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# Makerspace Project: MProgram a Soft Circuit with LilyPad Arduino



# MProgram a Soft Circuit with LilyPad Arduino



## What you need to know:

- Fundamental computer skills
- Sewing stitches with needle and thread

## What you need:

- 5mm LED lights
- conductive thread
- sewing needle
- needle nose pliers
- a piece of non-stretchy fabric
- LilyPad Arduino microcontroller
- Arduino IDE software

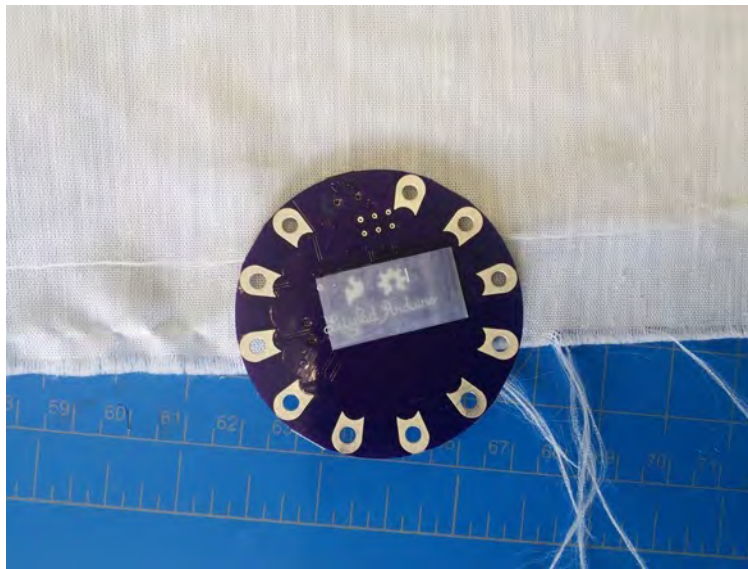
## Part I: Sewing the Circuit

1. Lay out your fabric flat on the table.



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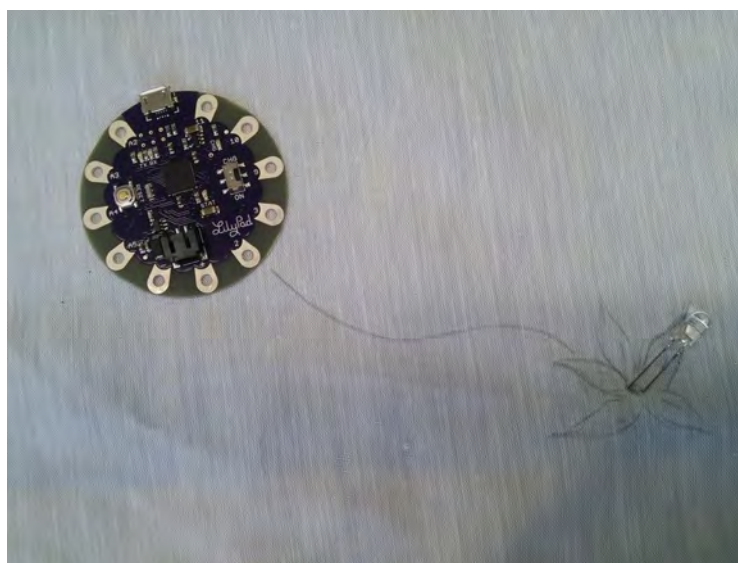
2. To make it easier to sew your circuit, secure the LilyPad Arduino to the fabric. Stick a small piece of double-sided tape to the back of the LilyPad and place it in the middle of the fabric.





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3. Next, choose a spot for the LED and use its wire leads to stick it through. You may want to sketch a design on the fabric to help you with this. I sketched a vine growing from the Lilypad with a flower at the end. The LED will be the flower's middle. Using the wire leads as pins, stick them through the fabric.



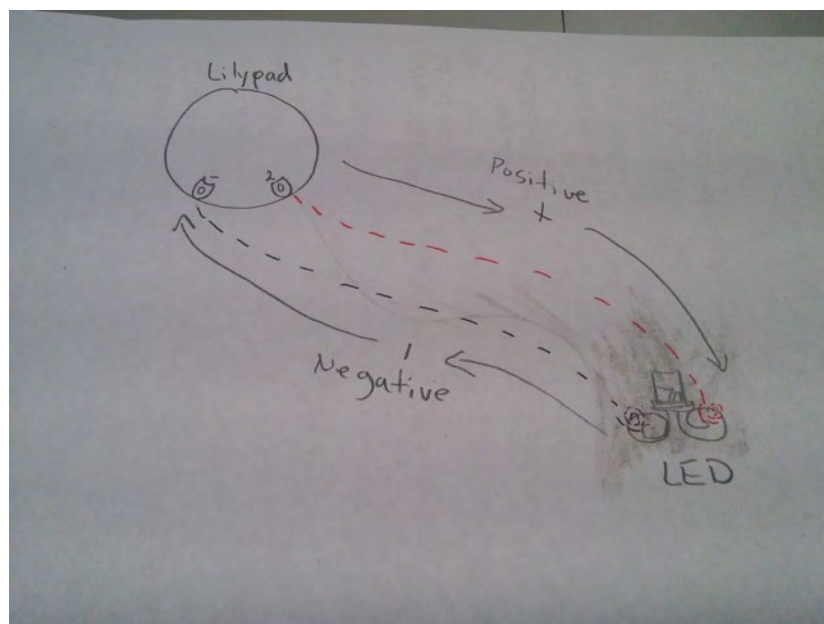
4. After that, you'll need to curl the LED's wire leads so they are shaped like a loop and easy to sew through. Turn the fabric over so you can see the wire leads on the other side. To keep track of which lead of the LED is positive and negative for later, look inside the LED bulb. The smaller triangle of metal is connected to the positive lead, and the larger piece of metal is connected to the negative lead. Using the needle nose pliers, clasp the end of one wire lead and slowly roll the wire lead into a loop shape. Do the same with the other wire lead. The result should look like so.



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5. Next, thread a needle with conductive thread. The conductive thread will conduct the electricity from the Lilypad to the LED. Coarse conductive thread tends to snag easily, so choose a needle with a large eye to make threading easier.

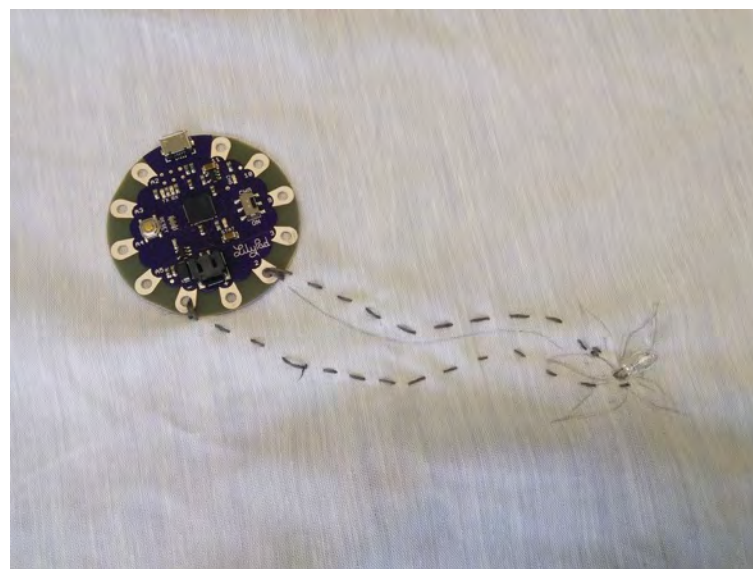
Take a close look at the Lilypad. You'll notice it looks like it has gold petals with holes around the edge. These are the Lilypad's sewable leads. You will sew through the lead with the number two (2) next to it. When programming the Lilypad, we'll refer to lead #2 as digital pin #2. You'll also sew to the lead with the negative sign (-) next to it. This lead is referred to as "ground" in the circuit. The negative wire lead of the LED light will be sewn to this lead on the Lilypad. Microcontrollers have holes called pins where you can plug in components. Because the Lilypad is designed for sewing projects, it has holes that are sewn through. How you'll sew the stitches will make sense with a quick diagram. Here's one below:





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6. Stitch a line from the #2 lead to the positive wire lead of the LED light that you identified earlier. If you did not identify the positive wire lead, you can still do so by look closely at the LED light. The wire lead extending from the smaller piece of metal inside the bulb is the positive lead. Wrap your stitch 2 or 3 times around the lead on the LilyPad and when you've stitched to it, 2 or 3 times around the LED light's loop. Do the same for the ground lead on the LilyPad and the negative lead on the LED light.



## Part II: Programming the Circuit

1. Now you can connect the LilyPad to the computer with the microUSB cord. There is a microUSB port at the top of the LilyPad between the A2 lead and the #11 lead.

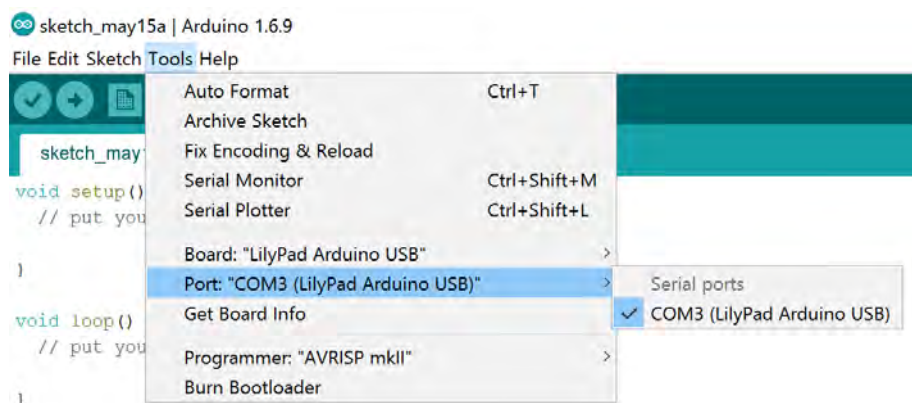
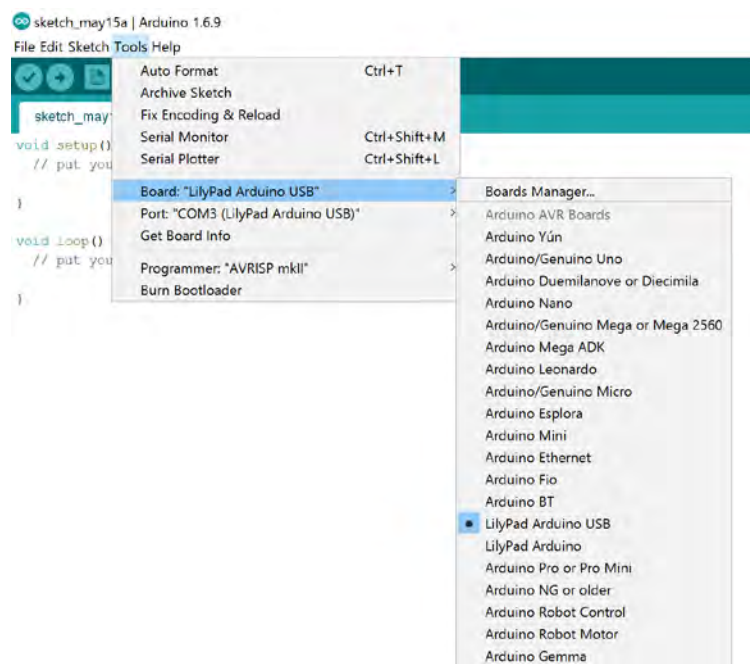




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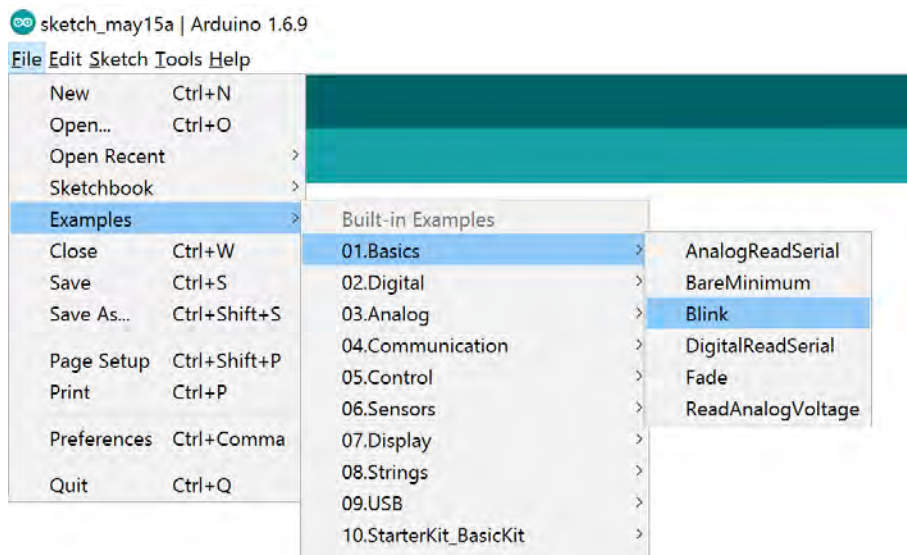
2. Open the Arduino IDE. Under Tools, go to Board, and select “Lilypad Arduino USB.” Under Tools, go to port, and select “/dev/cu.usbmodem1421 (Lilypad Arduino USB).”



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3. Under File, go to Examples, 01.Basics, and select “Blink.” This will open the Blink program which makes an LED connected to the given pin blink. Replace the number 13 with 2. Then at the top of the Arduino IDE click the Upload button, a right facing arrow. This will send the program to the Lilypad. The LED on your fabric should blink!



```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);           // wait for a second
  digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
  delay(1000);           // wait for a second
}
```

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