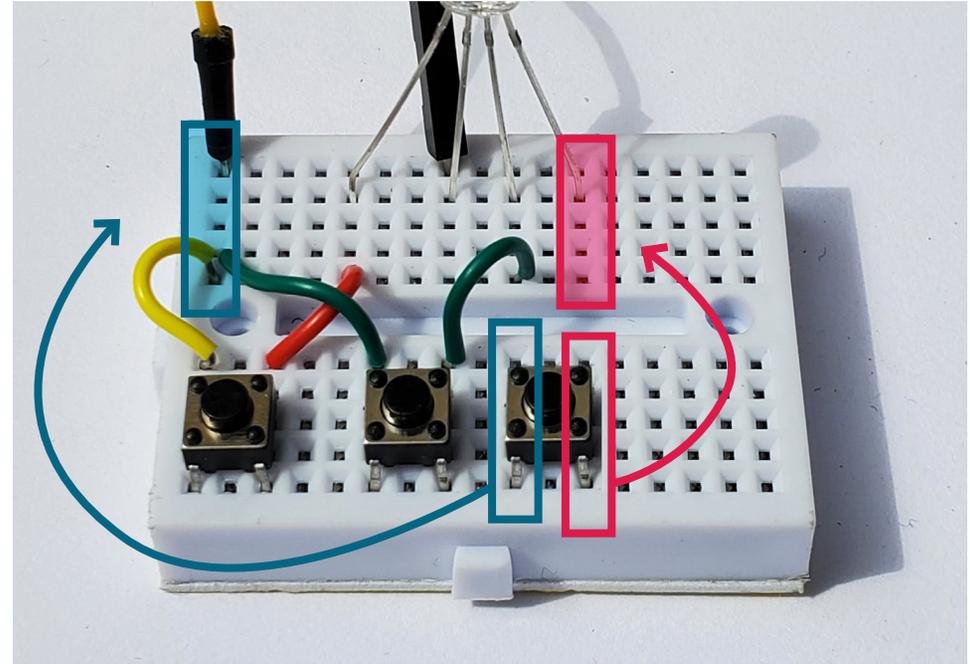
Step 8 - Second button

Now attach another button the same way you did the previous step. The upper left row of the button will attach to the far left row, the upper right row of the button will attach to the third prong of the 3 light LED.



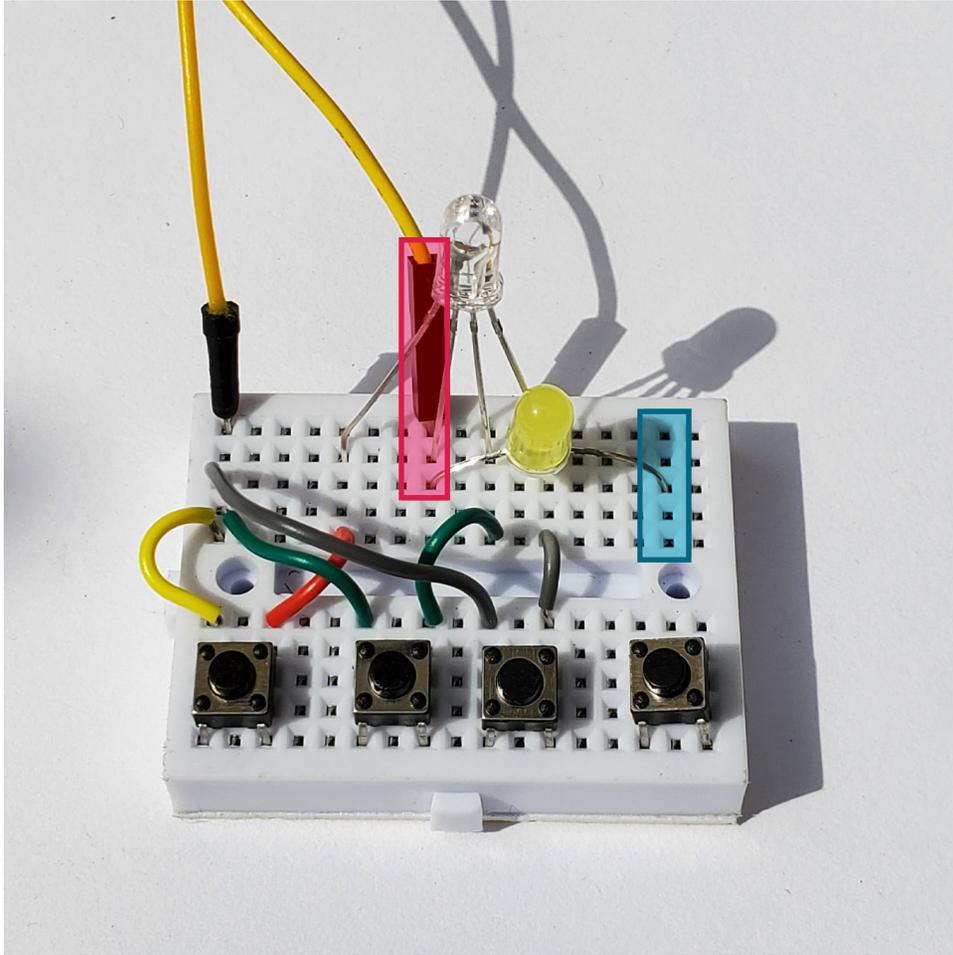
Step 9 - Third button

You're now going to attach a third button as shown below. One wire will go to the far left panel and attach to the left side of the button, you might have to use a long wire for this. The other wire will need to be attached from the right side of the button to the far right prong of the 3 light LED.

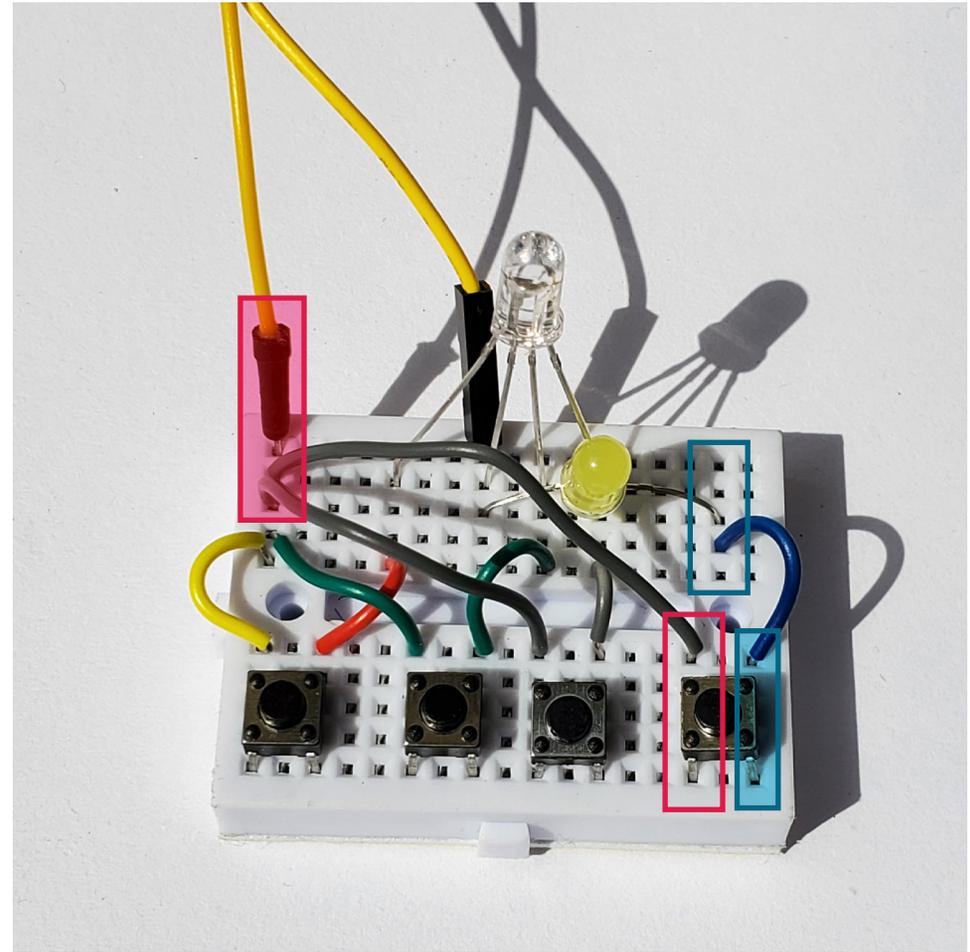


Step 10 - Add the single-light LED

You are now going to add the final LED to your circuit. The shorter end of the LED will attach to the row with the power prong of the 3-light LED. Attach the longer end to a free row on the far right.

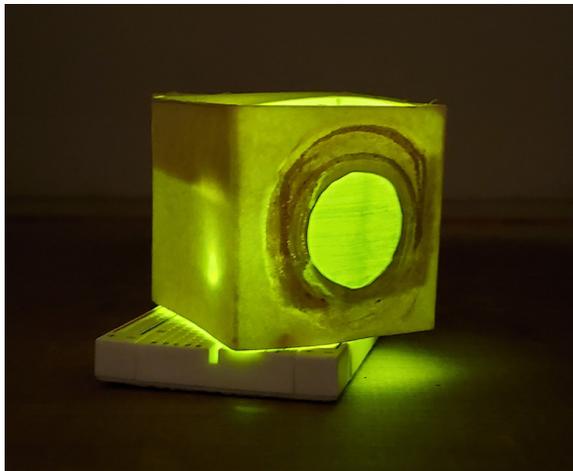


Attach your final long wire to the final open hole in the upper left row. Then attach that wire to the upper left of the final button. The last wire should attach from the upper right of the button to the free prong of the single-light LED. **Your circuit should be functioning at this point!** If the single-light LED doesn't light up, you can try switching the prongs of the LED around.



Challenge!

Using cardboard or paper, try creating a box that goes around the circuit to make it look like a traffic light.



Go Beyond

Experiment with a flash light or light on a cell phone and the 3 pieces of transparency.

Turn the lights off and use the 3 pieces of transparency over the light. What kind of lighting effects can you get? What happens when you overlay more than one color?

Do you have more than one light source in the house? You can try projecting light through the colored transparency with one light source, and get another person to do it with another light source. What happens when you project light with all 3 light sources and a color transparency overlay in a dark room?

HANG OUT,
MESS
AROUND,
GEEK OUT.



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