Hour of Code Unplugged Activity Packet

Coding is something everyone can do! You can even learn the basics of coding without a computer. This activity packet is designed for children and their grown ups to learn some of the fundamentals of coding together through interactive activities. Print this packet (double-sided is fine!) and get coding at home!

Table of Contents

Everybody Dance Now

Ages: 4-11 years old

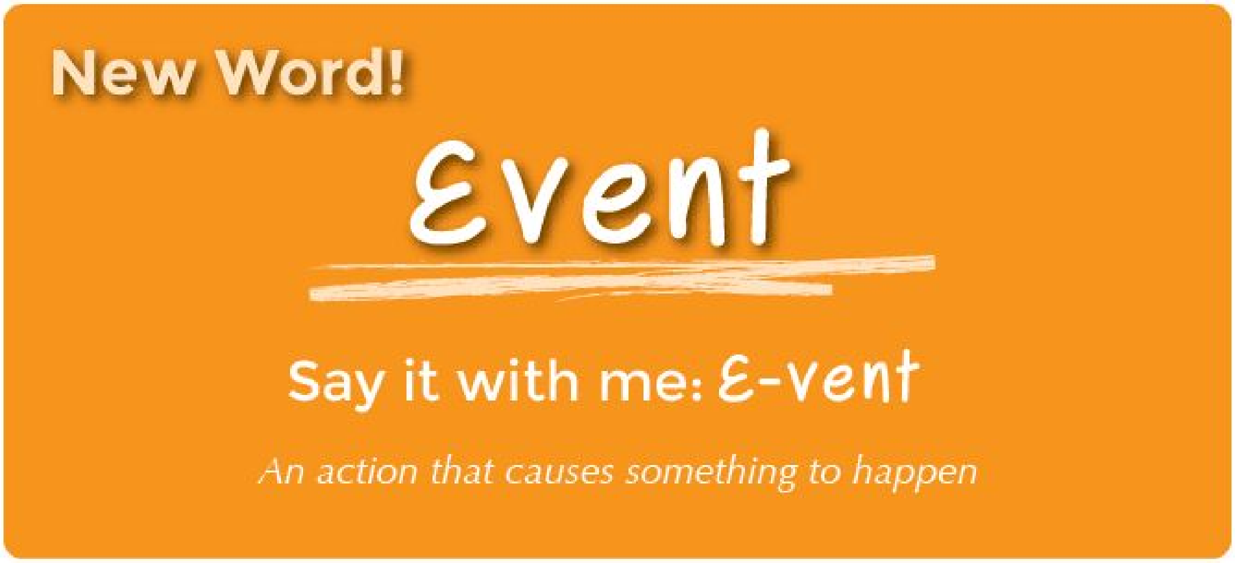
Lesson Objectives:

- Students will recognize actions of the choreographer as signals to initiate a command.

------------------------ Lesson Guide ------------------------------

1. **Description:** Programmers use “events” to change the way a program responds to a user’s actions, like the push of a button or the click of a mouse. When you touch the screen on your tablet to scroll, that’s an event. When you press a button on your controller to play a video game, that button press is an event, too! For this lesson, you’ll use a paper controller to choreograph a dance for your family member.

2. **Vocabulary:** Read this vocabulary card together.



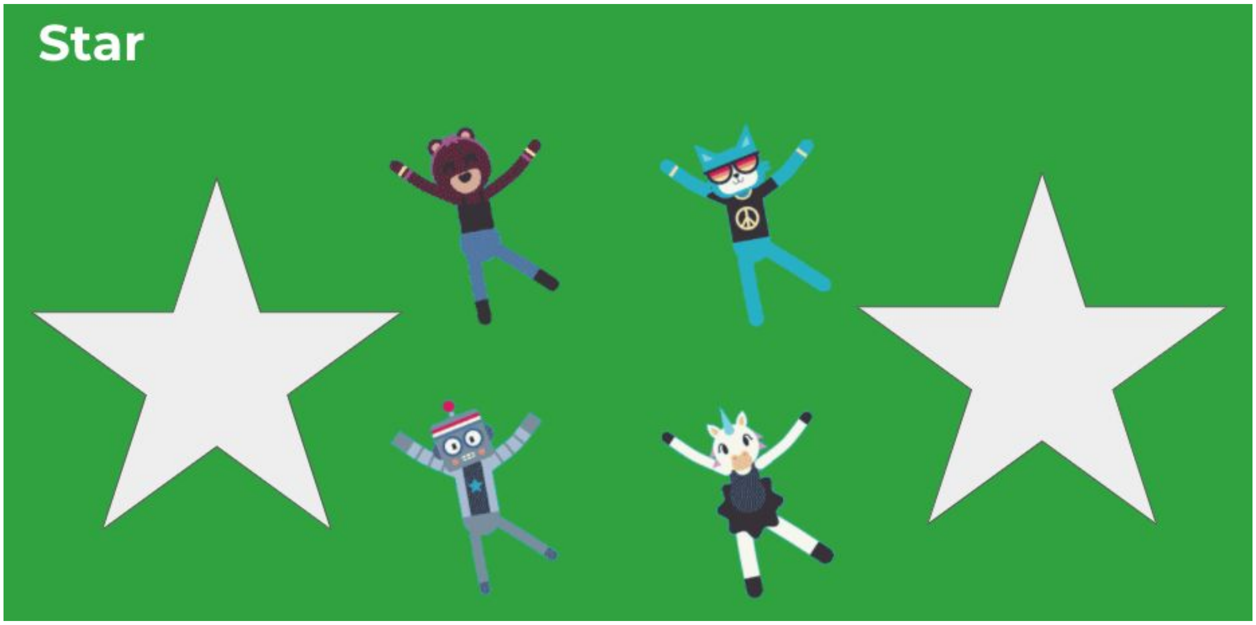
New Word!

Event

Say it with me: E-vent

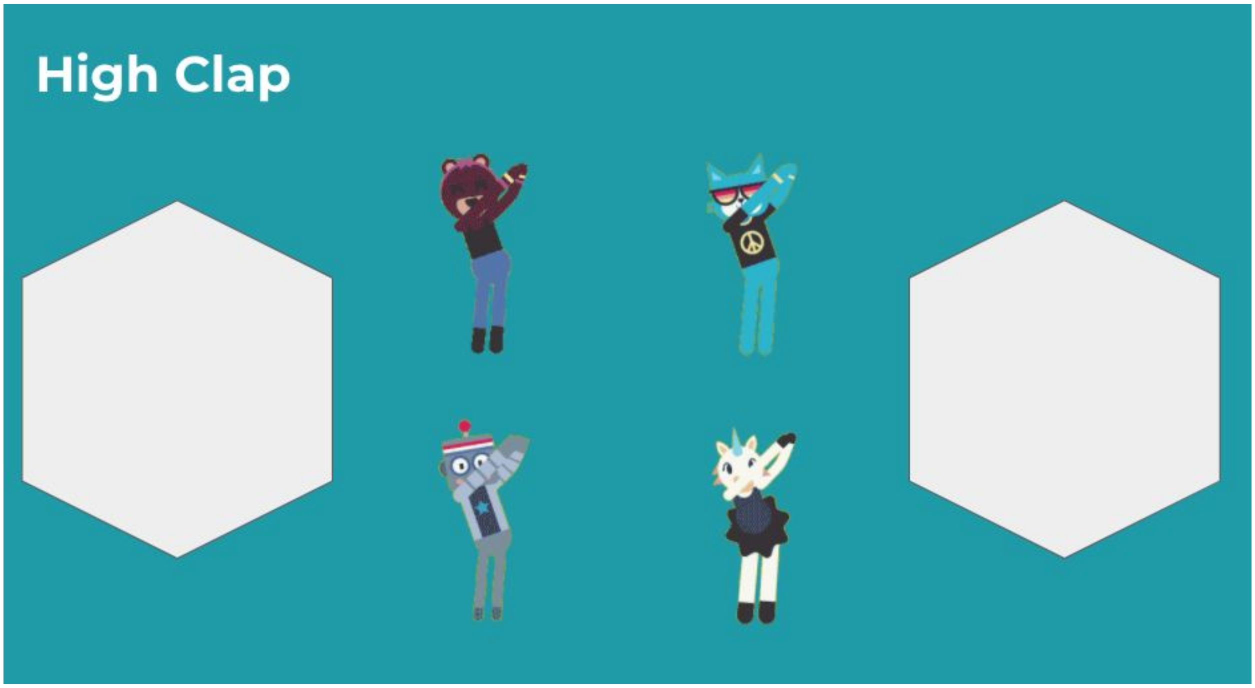
An action that causes something to happen

3. **Activity**
    a. Make connections: Ask your child “Where else have you seen “events” that give signals in the real world?
        i. What about something like something like a dance? How do dancers know when to do a certain move?
    b. Let’s learn some dance moves so we can program a new dance together!



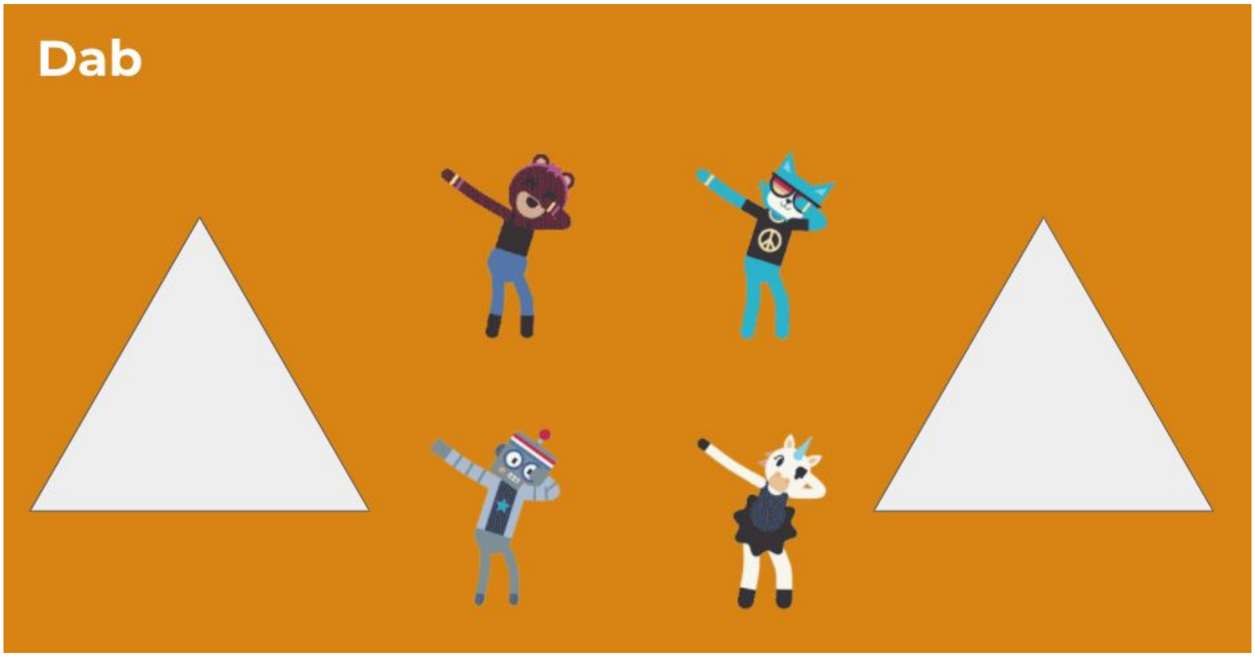
The Star

- **Step 1:** Start by standing up straight with your arms by your side.
- **Step 2:** Kick your right leg out and put both arms in the air to make your body look like a star.
- **Step 3:** Come back to standing position.
- **Step 4:** Kick your left leg out and put both arms in the air.
- **Step 5:** Repeat!



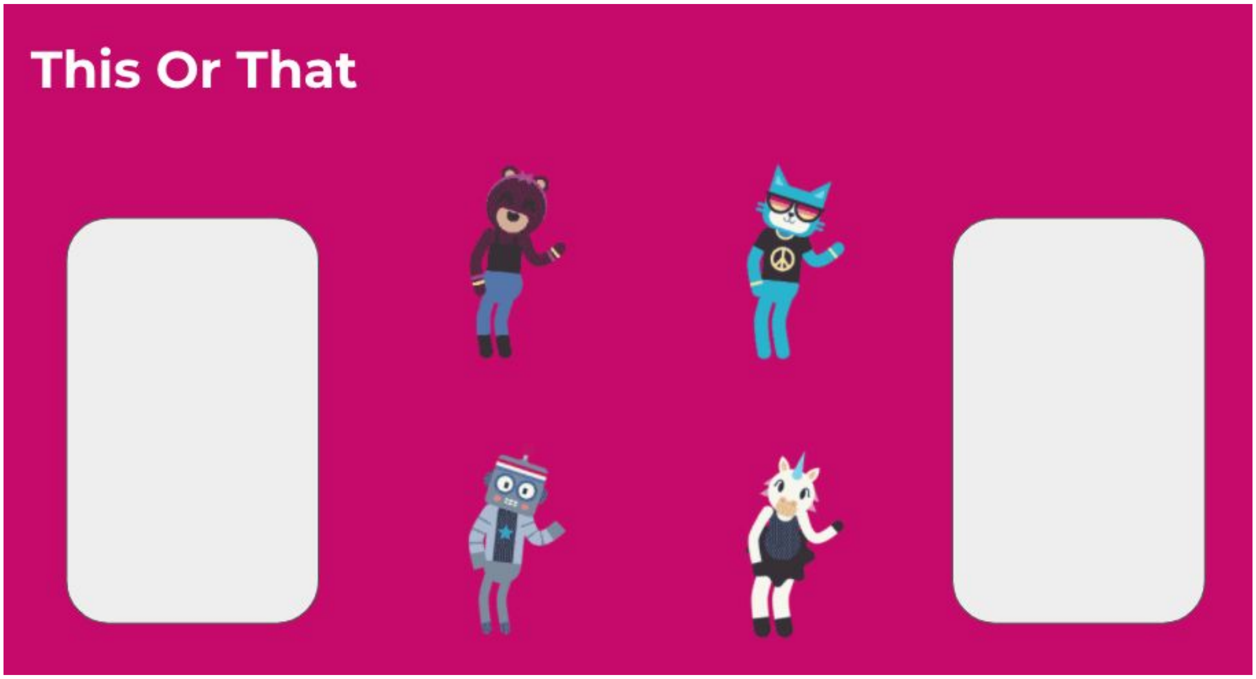
The High Clap

- **Step 1:** Start by standing up straight with your arms by your side.
- **Step 2:** Clap your hands to the right, above your head.
- **Step 3:** Come back to standing position.
- **Step 4:** Clap your hands to the left, above your head.
- **Step 5:** Repeat! (Bonus: try moving your hips to the side that you’re clapping on)



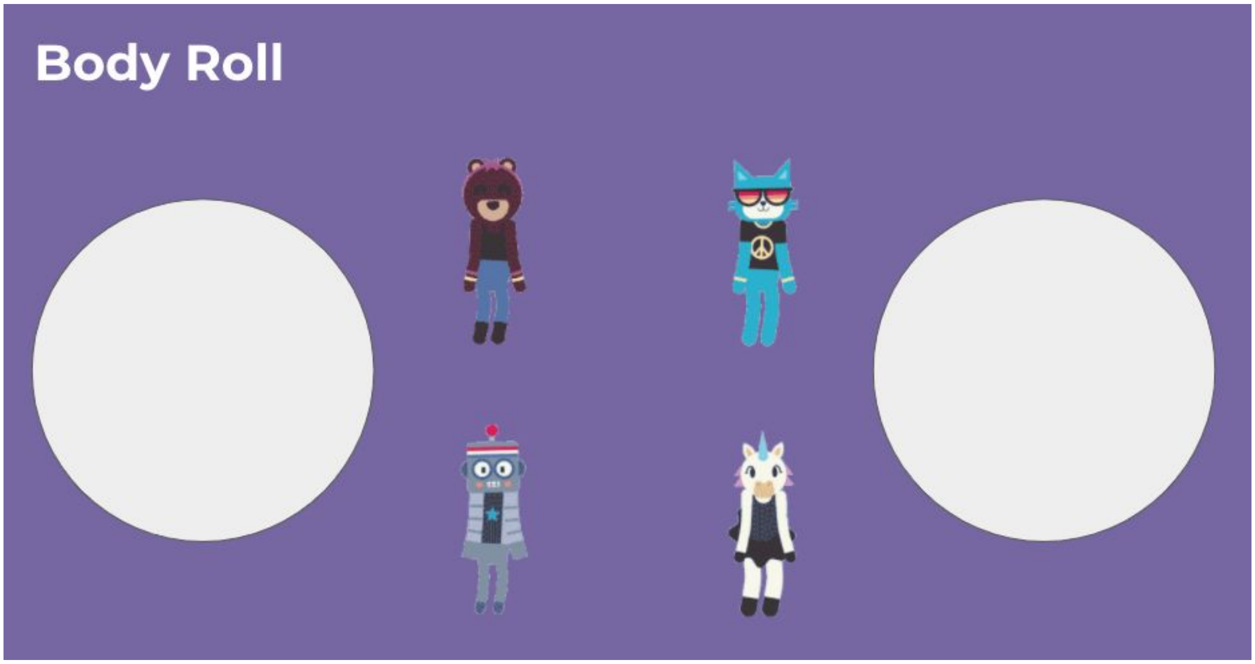
The Dab

- **Step 1:** Start by standing up straight with your arms by your side.
- **Step 2:** Drop your head into the bent crook of a slanted, upwardly angled arm while raising the opposite arm straight in a parallel direction (see image above).
- **Step 3:** Repeat! (Bonus: Lift a knee up while dabbing)



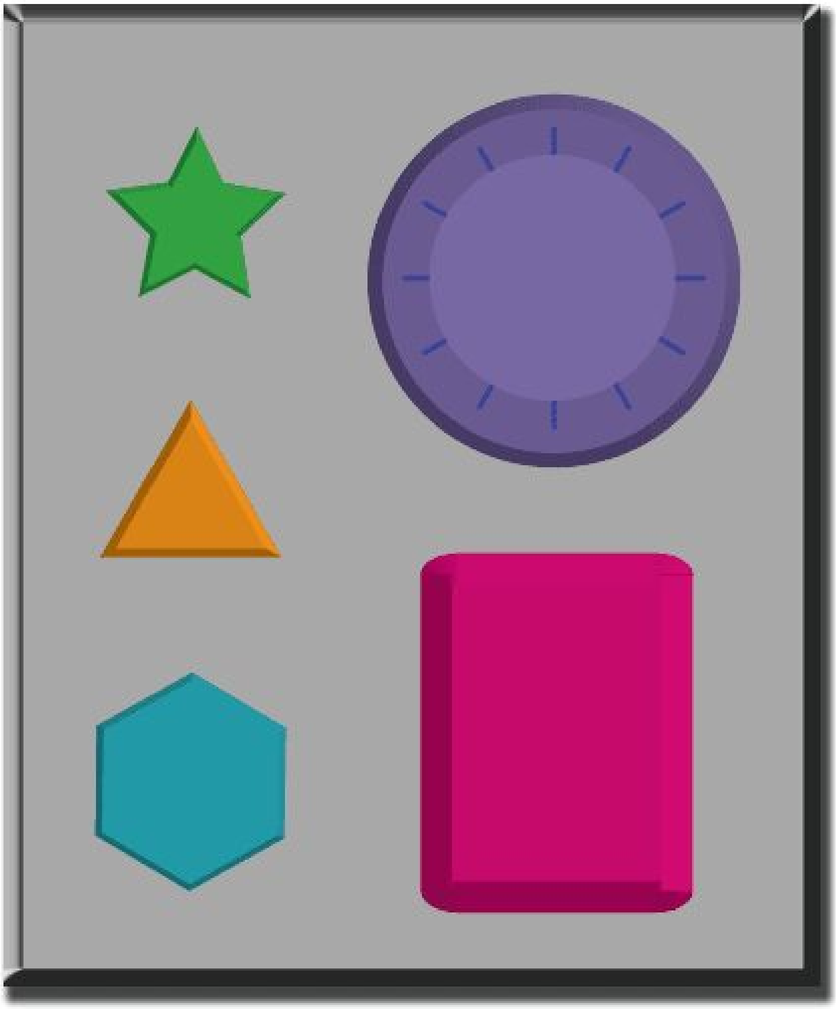
The This or That

- **Step 1:** Start by standing up straight with your arms by your side.
- **Step 2:** Raise your right hand like you’re a waiter holding a tray and tilt your head towards it.
- **Step 3:** Come back to standing position.
- **Step 4:** Raise your left hand like you’re a waiter holding a tray and tilt your head towards it.
- **Step 5:** Repeat!



The Body Roll

- **Step 1:** Start by standing up straight with your arms by your side.
- **Step 2:** Bend your knees and snake your body to the right, moving your head first and then your hips in one direction.
- **Step 3:** Repeat!



Activity Continued:

- Choose one choreographer and a dancer (or many dancers).
- Whenever the choreographer touches a button, the dancers will do the corresponding dance.
- As a reminder:
    - Star is the Star Dance
    - Triangle is the Dab
    - Hexagon is the High Clap
    - Circle is the Body Roll
    - Rectangle is the This or That
- Turn on your favorite song and hit the dance floor!

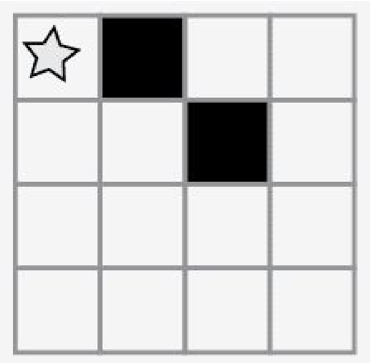
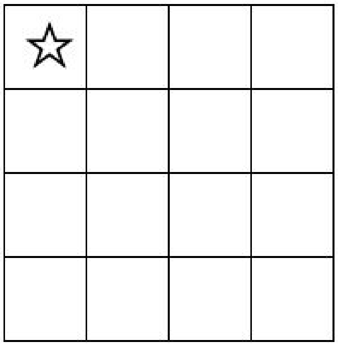
Graph Paper Programming

Ages: 6-13 years old

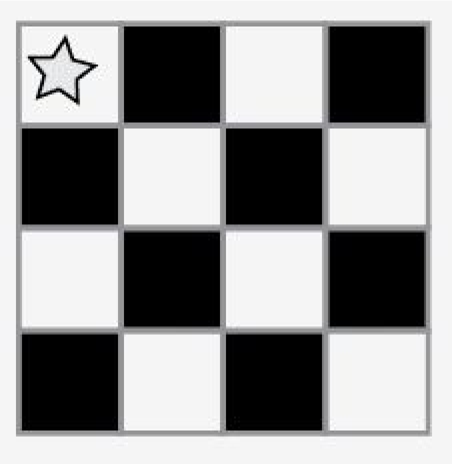
Lesson Objective: Students will be able to reframe a sequence of steps as an encoded program.

------------------------ Lesson Guide ------------------------------

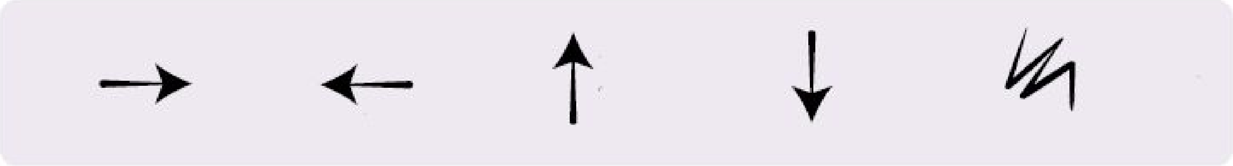
1. **Description:** By "programming" one another to draw pictures, you and your child will get an opportunity to experience some of the core concepts of programming in a fun and accessible way. Your child will use symbols to instruct you to color squares on graph paper to reproduce an existing picture.
2. **Introduce the Topic:** Ask your child, how do robots know how to do the things they do? Do they have brains that work the same way that ours do?
    a. The goal of this quick discussion is to call out that while robots may seem to behave like people, they're actually responding to their programming.
3. **Practice Together:** In this activity, students will act as both programmers and robots, coloring in squares according to programs that they have written for you.
   Say to your child:
    a. Today, you're going to get to program a robot... Me! You'll write programs using symbols with special meanings to help me recreate a picture.
    b. These are the only instructions that I understand.
        i. Move one square right
        ii. Move one square left
        iii. Move one square up
        iv. Move one square down
        v. Fill in square with color

	
Let's practice! Here is an image. Pretend that I am the drawing robot.	Starting at the star, tell me instructions to recreate the image to the left.

c. You just gave me a list of steps to finish a task. In programming, that's called an algorithm. Great work! Hmm, but what happens when we want to write down the algorithm for a drawing like this?
   i. What would the code sound like to recreate this picture?
   ii. What if you had to write it all out? Is there an easier way than writing all the words?

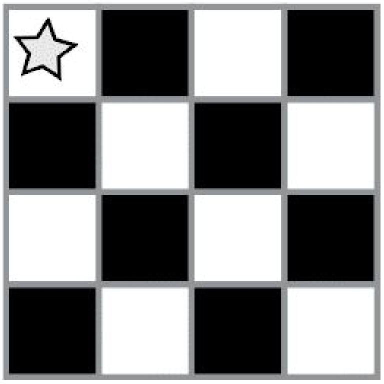


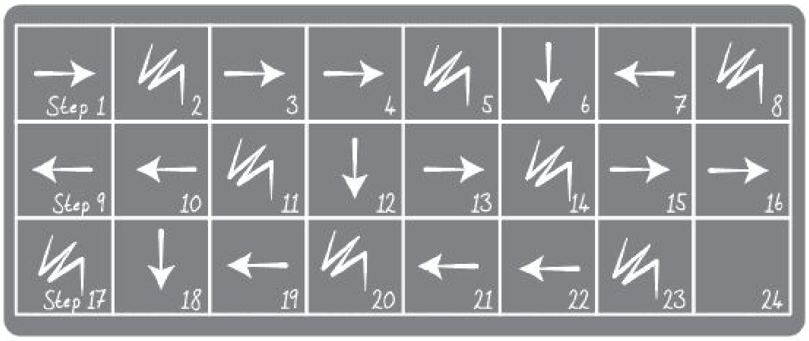
d. Show you child this list of symbols:



e. Discuss: How could we use these symbols to make our instructions easier?

f. Look at the sample solution using symbols below and discuss the benefits of using symbols shorthand.





Now you try!

Choose one person to be Partner A and another person to be Partner B.

Partner A, choose one of the images below. Don't let your partner know which one you pick!

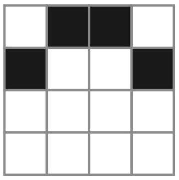


Image 1

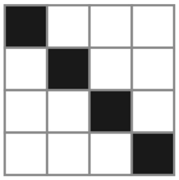


Image 2

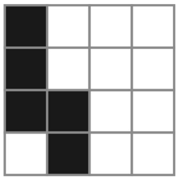
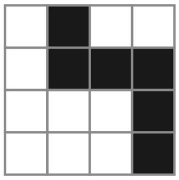


Image 3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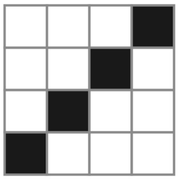


Image 5

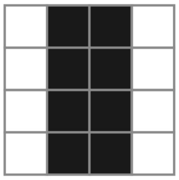


Image 6

1) Partner A, write a program.
(Use → ← ↑ ↓ ⍻)

Step 1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

2) Give your program to your partner.

3)Partner B, draw your partner's program:

☆			

Switch!

1)1) Partner B, write a program.
(Use → ← ↑ ↓ ⍻)

Step 1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

2)Give your program to your partner.

3) Partner A, draw your partner's program:

☆			

Use Binary to Make Pictures

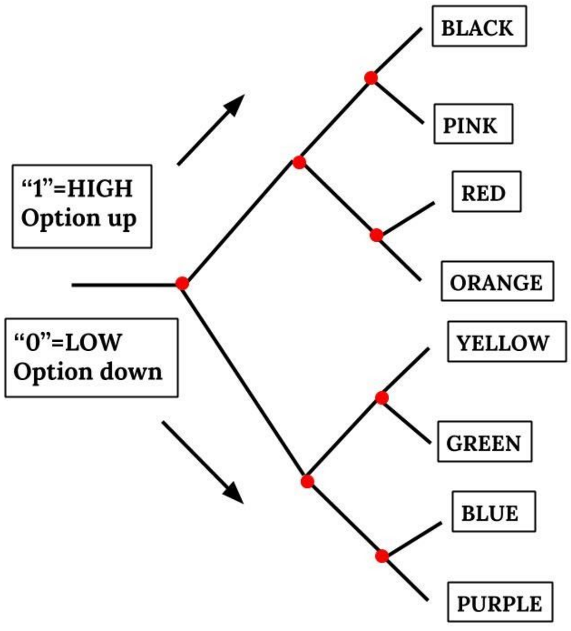
Ages: 10-18 years old
Lesson Objective: Students will learn how to use binary to represent colors and images.

---------------------------- Lesson Guide----------------------------

Description: We're going to look at one way that Binary can be used to represent **Color Images** and you'll be creating your own **Pixel Art.**

In this activity, we'll use binary coding to represent pathways through a series of "high" and "low" choices. For example, to the right are a group of colors at the tail-ends of a small tree-like diagram. Starting from the left, we can choose a color by using a sequence of High & Low decisions to move from left-to-right and ultimately end at a color.

For example, the color Orange would be "High Low Low".



Check Yourself:

1. How would you represent the color **Pink**? _____ _____ ____

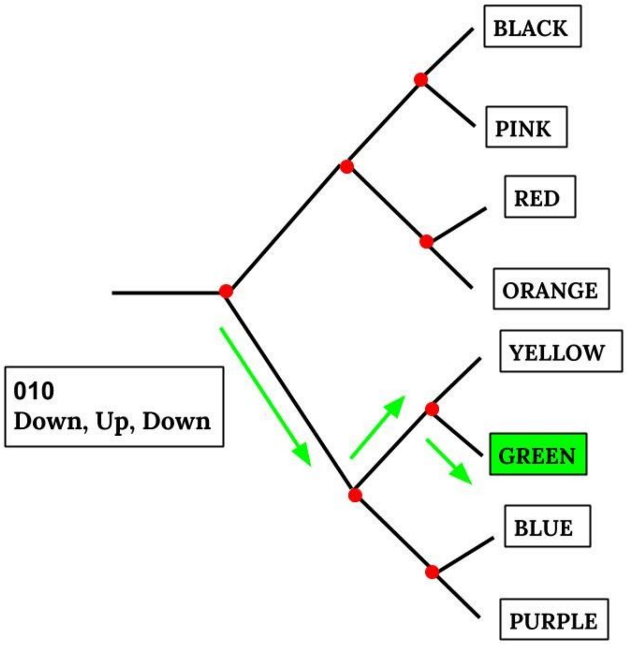
2. What color does this represent: **Low Low High**? ______________

(The answers are on the last page of this activity.)

Hey! We Can Use Binary For This!

A **0** will represent a **Low / Down** choice and a **1** will represent a **High / Up** choice. For example: the binary number 1001 could be read as “High Low Low High”

Using the same color map from before, we can use a *binary number* to represent a *color*. For example, the *number* **010** represents the *color* **green**



Now You Try!

1. Use this chart to determine what color would be coded by the number **111**. _____
2. Use the chart to determine what binary number would represent the color **orange.**

(The answers are on the last page of this activity.)

Representing Multiple Colors

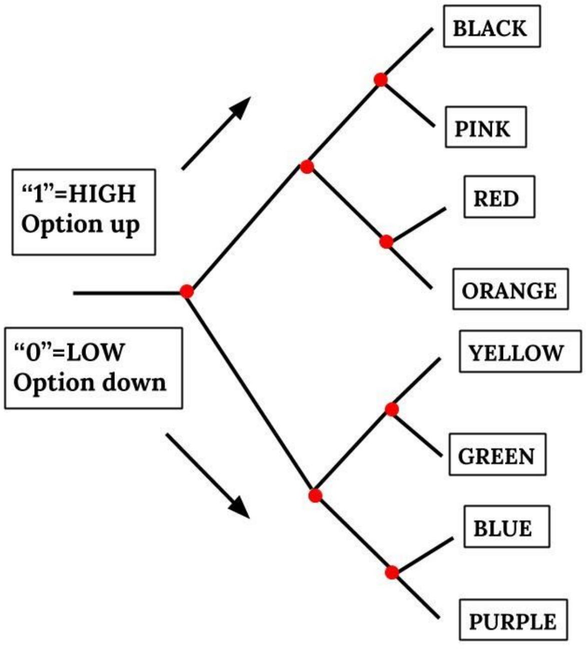
If we wanted to represent a *sequence* of colors, we can write a *sequence* of binary numbers to represent those colors. Here's an example:

101011110000

This longer binary number secretly represents **4 different colors**. We can see each individual color by breaking this number up into *chunks of 3*:

101011110000 → <u>101</u> <u>011</u> <u>110</u> <u>000</u>

Each *chunk* represents a single color. We can use the same chart to figure out each of these individual colors:

101 → Red **011 → Yellow** **110 → Pink** **000 → Purple**	

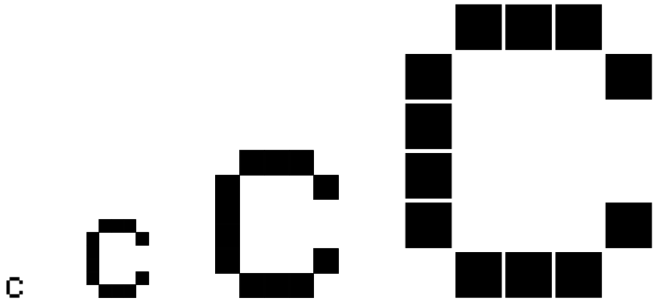
So the *number* **101011110000** represents the *colors* **Red Yellow Pink Purple**

Now You Try!

1. What colors are represented by **110011010** (hint: 3 colors)
2. What binary sequence represents **Blue Orange Black**? (hint: 9 digits)

An Introduction to Pixels

Most electronics like smartphones, computers, and television screens are made of millions of tiny pieces called **pixels**. Each pixel is like a tiny little box on your screen that is used to represent the images we see. Usually the pixels are so *small* that we don't even notice the boxes, but when we zoom-in we start to see them more clearly.

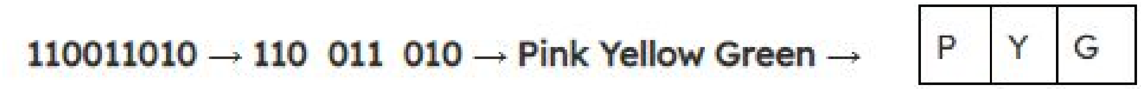


Source: csunplugged.org

Our electronic devices use *binary signals* to determine what types of images to create using these pixels using the following steps:

- They receive a *binary sequence*
- They *decode* the sequence to determine what colors the sequence represents
- Each color represents a certain *pixel*. The computer draws that color in the appropriate box

For Example:

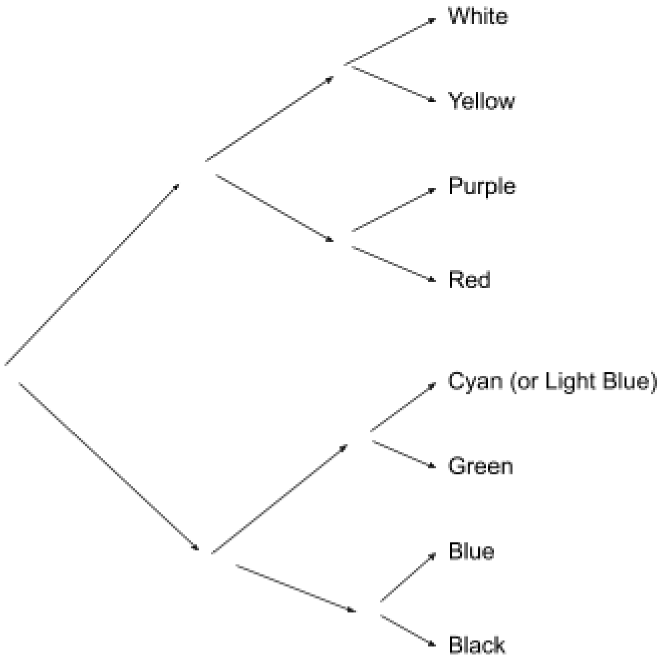


110011010 → 110 011 010 → Pink Yellow Green →

P	Y	G

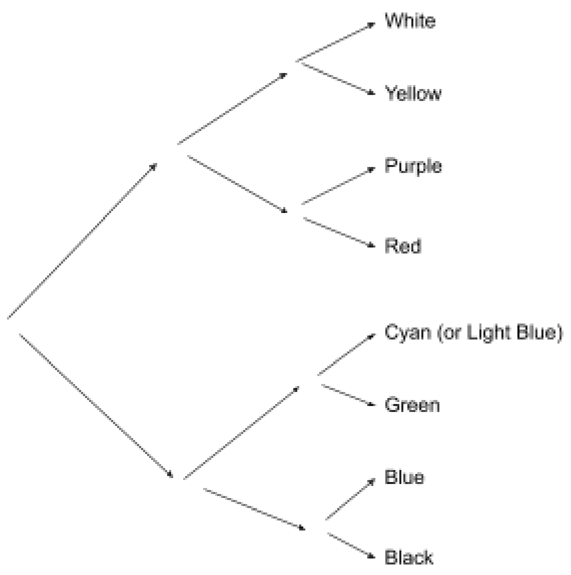
You Try!

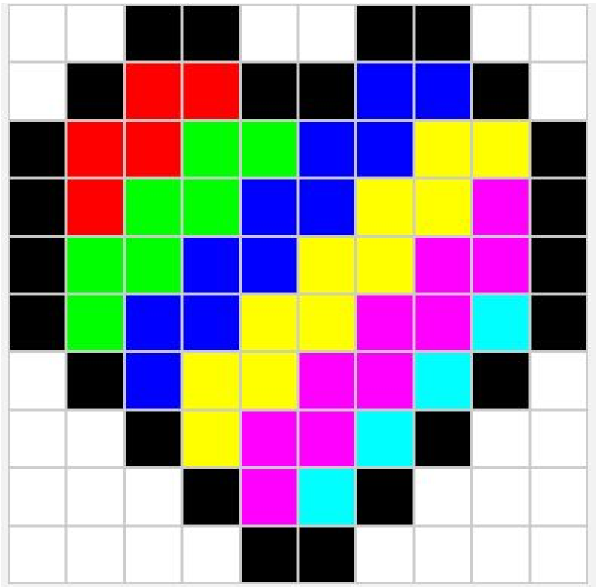
Use colored pencils / markers / post-its / crayons / etc to draw in the colors for each of the grids below. Use this *new* choice-map to determine which colors to use. The answers are on the next page for you to check when you're done.



100111001 110101011 100010001	(Color This In!)
100001100 001100001 100001100	(Color This In!)

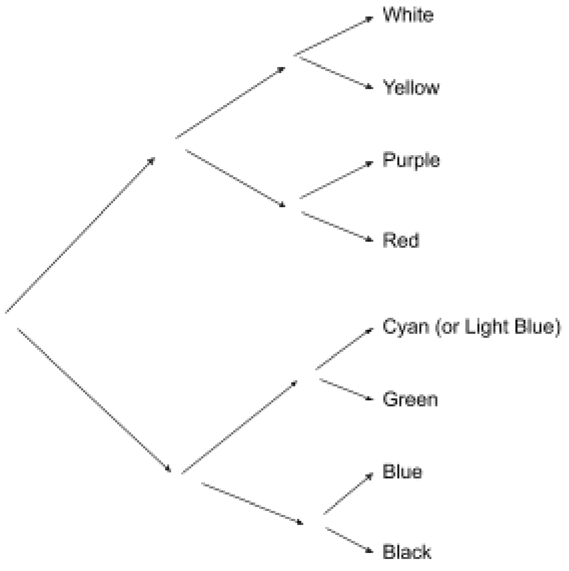
More Practice Drawing Pictures with Binary





Binary Encoding for 10x10 image

```
111 111 000 000 111 111 000 000 111 111
111 000 100 100 000 000 001 001 000 111
000 100 100 010 010 001 001 110 110 000
000 100 010 010 001 001 110 110 101 000
000 010 010 001 001 110 110 101 101 000
000 010 001 001 110 110 101 101 011 000
111 000 001 110 110 101 101 011 000 111
111 111 000 110 101 101 011 000 111 111
111 111 111 000 101 011 000 111 111 111
111 111 111 111 000 000 111 111 111 111
```



Binary Encoding for 10x10 image

111 111 000 000 111 111 000 000 111 111
111 000 100 100 000 000 001 001 000 111
000 100 100 010 010 001 001 110 110 000
000 100 010 010 001 001 110 110 101 000
000 010 010 001 001 110 110 101 101 000
000 010 001 001 110 110 101 101 011 000
111 000 001 110 110 101 101 011 000 111
111 111 000 110 101 101 011 000 111 111
111 111 111 000 101 011 000 111 111 111
111 111 111 111 000 000 111 111 111 111

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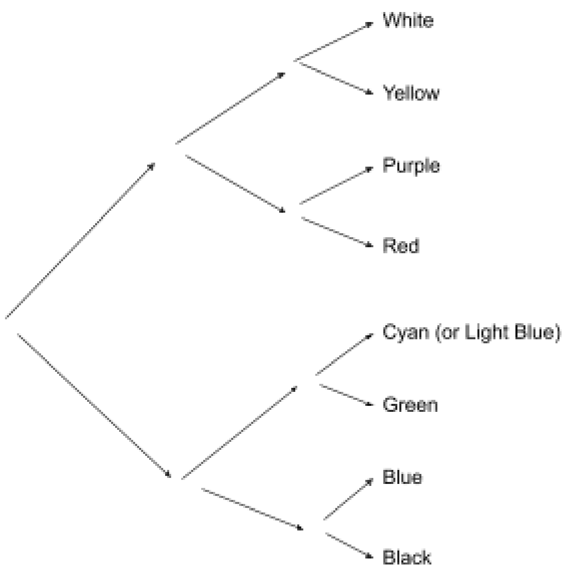
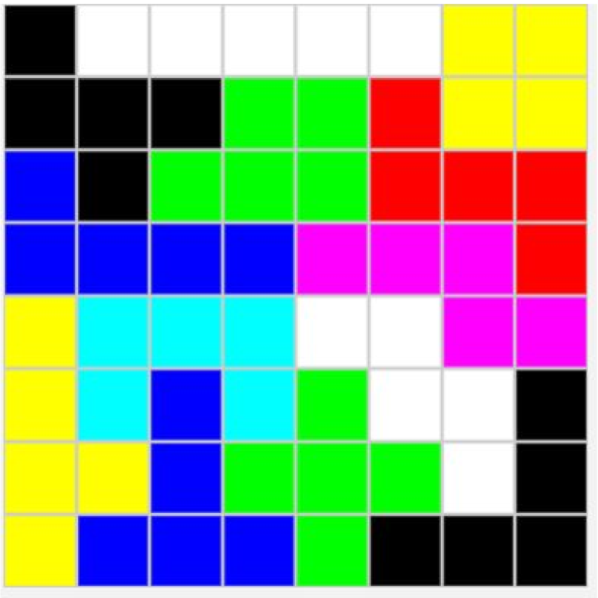
<td> </td>
<td></td>
</tr>
<tr>
<td colspan="2">Binary Encoding for 8x8 image
000 111 111 111 111 111 110 110
000 000 000 010 010 100 110 110
001 000 010 010 010 100 100 100
001 001 001 001 101 101 101 100
110 011 011 011 111 111 101 101
110 011 001 011 010 111 111 000
110 110 001 010 010 010 111 000
110 001 001 001 010 000 000 000</td>
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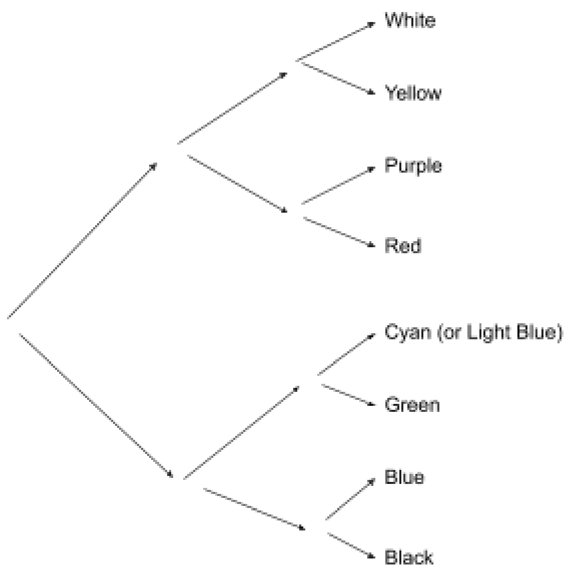
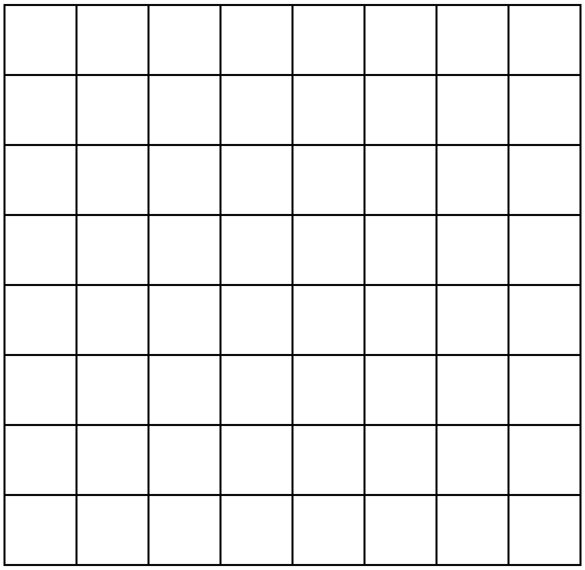




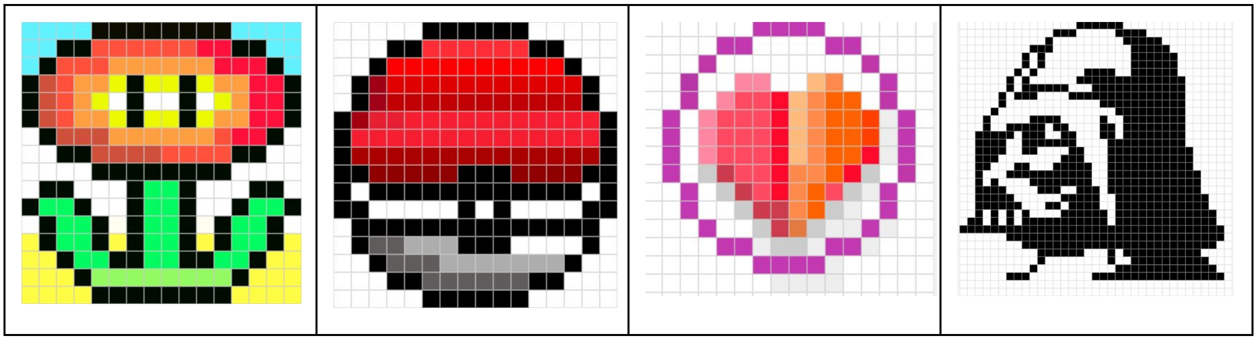
Binary Encoding for 8x8 image

000 111 111 111 111 111 110 110
000 000 000 010 010 100 110 110
001 000 010 010 010 100 100 100
001 001 001 001 101 101 101 100
110 011 011 011 111 111 101 101
110 011 001 011 010 111 111 000
110 110 001 010 010 010 111 000
110 001 001 001 010 000 000 000

Answers

<table>
<tr><td>Page 12</td><td colspan="2">1. <b>Pink</b> would be “Up Up Down”
2. <b>Low Low High</b> would be “Blue”</td></tr>
<tr><td>Page 13</td><td colspan="2"><b>1.</b> <b>111</b> represents “Up Up Up” which is the color <b>black</b>
<b>2.</b> <b>Orange</b> is “Up Down Down” which is the number <b>100</b></td></tr>
<tr><td>Page 14</td><td colspan="2"><b>1.</b> <b>110011010 → 110 011 010 → Pink Yellow Green</b>
<b>2.</b> <b>Blue Orange Black → 001 100 111 → 001100111</b></td></tr>
<tr><td rowspan="2">Page 16</td><td>100111001
110101011
100010001</td><td><table><tr><td>Red</td><td>White</td><td>Blue</td></tr><tr><td>Yellow</td><td>Purple</td><td>Cyan</td></tr><tr><td>Red</td><td>Green</td><td>Blue</td></tr></table></td></tr>
<tr><td>100001100
001100001
100001100</td><td><table><tr><td>Red</td><td>Blue</td><td>Red</td></tr><tr><td>Blue</td><td>Red</td><td>Blue</td></tr><tr><td>Red</td><td>Blue</td><td>Red</td></tr></table></td></tr>
</table>

Using *binary numbers* to represent Pixels, we can make some really creative designs. In the next few pages, you’ll have a chance to create some of these Pixel Art designs.



More Unplugged Resources

These lessons were designed for classroom use for teachers and students, but they’re easily suited for at-home learning.

Description	URL	QR Code
Secret Handshakes Age Group 4-11yrs In this lesson, students develop their own secret handshake sequences using three or more moves. They record their sequences with symbols and revise them based on challenge criteria.	https://sites.google.com/sfusd.edu/k-2cs/red/unit-1-unplugged-cs/3-secret-handshake-sequencing	SCAN ME
What is a Computer? Age Group: 4-11yrs In this activity students develop a preliminary definition of a computer through brainstorming ideas and sorting pictures into “is a computer” and “is not a computer” categories.	https://curriculum.code.org/csd-19/unit1/4/	SCAN ME
My Robotic Friend Age Group: 7-11yrs Using a predefined “Robot Vocabulary” your student will figure out how to guide you to accomplish specific tasks without discussing them first. This segment teaches students the connection between symbols and actions, as well as the valuable skill of debugging.	https://csedweek.org/files/CSEDrobotics.pdf	SCAN ME

Representing Numbers Age Group: 7-11yrs In this lesson, students learn about the binary number system. With a set of cards that represent the place values in a binary (base-2) number system by a collection of dots, students turn bits "on" or "off" by turning cards face up and face down, then observe the numbers that result from these different patterns.	https://curriculum.code.org/csd-20/unit5/5/	SCAN ME
Paper AI Age Group: 10-18yrs Play a game that they are probably all so familiar with that they may have stopped playing it altogether because it's not a challenge anymore. It's Tic-Tac-Toe!	https://minecraft.makecode.com/courses/csintro/ai/unplugged	SCAN ME
Will it Crash? Age Group: 11-18yrs Students trace simple robot programs on paper to develop a sense of how to read and reason about code with if statements in it. Students also try their hand at writing code by hand to handle a robot situation.	https://curriculum.code.org/csp-19/unit5/7/	SCAN ME