



STEM BINARY CODE

ORNAMENTS

Use binary code, art supplies, and your creativity to make a binary code holiday ornament!



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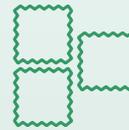
About the Activity

In this activity, you'll code without a computer, learn about the binary alphabet, and craft a simple ornament all in one great holiday STEM project.

Supplies



Red, green, and white pony beads



Small pieces of fabric to use as a backing on the ornament (*optional*)



Red, green, and white pipe cleaners



White glue



Scissors



1/2 inch ribbon



Grades: 3-5, 6-8

Topics: Career Exploration, Creative Arts, Emotional Wellness, History

Time: 30 minutes



ACTIVITY STEPS

Combine coding and creativity by making your own binary alphabet ornament!

1. Read the binary alphabet below. You can also download and print it for quick reference!

BINARY CODE ALPHABET REFERENCE	
A 00001	N 01110
B 00010	O 01111
C 00011	P 10000
D 00100	Q 10001
E 00101	R 10010
F 00110	S 10011
G 00111	T 10100
H 01000	U 10101
I 01001	V 10110
J 01010	W 10111
K 01011	X 11000
L 01100	Y 11001
M 01101	Z 11010

Did You Know?

At the most basic level, computers use something called binary code to understand what humans want it to do. It is made up of zeros and ones. The zero represents "signal off" and the one represents "signal on." Different arrangements of these zeros and ones mean different things. In this activity, you'll use binary language for letters of the alphabet to write a word, just like a computer would!

2. Now, use the binary alphabet to write a word.

Here's an example:

The word "CLOVER" would look like this!

C	L	O	V	E	R
00011	0100	0111	10110	00101	10010

This may seem challenging, but keep working at it, and you'll get it! It may be helpful to fill out a table like the one below to help you match the binary codes to each letter. Use as many columns as you need to get all your letters.

Letters									
Binary Code									

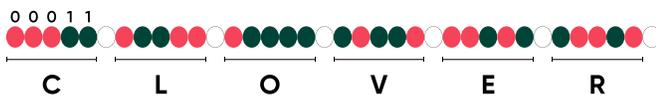


Activity Steps Continued...

- Once you have chosen your word and matched each letter to its binary code, you will plan out your beads! For this activity, you'll use the colored beads to represent numbers, like this:
 - Red beads = 0
 - Green beads = 1
 - White beads to separate out each letter

You'll probably want to use a word that is longer than 5 letters to make a reasonably-sized ornament.

A plan for the word "CLOVER" would look like this!



Did You Know?

Binary code uses a different number system than the one we use every day! The place value system we are used to seeing is a base ten system. That means it uses ten numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Binary uses a base two system. That means it only uses two numbers: 0 and 1!

Base Two Number	Value of Each Place Column	Base Ten Number
101	$4 + 0 + 1$	5
110	$4 + 2 + 0$	6
1001	$8 + 0 + 0 + 1$	9
11001	$16 + 8 + 0 + 0 + 1$	25
10111	$16 + 0 + 4 + 2 + 1$	23

- Twist two pipe cleaners together to make one long piece.
- Slide your beads onto the pipe cleaner, following the plan you made in Step 3. If you chose a long word, you may need to twist another pipe cleaner onto the end to give you more room for beads.

- Twist the ends of the pipe cleaners together and make a holiday shape from your beaded pipe cleaner.
- You can even finish off your binary code ornament by gluing some holiday fabric to the back of it! Let the glue dry, then trim the excess fabric.



- Using ribbon, tie a bow at the top of your ornament so you can hang it up!

Did You Know?

The first ornaments used to decorate trees were things like paper flowers, cookies, fruits, and nuts! They were used to remind people that spring and life would come back to the Earth soon.





TEST YOUR KNOWLEDGE

See how much you've learned about binary code!

1. What do the zeros represent in binary code?
 - a) Signal on
 - b) Signal off
 - c) Go
2. How many numbers were in the binary codes for the letters?
 - a) Two
 - b) Ten
 - c) Five
3. What type of ornaments would you have found on early trees?
 - a) Glass ornaments
 - b) Candles
 - c) Fruits

REFLECTION QUESTIONS • REFLECTION QUESTIONS • REFLECTION QUESTIONS

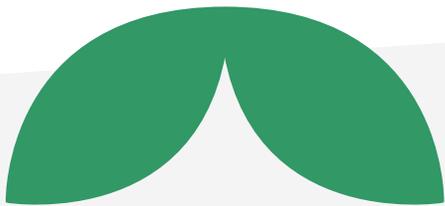
1. Many times, ornaments are hung on trees by people who celebrate Christmas, but not everyone celebrates Christmas during the holiday season. Could you find a friend or a community member who celebrates a different holiday and work together to create a binary code decoration for their home? If you don't celebrate Christmas, maybe you could create an ornament and give it to a friend who does!
2. Why do you think it was important to people long ago to be reminded that spring and life would return to the world after a cold winter?



INVESTIGATE AND EXPLORE

Did you enjoy learning about binary code and using it to create a word?

Take your binary learning to the next level by creating a binary code secret message! Find a friend or a family member and teach them what you learned today about binary code. Then, write a secret message to them in binary code and see if they can figure out what it says!



Share It!

Binary code may seem complicated, but anyone can learn it! Once you've mastered building your own binary code ornament, find a family member and create a binary code ornament together. You could even make a few binary code ornaments as gifts using the recipient's name!





CAREER CONNECTIONS

Meet Jason, a computer programmer who uses binary code and other types of computer code to create computer programs that help people get the right medicine!

When Jason was younger, he loved to play video games, and he was curious to know how they worked. He found out that there is a lot of code behind video games, and he was interested to learn more!

When he graduated high school, he went to a technical school to learn more about how to program computers. Now, Jason works with computers to create the software pharmacies use to supply people with medicine. He uses a type of computer code called hexadecimal code to make computer programs. Hexadecimal code is a lot like binary code, but it uses fewer numbers.

Chances are, if you've ever gone with a parent or caregiver to pick up medicine at a pharmacy, the pharmacist was using the computer program Jason helped create!

