

SIEMENS STEM DAY ACTIVITY

PIXEL ART

OBJECTIVES

Students will be able to:

- **Demonstrate** an algorithm to complete a task.
- **Create** an algorithm to automate a task for iteration.

THIS LESSON FOCUSES ON Engineering Design Cycle

- Creating or Prototyping

21st Century Skills

- Communication

OVERVIEW

Students work together to build an algorithm for drawing a pixel picture using coordinate directions and color assignments on graph paper. Then, students follow the algorithms of other groups to create the images on a larger scale with post-it notes.

STEM incorporates Science, Technology, Engineering, and Mathematics to focus on real-world issues and problems guided by the engineering design process. This type of instruction supports students in developing critical thinking, collaboration, reasoning, and creative skills to be competitive in the 21st-century workforce.

Each Siemens STEM Day classroom activity highlights one or more components of the engineering design cycle and an essential 21st-century skill.

MATERIALS

- **Pixel Algorithm Sample** Handout—one per student
- **Design Your Algorithm** Handout—one per group
- **Share Your Algorithm** Handout—one per group
- **Share Your Algorithm Alternative Method** Handout—optional
- color pencils
- sticky notes (multiple colors)

HAVE YOU EVER WONDERED . . .

How are computers taught to do things the same way over and over?

MAKE CONNECTIONS!

How does this connect to students?

There are 26 billion IoT (internet of things) devices installed in the world today, and by 2025 that number will triple. Many of them are in our homes including home voice assistants, shopping buttons, doorbell cams, smart locks, entertainment robots, intelligent lights, air monitors, and temperature controls.

How does this connect to careers?

An **IoT Software Developer** creates the algorithms and codes the microcontrollers to perform the tasks that make our life simpler. This role may involve working with many different industries to develop IoT devices. An IoT developer will find work in software companies, appliance companies, and home automation.

An **Algorithm Developer** explores and develops algorithms to solve complex computer problems using classic and deep-learning methods. This role may involve working with AI and machine learning. An Algorithm Developer can find work with state-of-the-art neural networks building intuitive user interfaces.

How does this connect to our world?

A unique collection of IoTs is called the Internet of Life Saving Things (IoLST)

Smart Traffic lights are helping first responders avoid traffic congestion and lower response times.

Personal devices monitor insulin, heart monitors, and blood pressure. These devices make it easier to function during the day and provides more accurate results.

EMS devices such as automated external defibrillators, or AEDs which can be used to restart the heart of someone having a heart attack.

BLUEPRINT FOR DISCOVERY

- To engage students in the upcoming activity, ask one or more of the following discussion questions:
 - Suppose you could create a device that would complete a task for you, what would be that task?
 - What kinds of devices can you think of that perform the same task over and over again?
- Draw a picture of a PB&J sandwich on the board. Engage with the students in creating a list of steps to make a PB&J sandwich on the board. Have them review the steps and mock through the steps. Inform them that you have just created an **algorithm**—a problem or set of rules to be followed in an operation.

¹ Statista, Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions), On the internet <https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/> (August 22, 2019)

3. Distribute the **Pixel Algorithm Sample** handout and review the procedure. As students are working, walk around the room to provide assistance and check to see that their second example is a reverse of the first.
4. Discuss with the students the difficulties and successes in the exercise. Take this time to answer any questions or address any misconceptions.
5. Separate the students into groups, providing each group with colored pencils and multicolored sticky notes.
6. Challenge groups to use the **Design your Algorithm** handout to draw a multicolor pixel picture and create the algorithm for the image. Each group should copy its algorithm onto the **Share Your Algorithm** handout and provide it to another group which will use its sticky notes to make a large-scale version of the image according to the provided algorithm.
 - o *Note:* If sticky notes or space is not available, consider using the **Share Your Algorithm Alternative Method** handout.
7. If time allows, groups can walk around the room gallery style and examine the works to see how accurately the image represents the provided algorithm.

TAKE ACTION!

- Students can research using IoT developer prototyping kits to make their own IoT devices.
- Students can create an “Algorithm Cookbook” that lists the operational steps of favorite preparations. They can exchange with peers or family members to see if their algorithms lead to the intended outcome.

NATIONAL STANDARDS

Technology Education

Standards for Technological Literacy




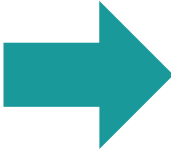
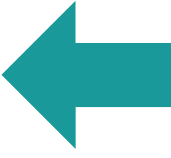

Standard 2: Students will develop an understanding of The Nature of Technology. This includes acquiring knowledge of the core concepts of technology.

Standard 17: Students will develop an understanding of The Designed World. This includes selecting and using: Information and communication technologies.

PIXEL ALGORITHM SAMPLE


Look at the Algorithm table below. Using your pencil shade in the blocks according to the Algorithm.

Block Key

					
Start	Move one block Down	Move one block Up	Move one block to the Left	Move one block to the Right	Shade the current block.


Example 1: Verify you can follow the Algorithm to make the pixel picture below. Start in the box marked with the star




			

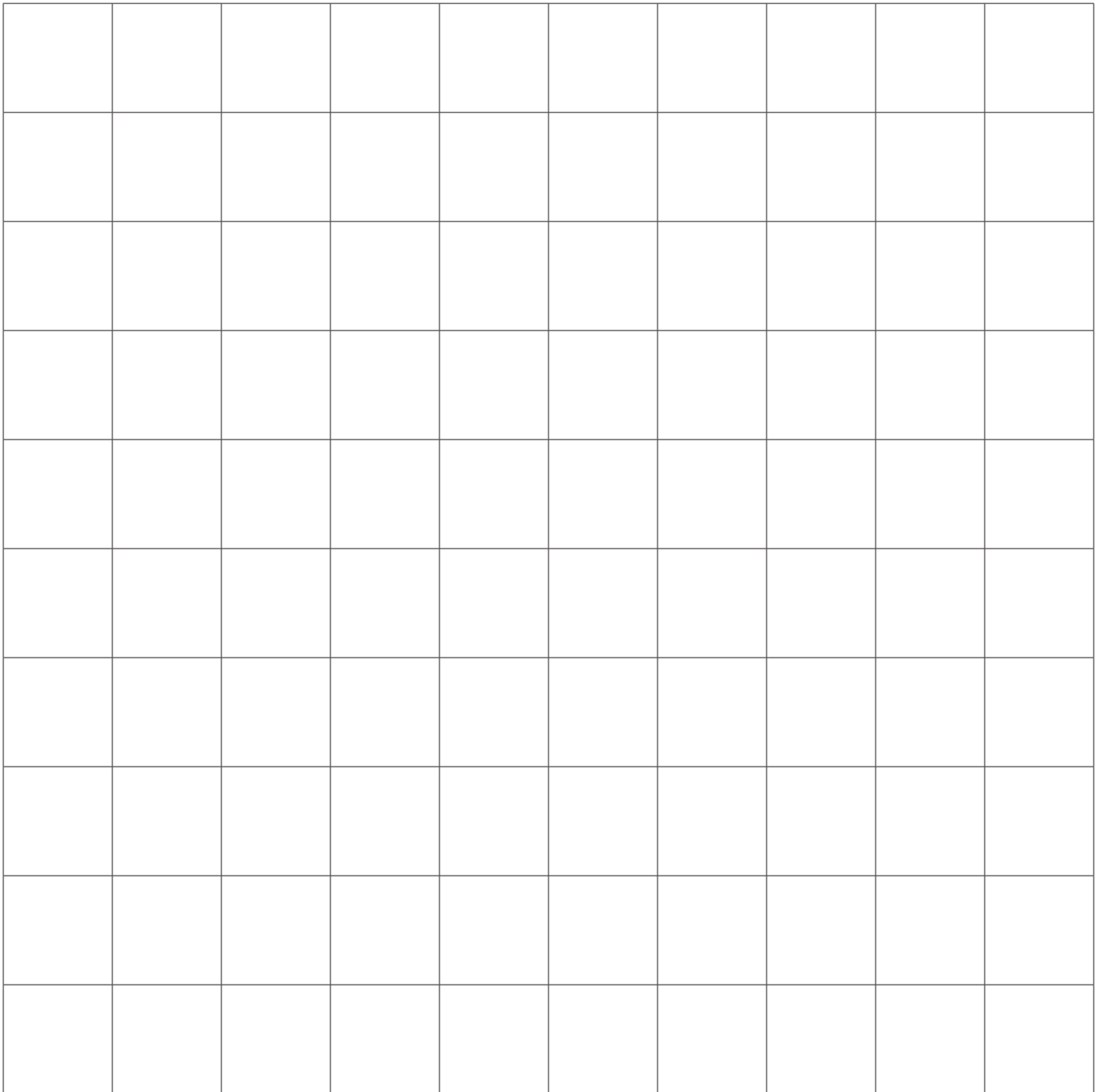
Example 2: Follow the Algorithm to make the pixel picture below. Start in the box marked with the star



DESIGN YOUR ALGORITHM

What picture are you going to make? Use the graph paper sheet to draw out a pixel picture. Use color  s to determine what color each pixel should be in the algorithm.



Write the Algorithm:

SHARE YOUR ALGORITHM

Check to make sure your algorithm is correct

Write your algorithm here:

Now swap with another group. Follow the algorithm precisely to follow the steps. Lay a post-it of the right color for each filled in block.

SHARE YOUR ALGORITHM ALTERNATE METHOD

Check to make sure your algorithm is correct
Write your algorithm here:

Now swap with another group and try to draw their picture here.
