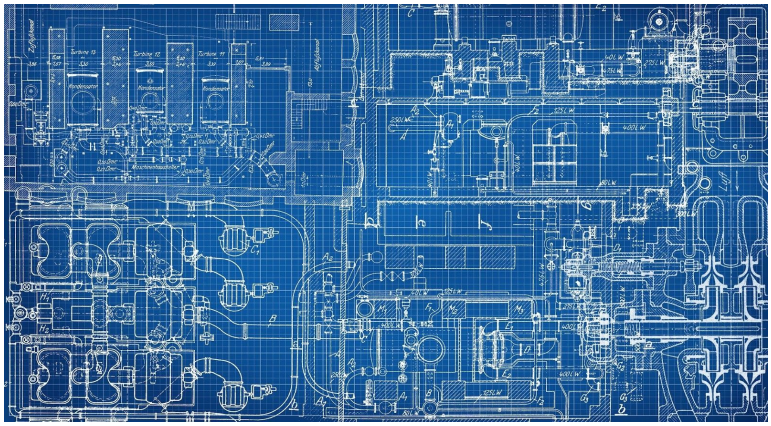


Inventors!
Grades 3rd-5th

This Lesson is designed to be completed independently and is recommended for children in grades 3-5.

In this Lesson Plan, children and adults will learn about inventions by listening to a library staff led storytime, exploring sounds, investigating electronics, and discussing how inventions can help others. This Lesson can be simplified or made more complicated as desired.

This lesson contains activities that have been connected to Missouri Learning Standards using the Missouri Department of Elementary and Secondary Education (DESE) guidelines. Although these lessons have been connected to a state learning standard, they are not intended to replace the educational curriculum provided through public, private, or at-home learning.

To access videos and databases, click on the hyperlinked text in the lesson plan. An active Christian County Library card is necessary to access select activities. For help, email youthservices@christiancountylibrary.org or call your local community branch.

1. **Introduction**
    a. Make sure to have the documents and handouts ready for the lesson and gather any needed supplies.
    b. Prediction Activity: Do you know about any inventors? Did their invention solve a problem in the world?
        i. DESE Standard: Reading 3.3.A

2. **Listen & Write**
    a. Listen to a library staff member read "Woosh" by Chris Barton, illustrated by Don Tate or go to coolcat.org to put it on hold and read yourself.
        i. Writing Prompt: What problems did Lonnie Johnson's inventions solve? What is one way he found an idea for an invention? What challenges did Lonnie Johnson face in pursuing his dream to be an inventor? This lesson will look at the work of several African-American inventors. Like Lonnie Johnson, many of these inventors faced discrimination and exclusion because of racism. By learning about their work, hopefully you will feel inspired and empowered to dream up your own inventions.
        ii. DESE Standard: Reading 3.3.C, Social Studies 3.6.E

3. **Otis Boykin (1920-1982)** was an inventor of important electronic components.

    a. Electronic devices like TVs, computers, and radios are made of many different components arranged into a circuit. These components control the flow of electricity in different ways. Otis Boykin worked with a type of electronic component called a resistor. Resistors slow down or *resist* the flow of electrical current. Some resistors were unreliable and affected by changes in temperature and air pressure, which could cause devices like a TV or important medical equipment to stop working. Otis Boykin invented a "wire precision resistor" which was much more reliable and affordable. His invention was a solution to the problem of unreliable components. Otis Boykin's resistor was used in a wide

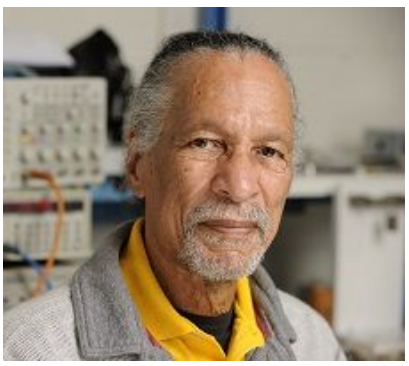
range of devices where reliability was important including military missiles and heart pacemakers.

i. To find out more about electric circuits, conductors, insulators, and resistance take a look at Handout A.
ii. Optional: Do you have any broken electronic devices at home? With help from an adult you can open it and take a look at the circuit inside.
iii. DESE Standard: 3.PS2.B.1

4. **Garrett Morgan (1877–1963)** invented a traffic light in 1923.

   a. In the early 1900's city streets were busy with many different types of transportation-bicycles, horse drawn carriages, pedestrians, and cars. Traffic lights had only two positions: go and stop, no yellow caution light like today. Garrett Morgan witnessed a traffic accident which inspired him to invent something that could make streets safer. Between stop and go positions, Garrett Morgan's traffic light would have all directions stop, similar to the modern yellow caution signal. This gave plenty of time for cars to safely stop and for pedestrians to safely cross the street. Garrett Morgan helped to solve the problem of dangerous streets with his traffic light, influencing the design of the modern traffic light.
      i. The next time you ride in a car, count how many seconds you have to wait at red lights. Are different lights faster or slower? Why might that be? How might other traffic signals and patterns be designed for safety?
      ii. See Handout B to make a model of Garrett Morgan's traffic light (for a sturdier model, try printing Handout B on cardstock paper).
      iii. DESE Standard: Social Studies 5.3a.C

5. **James E. West (born 1931)** invented a special microphone.



   a. A microphone is a device that converts sounds you can hear into electric energy. When sound is converted to electric energy it can be

recorded or played over speakers. Some older designs for microphones were large, bulky, and sometimes fragile. In 1960, James E. West invented a special microphone, called an electret (short for electricity and magnet) foil microphone. His microphone was special because it was very small and very sensitive to quiet sounds. That's why it's used in so many different devices today including telephones, hearing aids, baby monitors, and kids toys. His knowledge of sound and electronics helped him find a solution to the need for smaller microphones.

i. Learn about sound by going on a sound walk! Walk around (outside or inside). Start by listening to your footsteps. What other sounds do you hear? Where are the sounds coming from and what is making them?
ii. Make a cup and string telephone and learn about sound. See Handout C.
iii. DESE Standard: 4.PS3.B.1

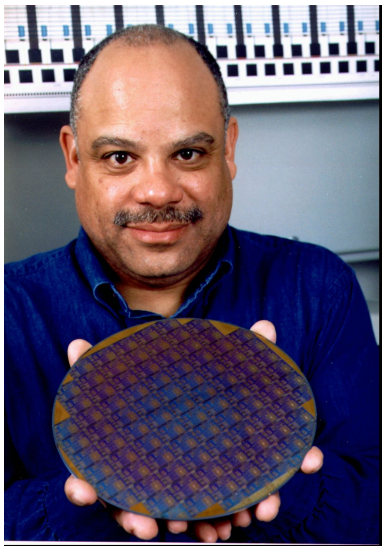
6. **Patricia Bath (1942-2019)- invented a laser tool that helps restore vision to people with blindness or poor eyesight**

   a. Patricia Bath was a doctor who wanted to help improve vision for people with poor eyesight or blindness. Cataracts mostly affect older people; they are cloudy spots that block vision and can lead to blindness. Removing cataracts with surgery could sometimes be dangerous, leading to infection and other problems. In 1981, Patricia Bath invented a new surgical tool for removing cataracts called a Laserphaco Probe that was safer and more precise. Her invention has helped doctors treat their patients and improve their eyesight.
      i. New inventions help doctors provide better care to their patients. Use a Christian County Library database to research other medical inventions:
         - Go to the Christian County Library website: christiancountylibrary.org
         - Click on 'Research' and scroll down to find Explora Elementary.

- Using the search bar at the top or the subjects on the front page, try to find information about two medical inventions. Find out the year the medical device was invented and what problem it solves or solved.

ii. DESE Standard: 5. PS4.A.1

7. **Mark Dean (born 1957)** is a computer scientist



   a. Computers were once large, expensive machines that filled up entire rooms and required expert knowledge to use. It was difficult for average people to benefit from computers because they weren't easy to access or use. Mark Dean was one of the inventors of the original IBM personal computer in 1981. This computer was much smaller and included a keyboard and monitor which made them easier to use. Today, smartphones are just as powerful (or more) and a fraction of the size of previous computers, expanding the possibilities of how computers can be used everyday.
      i. Practice the skills you need to be a programmer by carefully writing instructions to complete the maze on Handout D.
      ii. Learn how to count like a computer with binary numbers on Handout E.
      iii. Optional: Scratch is a programming language designed to introduce kids to the basics of computer programming. It's great for making games. Check it out online at: https://scratch.mit.edu
      iv. DESE Standard: 3.AP.M.01, 4.NBT.A.4

8. **And... you!**
   a. All of these inventors created something new that solved a problem in the world. We looked at their inventions and learned about electricity, traffic, sound, vision, and coding. What problems have you noticed in your life? Can you think of an invention that might help solve that problem? Make a sketch of your invention

and write some of the steps you would need to take to make it. It's important to remember that most of the inventors we learned about did not always work alone, a lot of them had help along the way to make their ideas better. Sometimes it helps to share your ideas for inventions with someone else!

i. DESE Standard: 4.ETS1.A.1

➢ **Explore more! Here are some optional links for more learning and fun!**

a. US Patent and Trademark Office Kid's Page
   i. https://www.uspto.gov/kids/inventors-kids.html
b. Famous African American Inventors resource from Scholastic
   i. http://teacher.scholastic.com/activities/bhistory/inventors/index.htm
c. Unplugged coding activities
   i. http://info.thinkfun.com/stem-education/6-unplugged-coding-activities-for-hour-of-code
d. Secret Bells sound activity from Exploratorium
   i. https://www.exploratorium.edu/science_explorer/secret_bells.html

➢ **Learning Standard**

a. The learning standards attached to each activity can be found at the following link:

i. Missouri Learning Standards/Missouri Department of Elementary and Secondary Education (DESE)

Electricity

Handout A

Most metals are good conductors of electricity. Wood, plastic, rubber, and cotton are good insulators and stop the flow of electricity. Can you find conductors and insulators around your house?

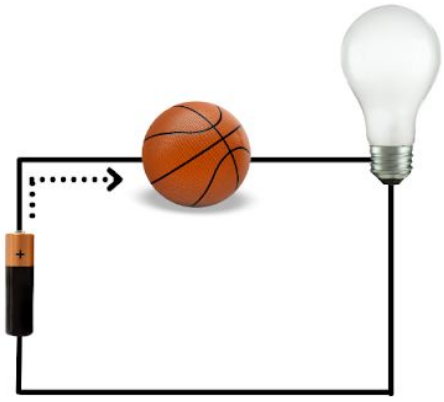
Conductors

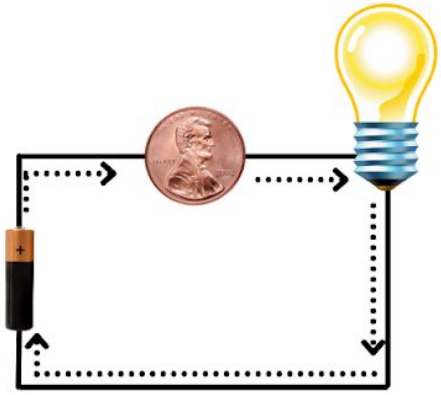
Allow electricity to flow, very LOW resistance

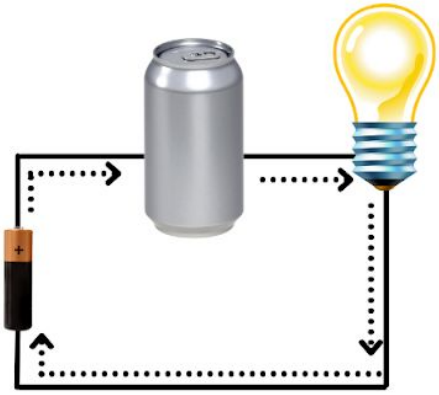
Insulators

Stop electricity from flowing, very HIGH resistance

Example Circuits:







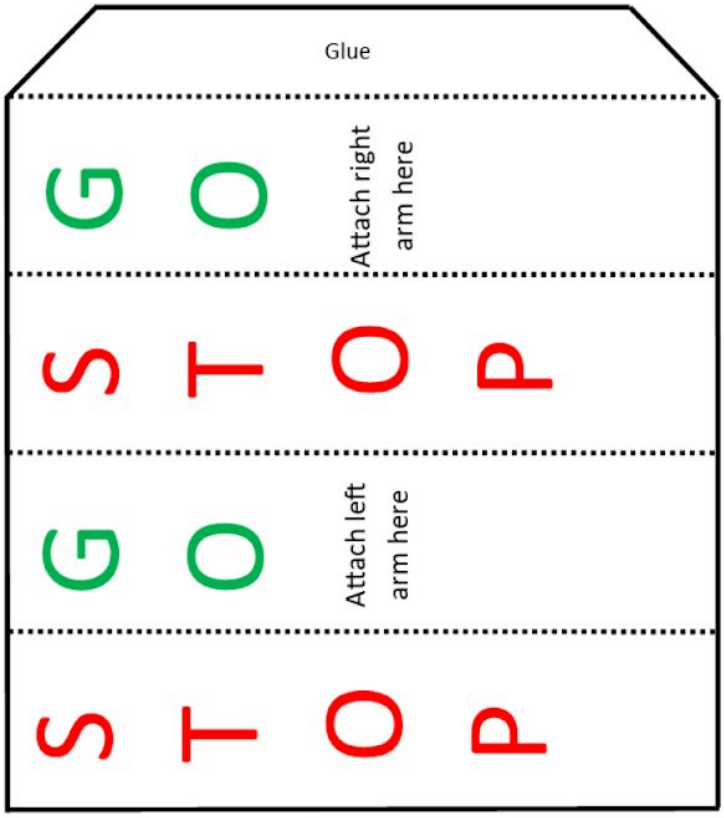
For a lightbulb to turn on, the circuit must be "closed." The positive and negative ends of the battery must connect to the lightbulb. Can you describe what's happening in the diagrams bellow? What would make it so that the lightbulb does not turn on?

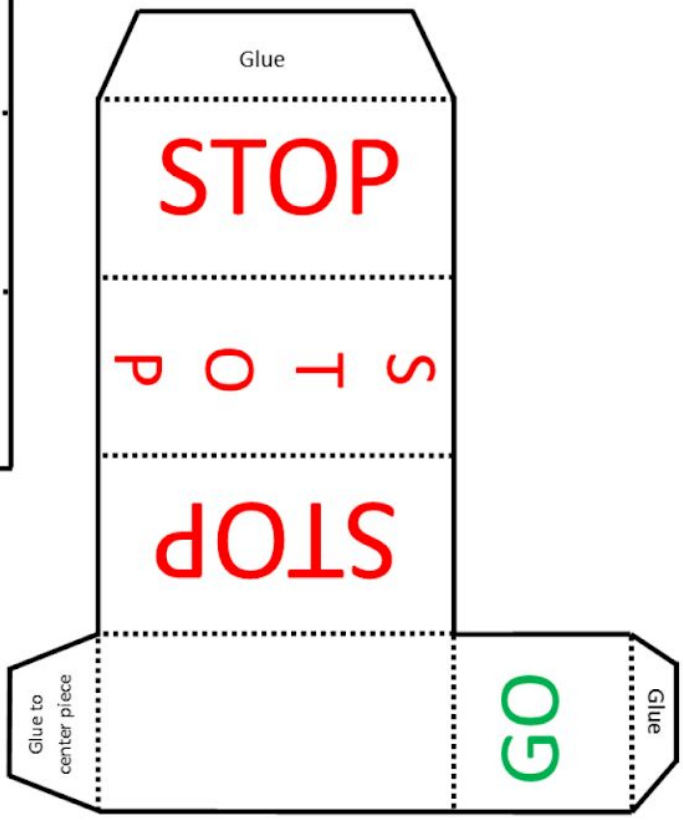
Handout B

Garrett Morgan's Traffic Light

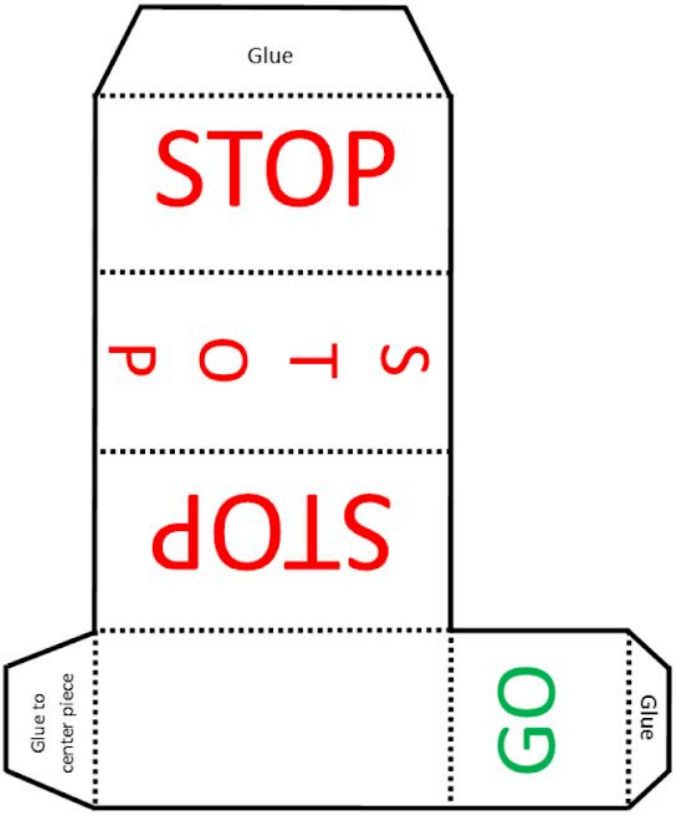
To change positions, the two arms would raise, indicating STOP to all directions. Then the traffic light would turn and the arms would lower. Cut along solid lines and fold along dashed lines. Glue the center piece together and the two arms. Then attach the two arms to the center piece like in the illustration below.

*Note: This craft works best printed on cardstock.

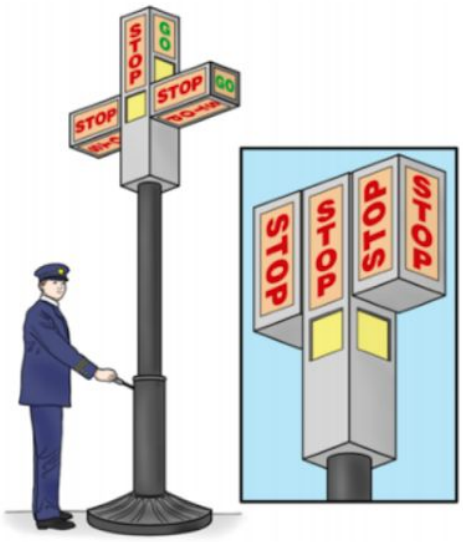




Right Arm



Left Arm

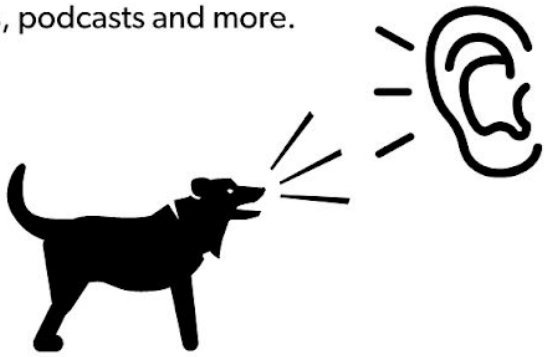


Sound

Handout C

James West invented a special microphone. Microphones convert sound vibrations into electricity. Microphones are used in telephones, virtual assistants like Alexa/Siri, and to record sound for music, movies, audiobooks, podcasts and more.

What is sound?



Sound is caused by vibrations moving through the air. Sound is created when vibrations cause tiny particles in the air to bump into each other. The particles keep bumping into each other until they reach your ear, where they are heard as sound.

Make a cup and string telephone!

You'll need: Two styrofoam, paper, or plastic cups and at least 5ft of string.

Poke a small hole in the bottom of the cups using a pen or toothpick. Pass the string through the first cup and tie a knot to keep it in place. Pass the other end of the string through the second cup and tie another knot. When you pull the cups apart so the string is tight, you should be able to hear sound pass between the cups. Find a partner to talk with on your cup and string telephone!

Experiment and discuss the results:

Try holding the string in between the cups with your hand. Does your telephone still work?
Try different materials for the string or cups, does it change how your telephone sounds?
Try a longer or shorter length of string.

How does it work?

Microphones convert vibrations in the air into electrical energy. The string and cup telephone works similarly but without electricity. When you talk, the sound coming out of your mouth travels through the air and vibrates the cup. The cup transfers the vibration to the string. The vibrations travel down the string and cause the second cup to vibrate, making vibrations in the air which then reach your ear.

Computer Science

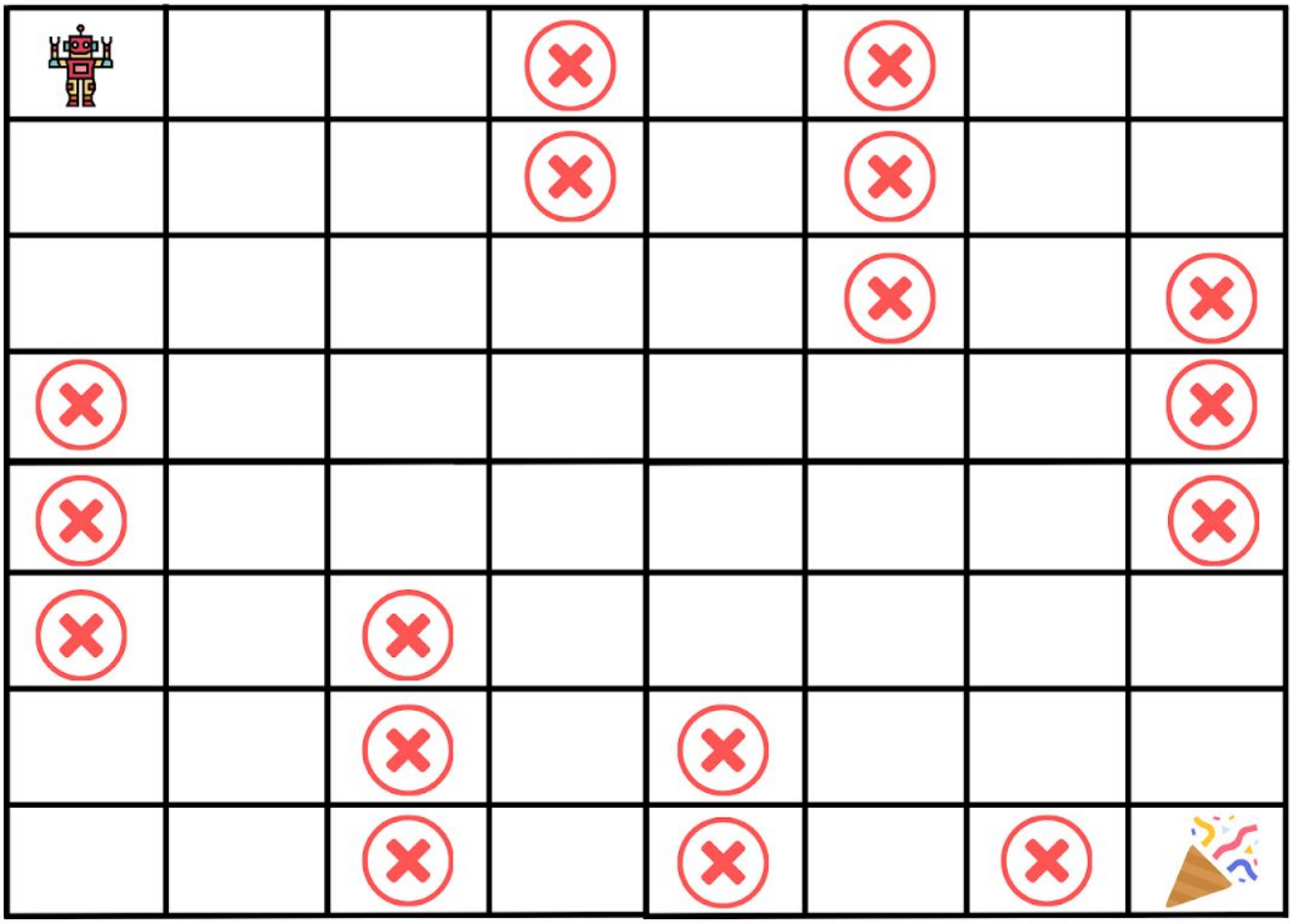
Handout D

Directions:

Computers need instructions to know what to do. Instructions for computers are known as code. Computers are not like humans, they can only follow instructions exactly as they are written. The code has to be written just the right way.

To practice coding, you'll write your the code to get through this maze. You can only use up, right, down, and left directions and you have to avoid the red X's. Computer programmers often use loops in computer code. This tells the computer to follow the same set of instructions a certain number of times or until something changes. Try to write one or more loops into your instructions: for example (DOWN, RIGHT, RIGHT) 2 times. Remember, computers can only follow instructions exactly as they are written, so make sure to write down every step from start to finish. You can have someone else follow your instructions as if they were a computer, then see if you need to make any changes to your code.

START



FINISH

Code:

Base-10 (regular way of counting)

1000's	100's	10's	1's
1	0	2	4

= 1000 + 0 + 20 + 14 = 1024

Base-2 or Binary (how computers count)

8's	4's	2's	1's
1	1	0	1

= 8 + 4 + 0 + 1 = 13

Converting Base-2 into Base-10

Practice converting Base-2 numbers into Base-10 by filling in the blanks.

8's	4's	2's	1's	
0	0	0	0	= 0
0	0	0	1	= 1
0	0	1	0	= 2
0	0	1	1	=
				= 4
0	1	0	1	=
0	1	1	0	=
				= 7
				= 8
1	0	0	1	=
1	0	1	0	=