DeSTEMber

CANDY CANE CODING

Learn to decode the "zeroes and ones" of binary code as you make your own binary-coded candy cane!

MATERIALS:

- Green pony beads
- Pen or pencil
- Pipe cleaners
- Red pony beads
- White pony beads

TEKS:

TECH 6/7/8.6 A: The student is expected to define and use current technology terminology appropriately.

TECH 6/7/8.6 H: The student is expected to discuss, explain, and evaluate how changes in technology throughout history have impacted various areas of study.

HOW TO:

1. Read the STEM Explanation below before you begin this activity!
2. Decide which letters you would like to "write" in binary code with your beads. This could be your initials or a shortened version of your name. Each letter that you select will require 8 beads, so choose your candy cane letters wisely!

3. Now, use the attached Binary Code Translation Sheet and a pencil or pen to translate your chosen letters into binary code.

4. Assign the red bead to represent "0," the white bead to represent "1," and the green bead to represent a "space."

5. Grab a pipe cleaner and bend the end so beads don't fall off, and then add a green space bead to get started!

6. Then, use the "0" and "1" beads to string your first letter! Add another "space" bead, then repeat this process for the remaining letters.

7. Add one "space" bead first. Then, use the "0" and "1" beads to string your first letter! Add another "space" bead, then repeat this process for the remaining letters.

8. Twist the end to lock the beads on. Then bend one end to make it look like a candy cane.

STEM EXPLANATION

How many different numerical digits can you name? Probably 10! All numbers, from 0 to infinity, are made up of the following 10 digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. This is called the base-10, or decimal system. A different type of number system, called **binary code**, uses only two numerical digits: 0 and 1. Zeroes and ones are put together in different combinations, typically in a string of eight "spots." These spots are also known as bits, and a string of eight zeroes and ones is called 8-bit binary code. The most commonly used version of binary code today is called UTF-8, which stands for "Unicode Transformation Format 8-bit." Check out the **Binary Code Translation Sheet** below to discover how to use zeroes and ones to write out letters, numbers, and symbols.

Character	Binary Code	Character	Binary Code	Character	Binary Code	Character	Binary Code	Character	Binary Code
A	01000001	Q	01010001	g	01100111	w	01110111	-	00101101
B	01000010	R	01010010	h	01101000	x	01111000	.	00101110
C	01000011	S	01010011	i	01101001	y	01111001	/	00101111
D	01000100	T	01010100	j	01101010	z	01111010	0	00110000
E	01000101	U	01010101	k	01101011	!	00100001	1	00110001
F	01000110	V	01010110	l	01101100	"	00100010	2	00110010
G	01000111	W	01010111	m	01101101	#	00100011	3	00110011
H	01001000	X	01011000	n	01101110	$	00100100	4	00110100
I	01001001	Y	01011001	o	01101111	%	00100101	5	00110101
J	01001010	Z	01011010	p	01110000	&	00100110	6	00110110
K	01001011	a	01100001	q	01110001	'	00100111	7	00110111
L	01001100	b	01100010	r	01110010	(	00101000	8	00111000
M	01001101	c	01100011	s	01110011	)	00101001	9	00111001
N	01001110	d	01100100	t	01110100	*	00101010	?	00111111
O	01001111	e	01100101	u	01110101	+	00101011	@	01000000
P	01010000	f	01100110	v	01110110	,	00101100	_	01011111

Why do we need binary code? Computers and other devices like calculators, printers, or microwaves use binary code to communicate information! Computers cannot understand words or numbers the way that humans do, so we need to communicate with them using electrical signals.

Binary code is a very useful language for communicating with electronic/computerized devices because it only requires two electrical positions: on or off. A one corresponds to "on," and a zero corresponds to "off"; this makes it easy and efficient for electronic devices to receive, store, and transmit information. Any code that uses only two symbols to transmit information is called binary code.

Can you think of any other examples of binary code systems? Morse code, which uses long and short sounds to represent letters, and Braille, which uses raised and flat dots so that individuals can use their sense of touch to read, are both examples of binary code systems.

CAREER: SOFTWARE ENGINEER

Software Engineers design, build, and maintain computer programs and applications that perform tasks and solve problems.

MEET GRACIE ERMI!

Gracie Ermi is a research software engineer who uses technology to tackle critical environmental challenges. She wants to emphasize to people that coding is not magic; with practice, anyone can learn to do it. In her free time, Gracie loves knitting, spending time with family and friends, cheering on Seattle sports teams, reading, and getting outside in the incredible Pacific

Learn more about Gracie!

RESOURCES
https://chandra.harvard.edu/resources/handouts/lithos/binary_bracelets.pdf
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