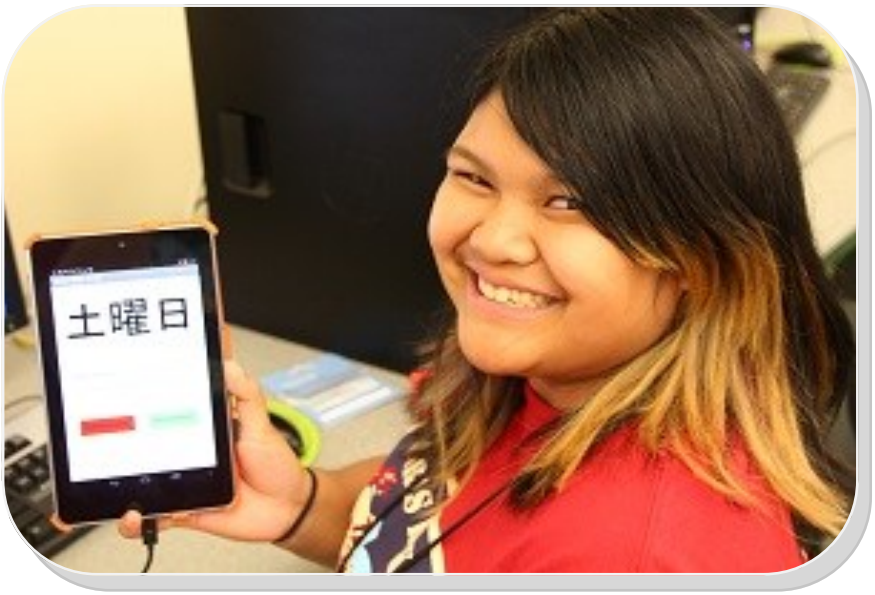
G.A.M.E.S. Camp 2014
Computer Science



Welcome:

Welcome to GAMES camp! We are excited that you are here and are looking forward to a fun week! During this camp, you will be investigating three areas of Computer Science:

- App development
- Programmable microprocessors and Arduino-controlled art and fashion
- Digital forensics and cybersecurity

What is Computer Science:

Computer Science *IS:*

- Practiced by mathematicians, scientists, and engineers
- A discipline that spans theory and practice
- Fun and creative
- The study of problem solving
- Diverse, and often requires both computer science expertise AND knowledge of a particular application domain
- Focused on processes for handling and manipulating information

With a partner discuss and answer the following questions:

1.) Can you think of a problem that a computer scientist could solve?

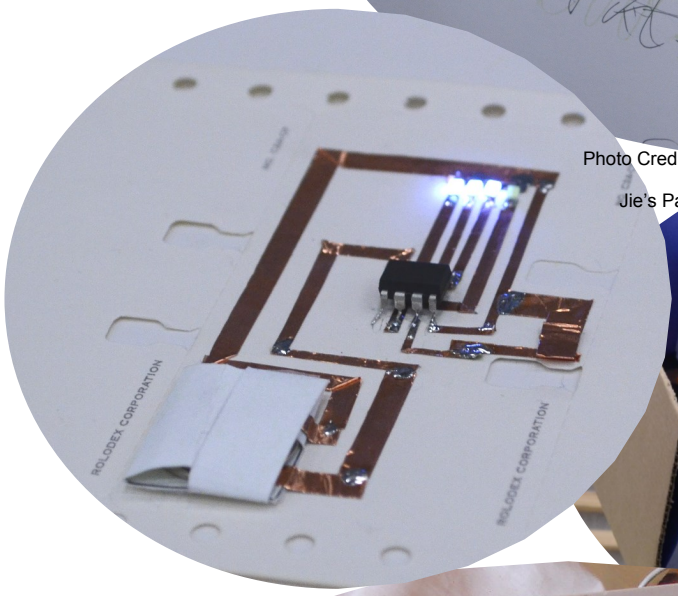
2.) Have you ever seen a computer simulation before? Describe it.

3.) What other jobs could benefit from the help of computer science?

Computer Career Resource http://www.jason.org/live/stem-career-qa-beth-mccabe-google-technologist
Google Technologist

Inspiration:

Photo Credit: David Mellis CC BY-2.0



Jie's Paper Electronics Workshop

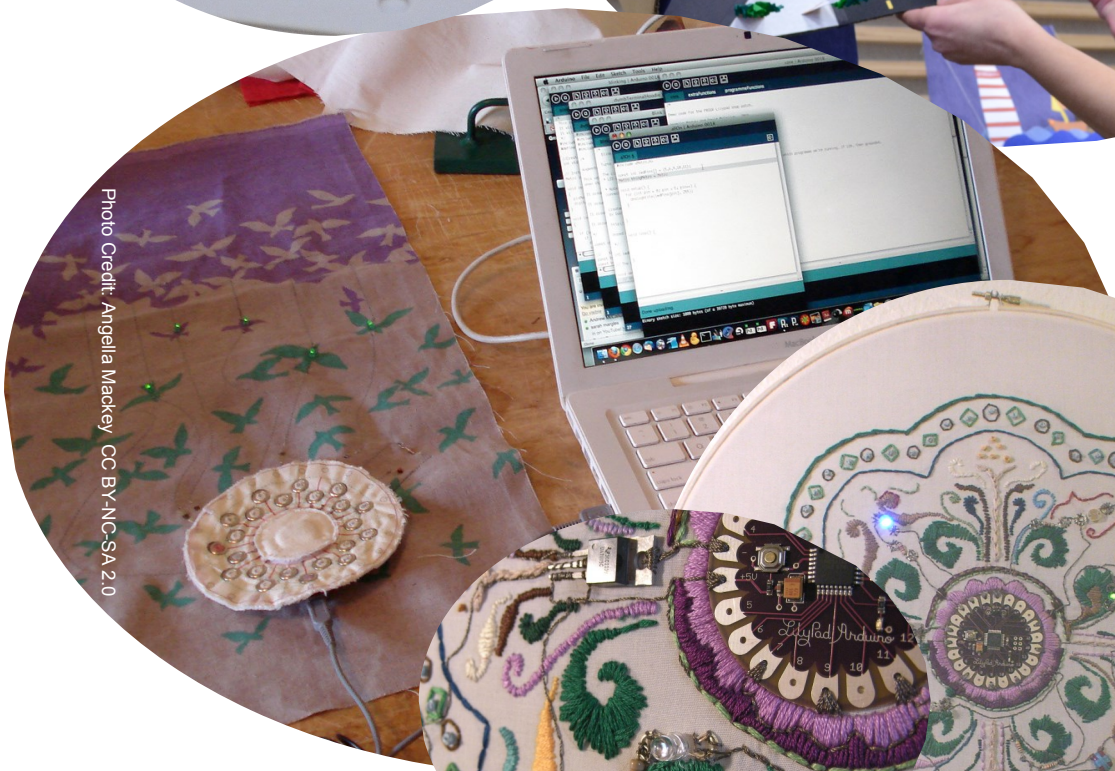


Photo Credit: Angella Mackey CC BY-NC-SA 2.0

Photo Credit: Becky Stern CC BY-SA 2.0

Made with Code https://www.madewithcode.com/

Circuit Sampler

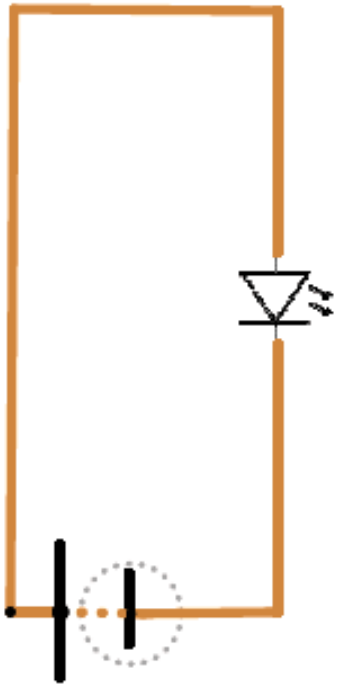
TCIPG

Materials -

copper tape
clear tape
LEDs
3V coin battery
scissors

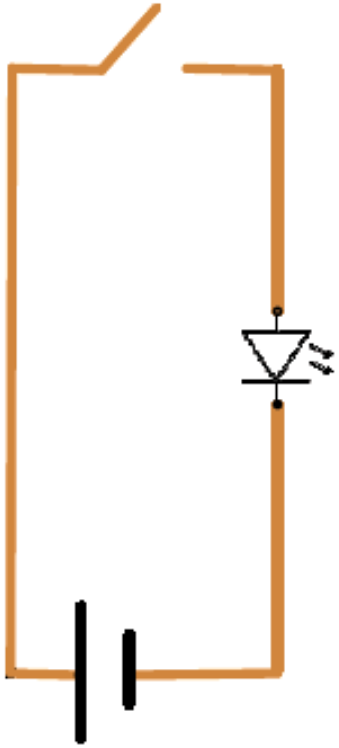
SIMPLE CIRCUIT

Trace the path of the circuit with copper tape, leaving breaks in the tape for the battery and LED. Both sides of the battery need to be a part of the conducting path. Place the battery on the copper tape right before the break. Extend the copper tape from the other side of the break so that it touches the top of the battery.
Tape the LED and battery into the circuit.



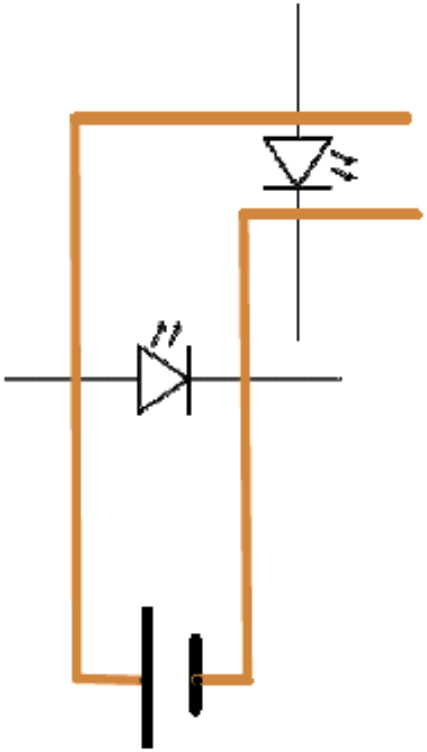
SIMPLE CIRCUIT with a switch

Leave a small gap in the circuit for the switch. One side of the copper tape near the gap should be long enough to touch the other side plus an extra inch. Fold the long piece of tape under itself, covering up the adhesive for a half inch.



PARALLEL CIRCUIT

Use a parallel circuitto power two or more LEDs, .
How can you add more LEDs?



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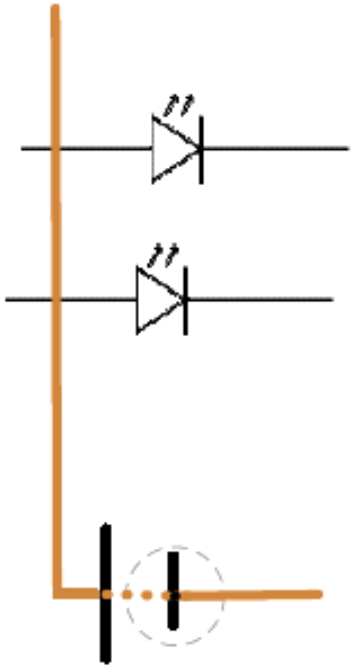
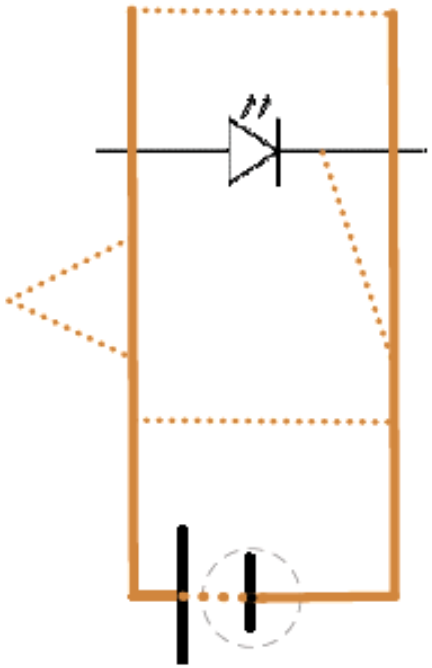
Short Circuits

Materials -
copper tape
clear tape
LEDs
3V coin battery
scissors

CIRCUITS
Trace the solid line paths of the circuits with copper tape, and tape the battery into the circuit.

Learn more about LEDs.
University of Illinois Celebrates LED 50 years
http://www.led50years.illinois.edu/
LED's: The Basics
https://learn.sparkfun.com/tutorials/light-emitting-diodes-leds





Light emittng diodes or LEDs create light when electrons are pushed through two different semiconductor materials. The two materials are layered together so that electrons can flow in only one direction. The moving electrons release photons that we see as colored light. The color of the LED light depends on the type of semiconductor.

LEDs need only small amounts of current and voltage to create light, but some colors require more power than others. LEDs don't create heat so they are more efficient light sources and they last longer than traditional light bulbs.

LED lighting is becoming more common. They are used to light supermarket displays and freezer sections, streetlights and traffic lights, automobile taillights, and have recently been installed to light the giant signs in Time Square in New York City.

Challenge I
1. Place two red LEDs into the circuit as shown. Do both light? Is this a parallel circuit?
2. Add a third and fourth LED.
3. Try LEDs of different colors.
4. How many LEDs can you light in this circuit?
5. Record what you observe in your handbook.

Challenge II
1. Place an LED into the circuit as shown. Does it light?
2. Cut a 3 inch strip of copper tape and leave the backing on. Place the tape into the circuit with the shiny side down in the various places shown by the dotted lines.
3. Add more LEDs.
4. Record what you observe in your handbook.

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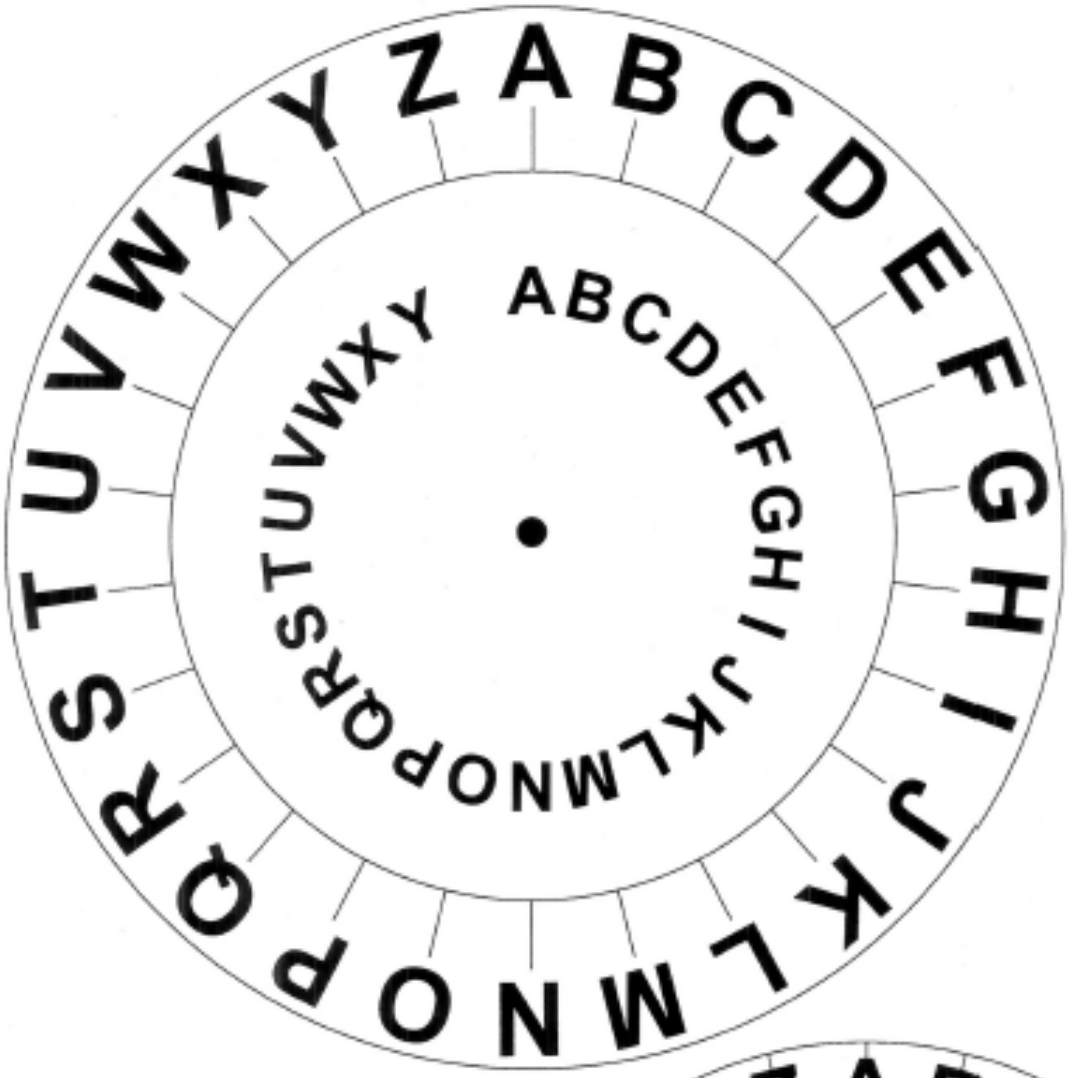


Cut out the 2 disks

Make holes into the disk centers and attach the smaller disk to the larger one using a brass paper fastener

CIPHERS

Ciphers

A **cipher** is a set of rules for converting between **plaintext** and **ciphertext**. These rules often use a secret **key**, and are used to encrypt and decrypt messages. It's a way of protecting secrets!

Shift ciphers are one common type of cipher. These simple ciphers substitute one letter for another letter that is some fixed number of positions further down the alphabet. The cipher key determines the number of letters for the shift. You can use a cipher wheel to encrypt and decrypt your secret message.

Today computers use much, much more complicated rules to encrypt passwords and other private information.

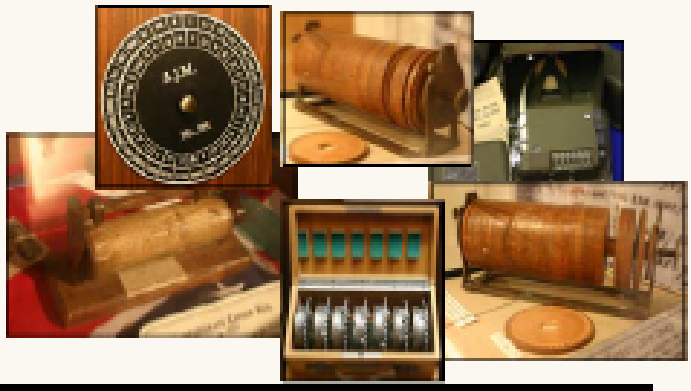
Encryption

Encryption consists of a few parts:

-Plaintext: The original text.

-Ciphertext: The encoded version of plaintext.

-Cipher: The algorithms or rules used to encrypt and decrypt ciphertext.



Examples

1. **Key=3**

   Ciphertext: *E-B-I-I-I*

   Plaintext: *hello*

2. **Key=6**

   Ciphertext: *I-G-K-Y-G-X*

   Plaintext: *caesar*

Ciphers in History

The Caesar cipher was used by Julius Caesar two thousand years ago. This is one of the first known uses of a shift cipher.

Ciphers were also used during the American Civil War, where Union and Confederate generals and civilians used codes and ciphers to transmit secret messages. Both sides attempted to break each other's code and cipher systems with varying degrees of success!

Unplugged Activity 1: Computational Thinking

Let's get to know each other a little bit! This activity will build upon last night's discussion about what Computer Science is and how it impacts your daily life. To start, let's watch a short video from Code.org.

Code.org is a non-profit organization that is dedicated to expanding the participation in computer science by making it more available in schools, particularly those in urban and rural neighborhoods, and to increase the participation by women and underrepresented students of color. Code.org also wants to harness "the collective power of the tech community to celebrate and grow C.S. education worldwide." The videos featured in the Code.org curriculum use real programmers from tech industry companies including Google, Facebook, Pinterest, and Twitter.

In this Code.org activity, you'll be engaging in one of the fundamental skills of computer science: computational thinking. Computational Thinking is a method of problem-solving that helps computer scientists prepare problems for digital solutions.

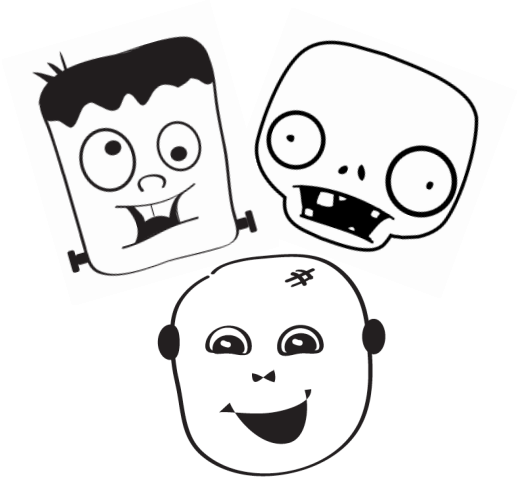
Key terms for this activity include:

Decompose:

Abstraction:

Algorithm:

Pattern:



Your goal is to write instructions so that another person could use only the Monster Catalog and draw one of these monsters, without knowing what the monster should look like ahead of time. Furthermore, you may need to describe more than one monster—you don't want to have to start over every time do you? How could you write instructions that you can reuse by making only small changes?

Steps:

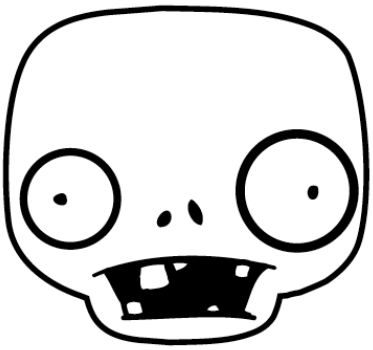
1) Decompose—What needs to be done to make the monster?

2) Patterns—What do the monsters have in common?

3) Abstraction—What's different about each monster?

4) Algorithm—How can you put this together to make a series of instructions your fellow campers can follow?

Let's write instructions for drawing the Zombus Vegitas:



Zombus Vegitas

Draw a _____ head

Now let's see how good you are! Use the one-page Monster Catalog to sketch a monster of your own design. Write an algorithm (on the back of the Monster Catalog) so that a partner can draw your adorably hideous creation without seeing your sketch. Use the space below:

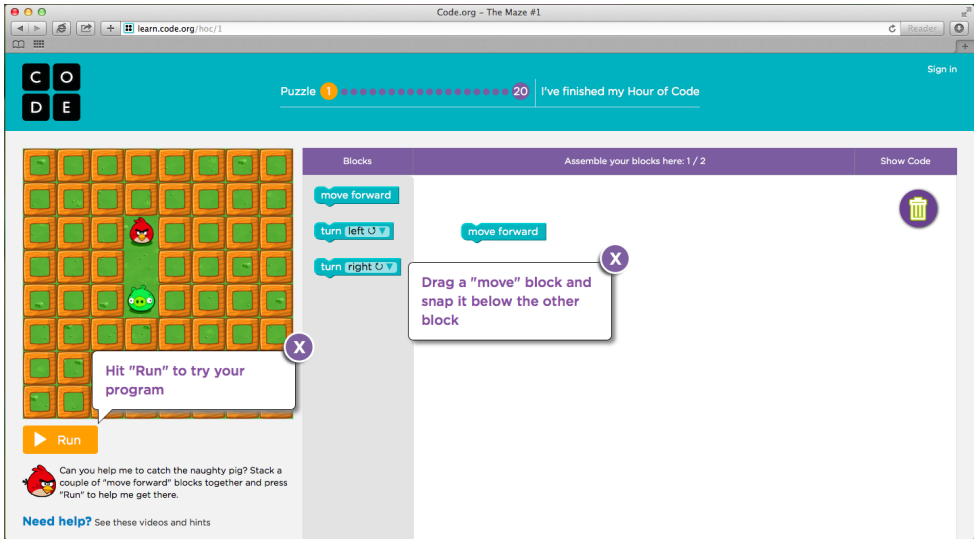
Trade algorithms with a partner and follow their instructions. Draw their monster in the space below.

Does your drawing look the way they intended it to look? Did your partner correctly draw your monster?

What is it called when a computer scientist finds and corrects mistakes in a program?

Let's Start Coding!

As an introduction to tile-based programming, you are going to do a series of puzzles in Code.org's Hour of Code curriculum. These are quick, fun, and allow you to see that after you learn a few basics, programming becomes intuitive and encourages your imagination! Open a web browser and go to: learn.code.org/hoc/1



There are 20 puzzles to complete in Stage 2, each more advanced than the last. Be sure to click on Show Code in each puzzle to see how the tiles you program with write lines of code. (While we are only going to do the Hour of Code section during Camp, there are hours worth of other activities to develop your coding skills—java, app development, you name it. If you have free time during camp, or at home, we encourage you to check them out at: code.org/learn/beyond)

When you're done with your Hour of Code, go ahead and print off your certificate!

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Unplugged Activity 2: Graph Paper Coding

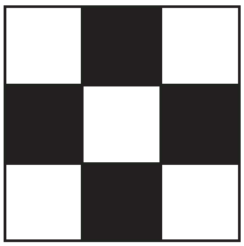
Computer Scientists don't sit in front of screens all the time — let's get out of our seats and get some air! In this activity, you'll be working in groups to explore the process of "coding." To code something means to *transform actions into symbols*. This isn't just done in computer science, any sort of pattern or recipe contains coding. In fact, women have been coding for generations—have you ever seen a knitting pattern?

Let's write a code for filling in a grid to look like the image below. The least confusing way to code an image like this is to return to the left of the image whenever you drop down to the next row. Assume in this activity that you will start in the top, left box of the grid.

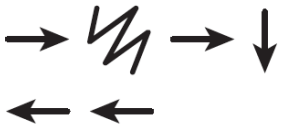
First, write down the steps for creating this pattern in WORDS. The first two lines are given as an example. Let's finish coding in words:

Step forward, fill-in, step forward, next row,

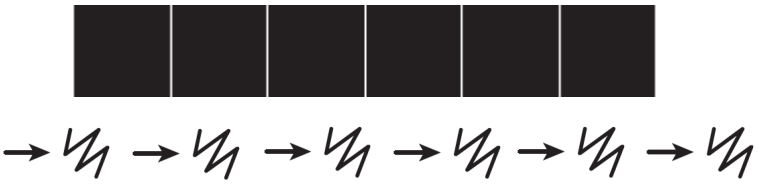
back, back,



Now let's code this—that is, let's transform the actions into symbols. The first two lines have been done as an example. Finish coding the image:



Are there any steps that seem unnecessary or that could be combined somehow? Take a look at the image and its code below. Can you think of a way to simplify this? What problems could redundant commands like this cause?



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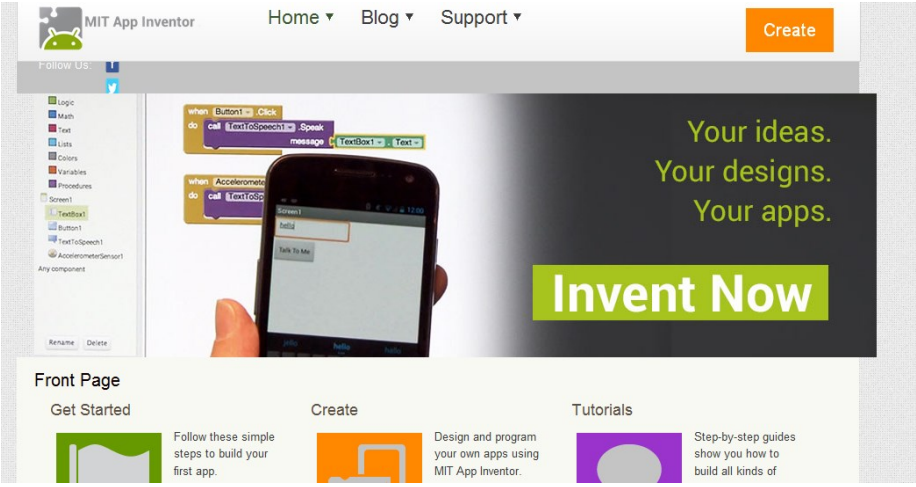
App Inventor 2

Now that we've explored some tile-based programming, you're ready for more of a challenge! App Inventor is another cloud-based tool developed by MIT that runs through a Web browser. You will be using App Inventor 2 to design and create your own app! To get started, you need a Google account. Login with your Gmail (or school email account if it is tied to Google) to get inventing.

After learning the basics of App Inventor 2, start brainstorming an app of your own design. What will it do? What will it look like? Do you have the skills necessary to create your design? Do you need additional resources (time, tutorials, etc) to program your app?



Instructions for set-up and connecting an Android device:

http://appinventor.mit.edu/explore/ai2/setup-device-wifi.html

Instructions for setting up the Emulator:

http://appinventor.mit.edu/explore/ai2/setup-emulator.html

Tour of App Inventor 2:

http://appinventor.mit.edu/explore/designer-blocks.html

Beginner Tutorials:

http://appinventor.mit.edu/explore/ai2/beginner-videos.html

App Inventor 2 Challenge

Let's put your knowledge of App Inventor 2 to use! Your challenge, is to create an app that satisfies one of the two options below:

1.) Apps for a Better World

The MIT App Inventor team is looking for innovative apps from creative programmers like you that illustrate App Inventor's versatility and functionality. Winning apps will be featured on the App Inventor homepage and need to be from one of the four areas below:

- Apps for Communities (apps that help organizations, companies, governments)
- Apps for Individuals (apps that help or entertain individuals)
- Apps for Research (apps that support research)
- Apps for Education (apps that support education)

To enter your app into this program you must email aiwebreview@mit.edu with "Application for App of the Month" as the subject line. Your email must contain the following information:

- Your App's title
- Which category(ies) you're submitting it for
- What the app does
- Why did you build it?
- What is your name, age, profession?
- What is the current status of the app? (e.g., is it currently in the Play Store?)
- 1-3 screenshots of the app
- App's .apk file OR a link to the app on the play store, if applicable

2.) Create a game (this is G.A.M.E.S. camp, after all!)

- A well-designed user interface with at least one button
- Media (sound, image, etc) played in response to an event
- Some decision-making (an if-block)
- A timer or clock component
- A procedure (a set of sequence statements that you refer to as a single command)

Try out the MoleMash game tutorial for inspiration—you'll also gain a deeper understanding of what App Inventor 2 can do!

The Google Play Store—Get your App Out There!

You love the app that you've made and feel like it has potential to improve the world or entertain the masses—so now what? You can add your app to the Google Play Store and the world can start downloading and using it!

To start, you'll need to register (and pay the $25 registration fee) at the Google Play Store's Developer Console:

https://play.google.com/apps/publish/signup/

Once registered, follow these instructions for uploading your app into the store:

https://support.google.com/googleplay/android-developer/answer/113469?hl=en

Status Bar
Action Bar
Navigation Bar
Status Bar
Action Bar
Navigation Bar

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Status Bar
Action Bar
Navigation Bar
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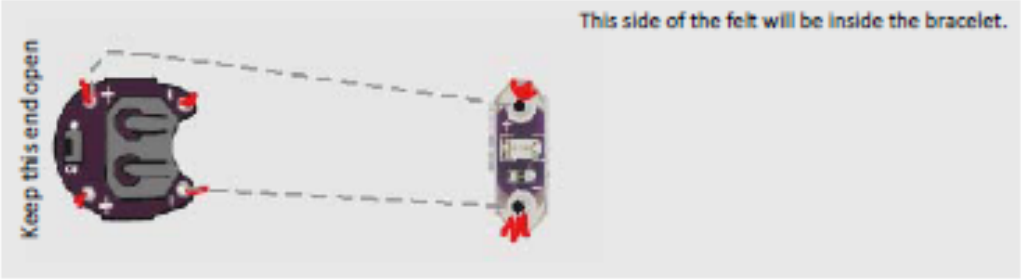
Navigation Bar

LED Bracelet

TCIPG
TRUSTWORTHY CYBER INFRASTRUCTURE FOR THE POWER GRID

Two strips of felt will be layered to form the bracelet.

1. Use regular sewing thread to attach the battery holder to one side of the layer of felt that will be next to your skin.
2. Use regular sewing thread to attach the LED to the same side of this layer of felt.
3. Use conductive thread to sew traces from the positive tab of the battery holder to the positive tab of the LED and from the negative tab of the battery holder to the negative tab of the LED.



4. Flip the bottom layer over and use regular thread to sew the stud parts of the two snaps to the end that does not have the battery.

5. Place the top layer over the bottom layer and mark where the LED will shine through.
6. Incorporate the LED as you embroider and stitch beads and other decorations to the outside of the top layer.
7. Use regular sewing thread to attach the socket parts of the two snaps to the end of the outside of the top layer.

8. Connect the two layers with regular sewing thread. Sew around both long edges and the short edge that is not near the battery holder.
9. Leave the short end near the batter holder open.
10. Insert the battery and turn on the switch. Then snap the bracelet onto your wrist!!!

MATERIALS

1 Coin battery

1 Battery holder

2 Metal snaps

LEDs

Needle

Conductive thread (shown as grey stitches in the drawings)

Regular sewing thread (shown as red stitches in the drawings)

2 strips of felt material, 8-9 inches long and 1.5-2 inches wide

Troubleshooting Your Circuit:

LEDs don't light, blink, or don't stay lit

Double check that your battery is secured and that the positive tab of the battery is connected to the positive tab of the LED

Be sure the conductive thread traces don't cross each other.

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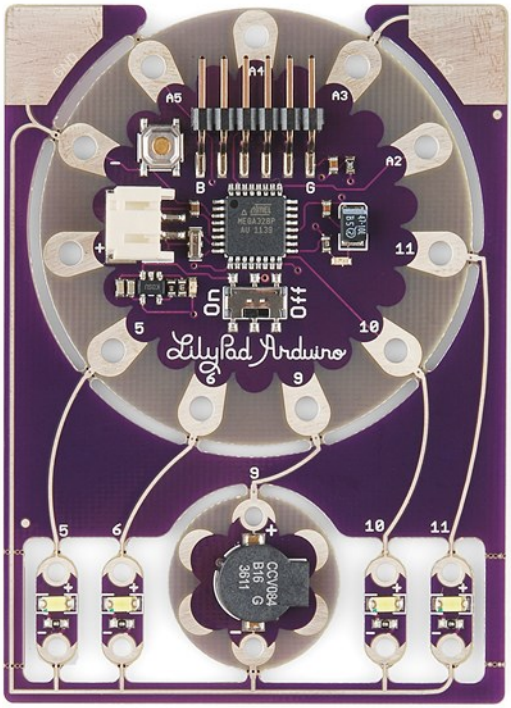
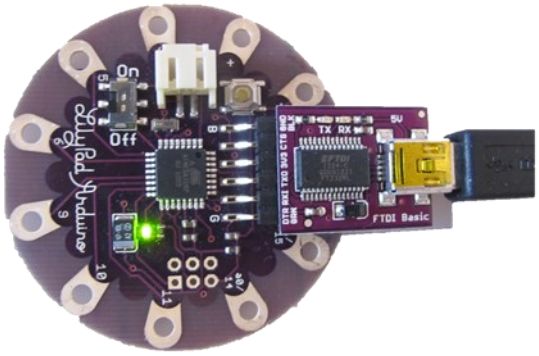
LilyPad Arduino Programming Tutorial



The LilyPad Arduino is a microcontroller board designed for wearables and e-textile projects. It can be sewn to fabric (or taped into notebooks or to hard surfaces) to add programmable fun to any project! LEDs are the bacon of electronics and prototyping—they make everything better (in our humble opinion). But wouldn't it be even better if you could program those LEDs to in a specific pattern of blinking awesomeness? Or add sound? Or maybe you want to add an accelerometer and LEDs to your favorite skirt so that when you twirl, the lights flash? You can do all of this with a LilyPad Arduino! (It's washable too—just don't forget to remove the battery first!)

Your LilyPad kit is the ProtoSnap LilyPad Simple which contains the LilyPad simple board, 4 LEDs, a buzzer, a rechargeable battery, a FTDI chip for programming, conductive thread, and needles. Additional accessories, sensors, and materials are available at sparkfun.com should this become your new hobby.



LilyPads are programmed using the Ardunio environment which you must first download. Use the link below to learn the basics of LilyPads—what the hardware is, how the components get attached to the board, and how to upload code to the device. After a few introductory pages, the tutorial will take you through the steps for downloading and installing on your computer. After that, there are instructions for uploading some sample code and creating a Raygun project—you don't actually have to make a raygun, but do follow the instructions! It's very thorough and a great way to dive into the eTextile world. We uploaded the code and then sewed our LEDs into a different configuration, ignored the buzzer, and then edited the code in Arduino. Regardless of what you decide to do—do NOT snip apart your Development Board until the tutorial tells you to do so!

https://learn.sparkfun.com/tutorials/protosnap-lilypad-development-simple-hookup-guide/introduction

Photo Credit: Angella Mackey CC BY-NC-SA 2.0

iRobotics Demo

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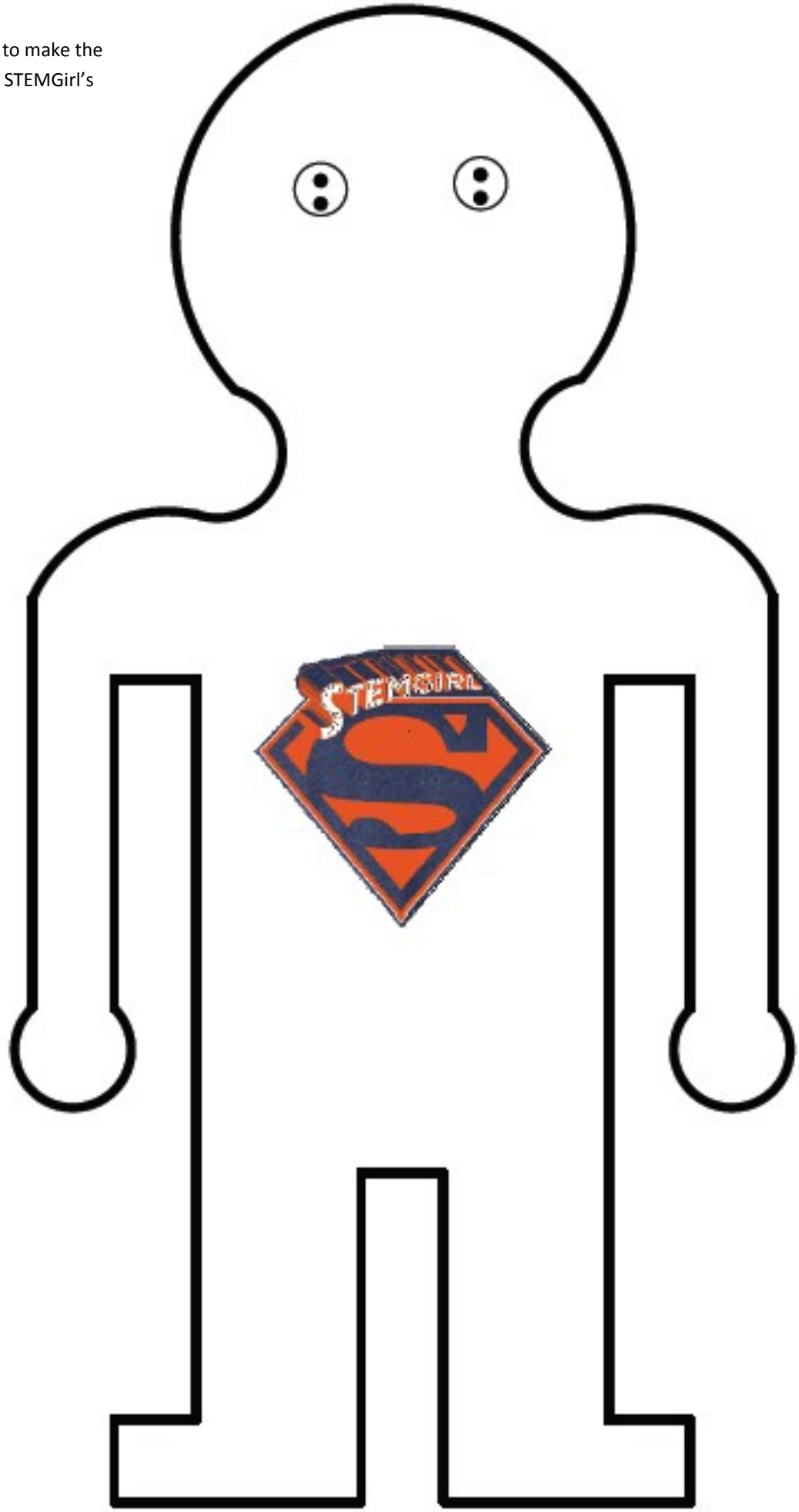
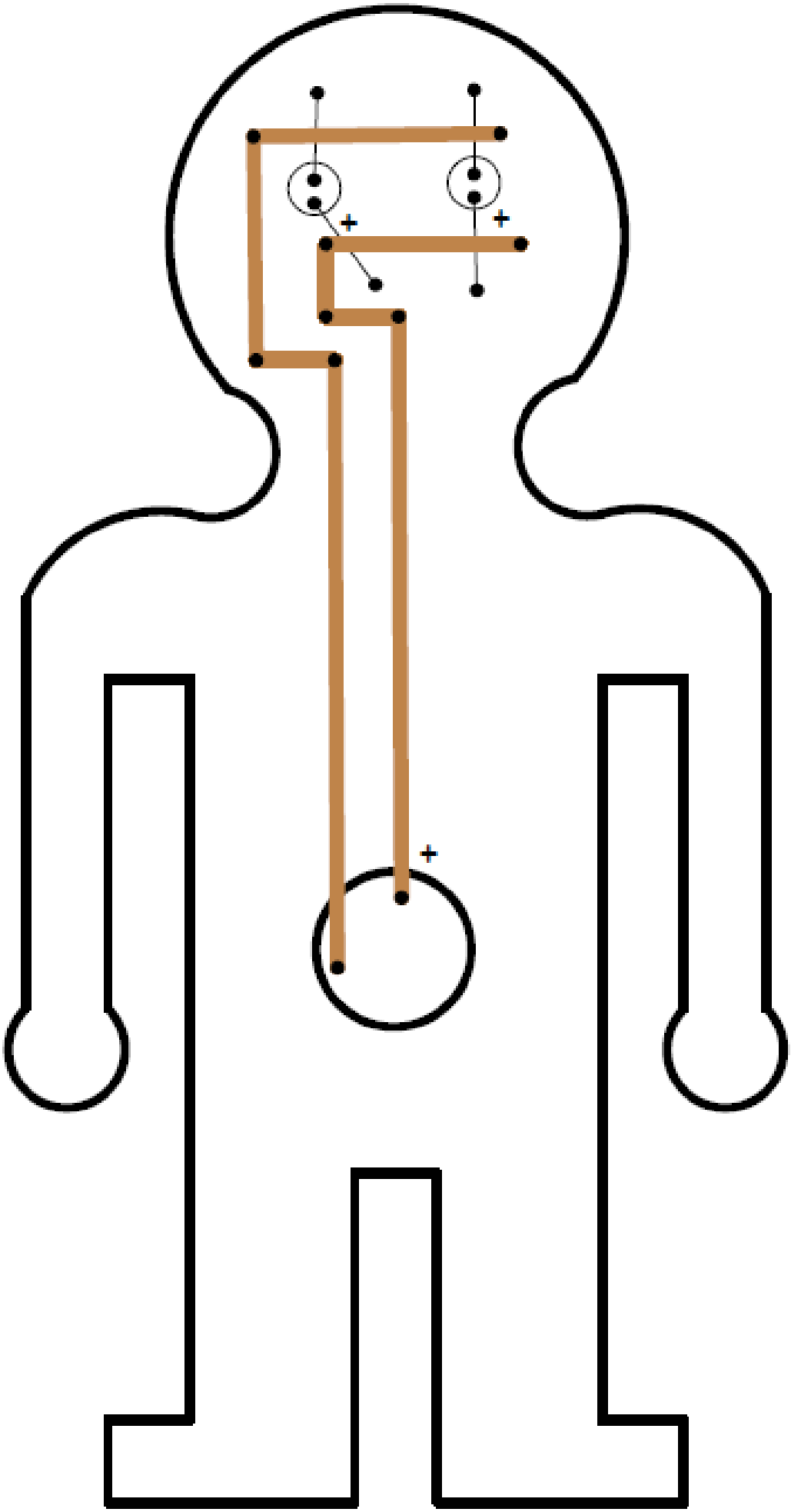
Build the circuitry to make the LED's light up the STEMGirl's eyes.





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Investigate Computer Science at the Khan Academy.

Visit *Cryptography & Information Theory* to learn select topics from computer science - cryptography (how we protect secret information) and information theory (how we encode and compress information). Start with Ancient Cryptography https://www.khanacademy.org/computing/computer-science/cryptography

CRYPTOGRAPHY & INFORMATION THEORY

Journey into cryptography

How have humans protected their secret messages through history? What has changed today?

ALL CONTENT IN "JOURNEY INTO CRYPTOGRAPHY"

Ancient cryptography

Explore how we have hidden secret messages through history.

- What is cryptography?
- The Caesar cipher
- Caesar Cipher Exploration
- Frequency Fingerprint Exploration
- Polyalphabetic cipher
- Polyalphabetic Exploration
- The one-time pad
- Perfect Secrecy Exploration

Modern cryptography

A new problem emerges in the 20th century. What happens if Alice and Bob can never meet to share a key in the first place?

- The fundamental theorem of arithmetic
- Public key cryptography: What is it?
- The discrete logarithm problem
- Diffie-hellman key exchange
- RSA encryption: Step 1
- RSA encryption: Step 2
- RSA encryption: Step 3
- Time Complexity (Exploration)
- Euler's totient function
- Euler Totient Exploration
- RSA encryption: Step 4
- What should we learn next?

Computer Career Resource http://www.jason.org/live/stem-career-qa-james-bryant-cybersecurity-consultant
Cybersecurity Consultant

Lilypad Challenge

The file, *samples.ino*, contains sample code for using the various components on your Lilypad board. Make sure you don't snap off any of the components! The program won't work if your Arduino isn't connected in the ProtoSnap format.

Read the comments that accompany the code, especially the lines in setup() and loop(). Run the program on your Arduino, then explore by uncommenting and reorganizing the code. How does the Arduino's behavior change when you run certain lines of code? How does it change when you run code in a different order?

Record what you see here.

Fab Lab Field Trip Day!

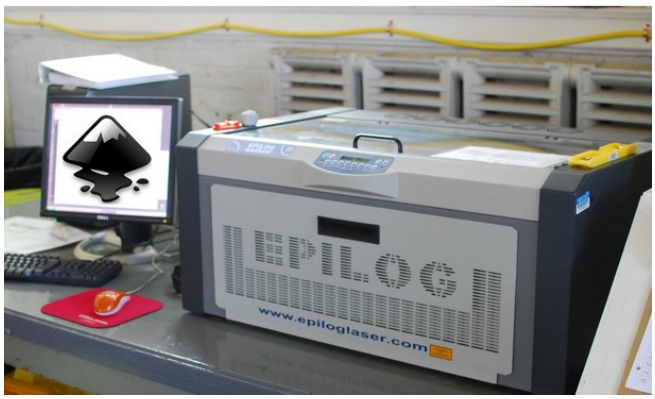
The mission of the Champaign-Urbana Community Fab Lab is to promote ingenuity, invention, and inspiration by introducing learners of any age to modern prototyping and fabrication equipment. Their goal is to encourage creativity as well as an interest in architecture, art, computing, engineering, mathematics, science, and technical trades. The Fab Lab believes that community access, provided at a reasonable cost and in cooperation with the global Fab Lab network, builds local capacities by enabling personal growth, economic development, and cross-cultural understanding. People are encouraged to build, tinker, and make virtually anything they can imagine!

Before we visit the C-U Fab Lab, use Inkscape to design your artwork for your laser cutter project.

Visit the C-U Fab Lab website (http://cucfablab.org/book/inkscape-beginner-tutorial-videos) for the Inkscape Video Tutorials. Start with the **Beginner Tutorial** and also complete the **Epilog Laser Intro**.

Introduction to Inkscape for the Epilog Laser Engraver

Creating shapes and lines for raster engraving and vector cutting
Champaign-Urbana Community Fab Lab
By Jeff Ginger | v1.6 | 06.2014



Find more information about the using the Laser Engraver see this document. https://docs.google.com/document/d/1Yck6-zOFX5B75dlv1EvKawbjuQrYNIP15_hh479P71U/edit?pli=1

Steganography

Steganography means "covered writing" and dates back to ancient times. Encryption changes the message, but steganography hides it. Using invisible inks is one example of steganography. Other steganography techniques include hiding text within other innocent looking text passages or within photos.

Can you find the message hidden in this text?

Fishing freshwater bends and saltwater coasts rewards anyone feeling stressed. Resourceful anglers usually find masterful leapers fun and admit swordfish rank overwhelming anyday.

The bear above is an adorable glow-in-the-dark skeleton costumed bear. The bear below is the same photo, now containing a hidden secret picture. Can you see any difference?

Digital Forensics, Privacy, and Security

What information are you sharing?

What does your online activity reveal about you?

Who could be listening to your phone activity?

all tech considered TECH, CULTURE AND CONNECTION

behavior | privacy & security | social web | innovation

privacy & security

Project Eavesdrop: An Experiment At Monitoring My Home Office

by STEVE HENN

June 10, 2014 3:47 AM ET

Your Digital Footprint

http://www.internetsociety.org/your-digital-footprint

Access Point Demo

Shane Rogers

Illinois Cyber Security Scholars Program

Explore the fascinating field of cybersecurity through the Illinois Cyber Security Scholars Program, open to undergraduate and graduate students in computer science and computer engineering as well as to law students.

Through the program, funded by the National Science Foundation, students can explore cutting edge profession that is expected to increase by 53 percent over the next 5 years. Graduates will be prepared for careers that may take them to research labs or government agencies where they will defend against the growing threat of cyber crime.

Students will study under some of the nation's top academic experts in cyber security and cyber law, learning how to protect the nation's cyber infrastructure by designing more secure systems and methodologies, as well as better policy. Graduates of the program will receive a certificate in cyber security.

https://publish.illinois.edu/cybersecurityscholars/

Photo Forensics

What information can you learn from this photo?

Where was it taken?

Was the yellow person walking there when it was photographed or was she added later?

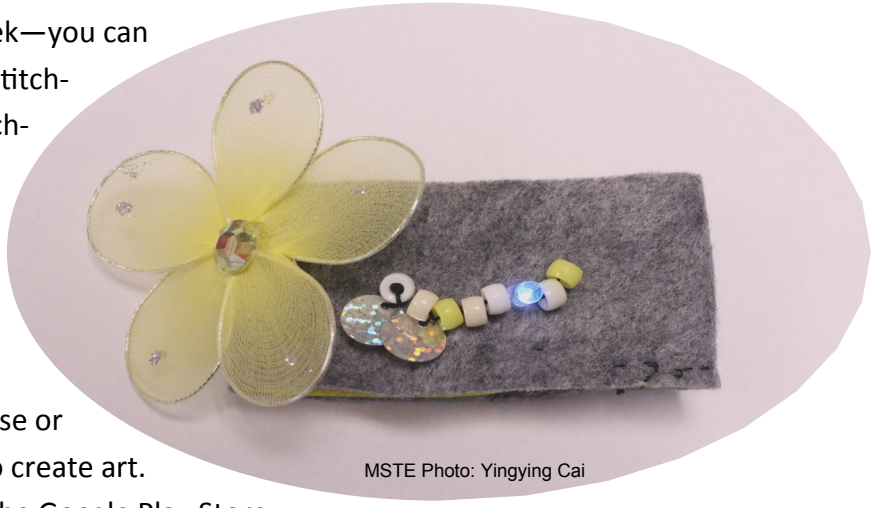
How can you tell?

Photo Forensics Resources

- Photo Forensics: How to Check If a Picture Has Been Photoshopped or Not
  http://internet.wonderhowto.com/how-to/photo-forensics-check-if-picture-has-been-photoshopped-not-0138649/
- FotoForensics Indicates If Photos Have Been Digitally Modified
  http://www.ghacks.net/2012/02/10/fotoforensics-indicates-if-photos-have-been-digitally-modified/
- Sorting the Real Sandy Photos from the Fakes
  http://www.theatlantic.com/technology/archive/2012/10/instasnopes-sorting-the-real-sandy-photos-from-the-fakes/264243/
- FotoForensics http://fotoforensics.com/
- FotoForensics Tutorials http://fotoforensics.com/tutorial.php
- Error Level Analysis Tutorial http://fotoforensics.com/tutorial-ela.php

Final Projects

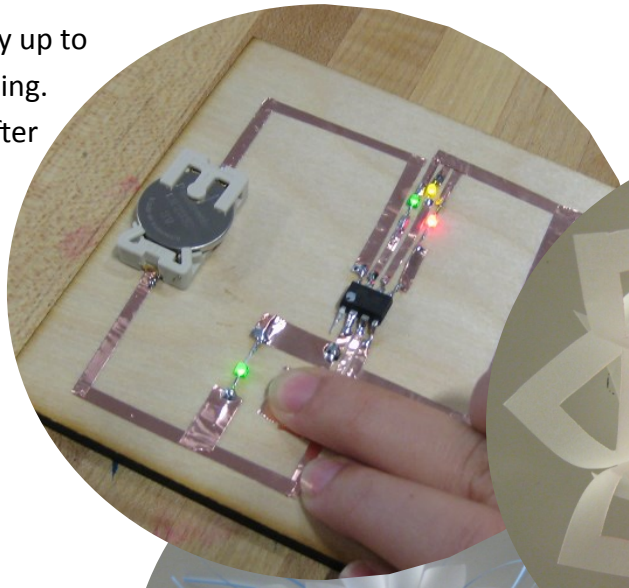
We've covered a lot of ground so far this week—you can code, you can stitch, and you can code your stitching! You've seen a variety of projects and techniques as inspiration and now it is time to choose your final project. You will be sharing your project with your parents/guardians during the Closing Ceremony on Saturday.

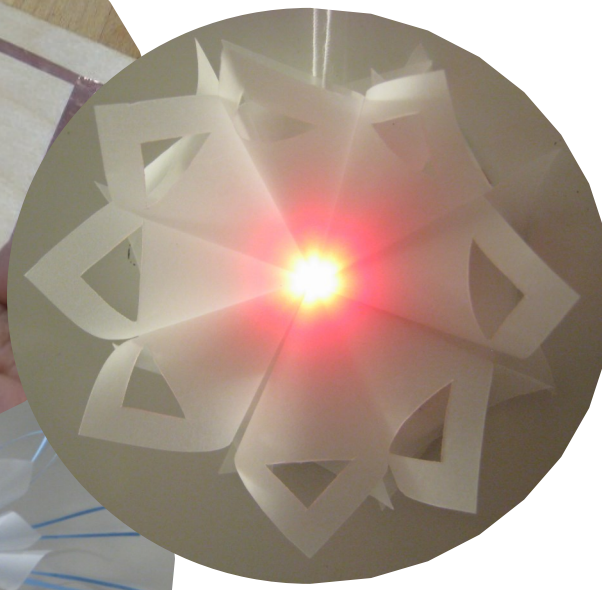


MSTE Photo: Yingying Cai

Join a specialty group and learn more about incorporating your Lilypad Arduino into a purse or jewelry project. Use copper tape and LEDs to create art. Design and develop an App and submit it to the Google Play Store. Imbed a secret message into a photo by altering a small number of pixels.

What you decide to do is ultimately up to you, but it *must* involve programming. (This is Computer Science camp, after all!)





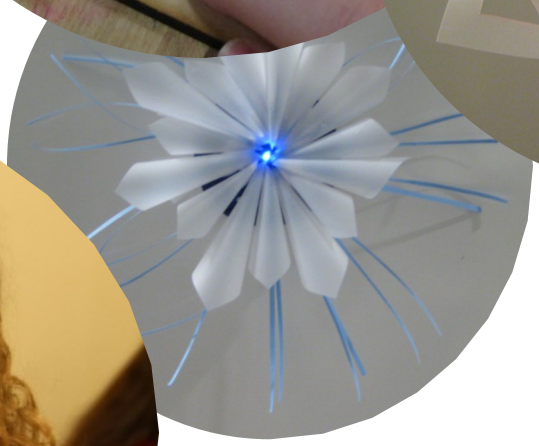


Photo Credit: David Mellis CC BY-2.0

Jie's Paper Electronics Workshop

Final Thoughts and New Beginnings

How have you used computer science this week? What have you learned about micro-processors and cyber physical devices? What is the *internet of things*? How can you enjoy the advantages of the online world and protect your privacy? Why is design an important part of app development? What do you want to learn more about?

NOTES

NOTES

G.A.M.E.S. Camp 2014

Samantha Lindgren

Jana Sebestik

Rebecca Byrd

Mary Reagan

Naphat Lertratanakul