



# Outreach Playbook

## Binary Bracelets

Metrics:

Grade Level: 1 - 6	# of Student Participants: Can be as many as desired	Duration (hrs): 30 minutes - 1 hour, depending on the group size	# of SWE Volunteers: 1 volunteer per 5 students	Partner orgs (if any): N/A
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## Overview of Activity

This activity is targeted towards a younger audience with a growing interest in technology, specifically, the internal workings of a computer. Elementary school children are consuming technology and being influenced by their online interactions on a phone, tablet, and computer nearly everyday. This activity introduces the concept of binary and how a computer stores all its information at the primary level through binary. The children will store their own personal information (initials/first name) in binary by following a “binary decoder key” to mimic how a computer may store capital letters. They will have the opportunity to craft a bracelet with their initials coded in binary, which allows them to practice “coding” and searching for information while also expressing their creativity in a fun and hands-on approach.

By the completion of the activity, the students will understand that “binary” is a way of representing information using only two options. In this activity, the two options are white squares and black squares which draw a parallel to the definition of a binary digit/bit. In a computer, the two options are the binary digits “0” and “1”. The most fascinating takeaway for students will be the idea that everything that they see on their digital screen is actually stored in binary digits, in other words, just ones and zeroes. Any image, text, or graphic is just a combination of ones and zeroes for the computer. This real-life connection allows students to expand their curiosity about how their interactions with different devices may not be interpreted the same way as they had thought.

## Outline and Script

### Activity Steps:

First, begin the activity by explaining what binary means. Write “binary” on a paper, whiteboard, chalkboard, or any writing surface available, and underline “Bi-”.

- Talking point: What does the prefix “bi-” mean? (Two! Consider bicycle, binoculars.) In this case, binary refers to two digits, 0 and 1.

Then explain what exactly binary code is. For instance, for older students, you can explain that binary is a base 2 number system, since it uses only 0’s and 1’s, but most of the world operates on a base 10 number system, since it uses digits 0-9. For younger students, you can explain that like many power switches they use in their daily life, there are two states that a computer wire can be in: on or off. Explain why binary is important/relevant, which is because computers use binary to store information.

- [Useful website](#) for general introduction to binary code

Next, pass out a piece of string to every student. These should be cut beforehand for younger students. Also pass out the decoder key. You can choose to pair students up, place them into groups, or allow students to work alone. Explain that they will be coding their own names (or if their name is too long, they may do initials) into binary. They can choose two colored beads to form their name and place the beads on the string to form a bracelet.

A	■□■ ■■■□	N	■□■ □□■
B	■□■ ■■□	O	■□■ □□□
C	■□■ ■■□	P	■□■ ■■■■
D	■□■ ■□■	Q	■□■ ■■■□
E	■□■ ■□□	R	■□■ ■■□
F	■□■ ■□□	S	■□■ ■■□
G	■□■ ■□□	T	■□■ ■□■
H	■□■ □■■■	U	■□■ ■□□
I	■□■ □■□	V	■□■ ■□□
J	■□■ □□■	W	■□■ ■□□
K	■□■ □□□	X	■□■ □■■■
L	■□■ □□■	Y	■□■ □■□
M	■□■ □□■	Z	■□■ □□■

*Binary decoder key from code.org*

- Talking point: Why would we use binary to represent a letter rather than just the letter itself? (It is much simpler for a computer to use a 2 number system rather than the 10 number system that humans use. The more numbers, the more complicated the calculations for the computer. For older students, introduce terms such as *transistor*, *bit*, and *byte*.)



- [Useful website](#) for more detailed information about binary and its use

Assist the students in tying their bracelet together as needed. As a closing activity, you can ask the students to decode each others bracelets! (This is especially fun if the students are not familiar with each other, since they can get to know each other this way.)

This link is a general resource for the binary Bracelets activity:

<https://code.org/curriculum/course2/14/Teacher>

We modified it to better suit the student needs and make the activity more engaging for different age groups.

## Lessons Learned

The students enjoyed coding their names into binary and creating a souvenir to be able to bring home. A helpful tip to get them engaged in the activity is to make coding/decoding into a game or small competition. For elementary school age students, we did a small introductory puzzle where we wrote a secret message (“SWE”) in binary on a whiteboard and had the students work together using the decoding key to find out what the letters were. This got them excited to code their own names/initials and make their binary bracelets.

For younger children (grades 1-5), it may also prove helpful to approach the activity using a “spy” or “secret agent” mindset to get them excited for the activity. This proved to be effective in a spy-themed workshop that we had conducted in Spring 2022. For older children (grade 6 or higher), it may prove helpful to have them create a larger craft than a bracelet (e.g. a necklace or miniature tapestry) to allow them more practice with binary.

Initially, it may be overwhelming to the students, as the decoding key can be confusing. It is important to carefully explain what binary is and how it connects to the activity (e.g. it only uses two values - 0's and 1's, so the bracelets only have two colors). Do not simply give the materials and decoding key to the kids, or they will feel lost.



## Accessibility Adaptations

For a smaller budget: Instead of using beads and pipe cleaners/strings, an alternative is to use a strip of paper and color in squares with a colored marker. This option would be more cost effective.

For students with color blindness/confusion: Rather than using colored beads, this activity can be performed using only black and white beads.

For a completely virtual format: This activity can be conducted through a virtual platform such as Zoom or Bluejeans where the host can share their screen to show the binary decoding key, and students can easily cut a strip of any paper and make lines or draw squares to represent black. This method is especially helpful for young children, since they may struggle with beads and string. We have had experience with virtual accommodations with the global pandemic, and having a demonstration video is a great asynchronous alternative to show the students, which allows them to complete the activity on their own time.

## Materials and Costs

x=Number of students participating

Certain materials like scissors and pencils may already be available in the classroom for the students to use.

Item	Quantity	Where to Buy (link if applicable)	Total Cost
Pipe Cleaners	x	Walmart/Target/Any Stationary Store <a href="#">Amazon alternative</a>	\$6.99x
Beads	15x	Walmart/Target/Any Stationary Store <a href="#">Amazon alternative</a>	\$6.99x



Safety Scissors	x	Walmart/Target/Any Stationary Store	\$2.00x
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**Describe any additional funding sources outside of section budget (if applicable):**

No additional funding sources outside of the section budget were required.