BINARY CODE CRACKING

MIDDLE SCHOOL LEVEL 1

Coding is the language we use to communicate with computers. It's how programmers are able to develop software for everyone to use. It is a language that can set young minds on a path to a successful future. In this game, we will introduce students to ASCII binary code.

The modern binary system was developed in 1679 by Gottfried Leibniz. Leibniz was fascinated by the I Ching from China, noting that its hexagrams correspond to binary numbers. In binary code, letters are replaced by a series of 0s and 1s. In this game, students will be tasked to decipher binary code numbers into their corresponding letters to reveal the hidden message. Use the character legend below to crack the code!

EDUCATIONAL STANDARDS:

NGSS CONNECTION:
MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

COMMON CORE CONNECTION:
ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.

DOK:
Level 3: Strategic Thinking
Level 4: Extended Thinking

MATERIALS NEEDED:

- ❏ Paper
- ❏ Pencil

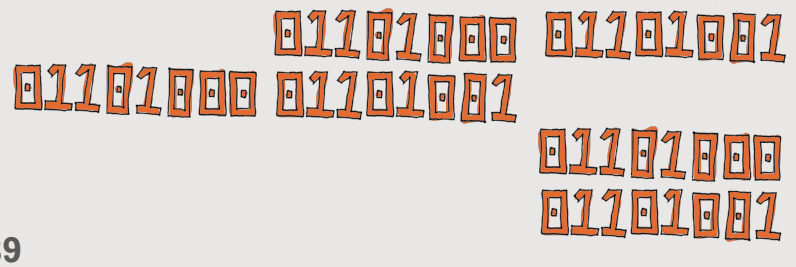
DIRECTIONS:

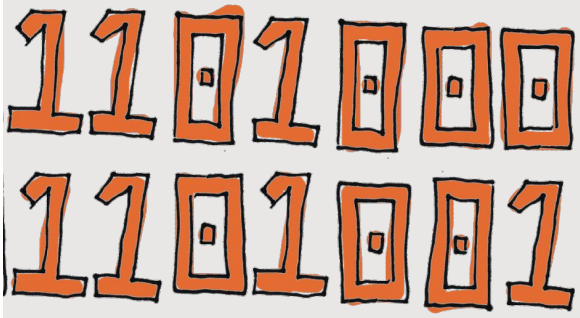
1. Use the key provided to translate the secret code below
2. Student and educators can generate their own secret codes and share them with one another to decode them

SECRET CODE:

01110100
01110111
01101111

01100010
01101001
01110100





OBJECTIVE:

Students will be able to integrate scientific and technical information on analog and digital signals to support claims that digitial are more reliable.

ESSENTIAL QUESTIONS:

- What are analog and digital signals?
- Which signals are more reliable than others? Why?

KEY:

Letter	ASCII Code	Binary	Letter	ASCII Code	Binary
a	097	01100001	A	065	01000001
b	098	01100010	B	066	01000010
c	099	01100011	C	067	01000011
d	100	01100100	D	068	01000100
e	101	01100101	E	069	01000101
f	102	01100110	F	070	01000110
g	103	01100111	G	071	01000111
h	104	01101000	H	072	01001000
i	105	01101001	I	073	01001001
j	106	01101010	J	074	01001010
k	107	01101011	K	075	01001011
l	108	01101100	L	076	01001100
m	109	01101101	M	077	01001101
n	110	01101110	N	078	01001110
o	111	01101111	O	079	01001111
p	112	01110000	P	080	01010000
q	113	01110001	Q	081	01010001
r	114	01110010	R	082	01010010
s	115	01110011	S	083	01010011
t	116	01110100	T	084	01010100
u	117	01110101	U	085	01010101
v	118	01110110	V	086	01010110
w	119	01110111	W	087	01010111
x	120	01111000	X	088	01011000
y	121	01111001	Y	089	01011001
z	122	01111010	Z	090	01011010

FUN FACTS

A. **Another form of binary is braille, the writing system used by the visually impaired.**

B. **The longest binary number sequence memorized in one minute is 270, and was achieved by Aravind Pasupathy in April 2015.**

ENGAGE:

1. Students are presented the binary code cracking activity
2. Students try and crack the code
    a. Allow students a few minutes without the "key"
    b. Once students frustration sets in provide them the "key" to allow them to solve it
3. Reflect with students
    a. What are the benefits of communicating in 0s and 1s?
    b. Was this a more efficient way of communicating?

EXPLORE:

1. Students are presented with a black and white image of the Two Bit Circus Foundation logo
    a. Provide students with paper and ask them to draw a copy of the image presented to them
    b. Students will struggle and no two copies will look perfectly identical
2. Next present to students a black and white "pixelated" version of the logo on graph paper
    a. Provide graph paper and ask students to make a copy of the drawing.
    b. Students should find it much easier to make the drawing now, as they shade in specific boxes
3. Perform a TPS (Think-Pair-Share)
    a. Which method of creating the logo was simpler?
    b. Faster?
    c. Which method produced the least differences in copies amongst your peers?
    d. Which method was more reliable?
    e. Which method is more efficient?
4. Compare/contrast the binary code-breaking activity and the logo activity
    a. Using letters is like drawing the picture freehand (analog)
    b. Using the binary (0 and 1) is like drawing shading in boxes
5. Evaluate
    a. TPS responses from evidence
    b. Comparing and contrasting using reasoning

EXPLAIN:

1. Ask students to research online
    a. Analog vs. Digital signals
        i. Students should gather information
        ii. Synthesize into a paragraph
    b. Why are digital signals better than analog over long distances?
        i. Gather information and synthesize
2. Teacher may facilitate learning through questioning and shared teacher research
    a. Analog vs. digital text
    b. Video analog vs. digital
    c. how images are stored in a computer

3. Students should use their knowledge and reflect on their past two activities
    a. Which method in the above activities could be considered analog? Digital?
    b. Does your research understanding of analog and digital match your conclusion about
        i. Efficiency?
        ii. Reliability?
    c. It should be noted that digital is better over longer distances because it is less affected by interference. Similarly, their drawings using the graphical method and a series of 0s and 1s are less likely to be distorted than an analog picture (interference from us effects the visual)
4. Evaluate
    a. Research methods
    b. Synthesizing and evaluating of information
    c. reasoning

ELABORATE:

1. Ask students
    a. Is the idea of a digital signal new?
    b. How might we have communicated in the past with analog and digital signals? (don't tell them this!)
        i. Traditional mail, talking, music are all analog signals
        ii. Morse code is one of the earliest forms of digital signals
2. Present students with a sample of morse code
    a. Morse Code alphabet and numbers
    b. Have them construct an argument whether it is digital or analog
        i. Students should use their previous activities for evidence
        ii. Discuss the use over distances
            1. Reliability
            2. Efficiency
            3. Interference
    c. How are modern computers and the way they work similar to Morse code?
        i. Are they more efficient?
        ii. How?
    d. History of Morse code
3. Evaluate
    a. Evaluating evidence
    b. Reasoning from evidence