CRYPTOGRAPHY SCAVENGER HUNT

A major mission at Idaho National Laboratory is to study and improve security on computer systems. This field of study is called cybersecurity. Cybersecurity is intended to prevent criminals, foreign governments, and extortionists from compromising sensitive data that is stored and transmitted on computing systems. Cryptography is a way of coding information in such a way that only the transmitter and receiver of information can interpret its meaning. Cybersecurity professionals encrypt sensitive data so that if the communications are intercepted in between the transmitter and receiver, they cannot be understood by the interceptor.

In this activity, you will encrypt a message for your students or children. The message will divulge the location of one or more hidden treasures. There are many ways to encrypt messages. This lesson will suggest two, but you are encouraged to get creative and find other ways to encrypt the messages you give to your students or children.

GRADE LEVELS: K-12

VOCABULARY

Cryptography – *enciphering and deciphering messages in secret code.*

Cybersecurity – *measures taken to protect a computer or computer system (as on the Internet) against unauthorized access or attack.*

Encrypt – *enciphering and deciphering of messages.*

MATERIALS

- Sudoku puzzle (http://www.sudokuessentials.com/support-files/sudoku-easy-2.pdf, handout included)
- GPS or GPS phone application
- INL Secret Decoder wheel (handout included)
- Brass brads (for the INL Secret Decoder wheel)
- A treasure of some kind

PROCEDURE

Encrypting a Message with Sudoku

One fun way to encrypt a message is to require the receiver of the message to solve a puzzle in order to break the code. Sudoku puzzles are nearly perfect for this except that they do not include the number zero. Any zero in your message will have to be stated.

1) *Use a geocaching or GPS application on your phone to mark and record the location of something you hide for your children or students.*
2) *Print a Sudoku puzzle with its solution from the internet. An easy puzzle is suggested to start with (http://www.sudokuessentials.com/support-files/sudoku-easy-2.pdf).*
3) *In the blank puzzles that you will give to your students, write the letters A through I in the blank spaces where, when the puzzle is solved, the corresponding numbers will appear (see attached for example).*
4) *Assign the letters A through I to the numbers 1 through 9 **randomly**.*
5) *Give your students the coordinates to a geocache in letters instead of numbers.*
6) *When the students solve the puzzle, they will have broken the code.*
7) *They will use the Sudoku puzzle results and the broken code to replace the letters in the coordinates with numbers.*
8) *Accompany your students to find the treasure, but make sure to let them do all the finding.*

Encrypting a Message with the INL Encoder Wheel

INL has produced a Secret Decoder Wheel (handout included) where letters correspond to symbols. For young children, it's fun to describe the location of a treasure in words, encode the message in symbols using the wheel, then give the encoded message to students. The students go find the treasure.

THE SCIENCE BEHIND IT

Encryption and cybersecurity are fields accessible to all kinds of scientists, engineers, and mathematicians. Do you like puzzles? Do you like secrets? Do you like computers? This might be the field for you.

Mathematicians develop complex algorithms that are used to encode information. Computer programmers turn those algorithms into code that a computer can understand. Scientists study the effectiveness of the code and come up with new algorithms themselves. Even historians get involved by studying and adapting ways that humans have encoded messages for millennia. You can get involved in cybersecurity, too!

EXTENSIONS

Can you think of other ways to encode messages besides the two mentioned in this activity? Certainly, you can! Challenge yourself to make more complex and creative encryption methods. Make a game of it. Have fun!

RESOURCES

- *www.sudokuessentials.com*

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*For information on grants, training and student opportunities; curriculum ideas and resources, please visit us at: **stem.inl.gov**.*

Sudoku Essentials

					6		8	
		9	1		5	3	7	2
	8	F	7				1	6
					H		3	4
	B	A	3	5	1			C
7	3							
6	1				8		2	
8	2	3	9		4	6		
I	7	D	6		G	C		E

Puzzle #: 2

Difficulty: Easy

Date: 3/29/2006

Secret Decoder Wheel

Instructions:

1. Carefully cut out both wheels.
2. Place the smaller wheel inside the larger with the center dots aligned.
3. Attach the wheels together with a brad.
4. Line up the two 'A' boxes.
5. Count the number of the boxes called for by the key. For example, if the key is '2,' spin the smaller wheel two positions to the right (clockwise). If the key is '-4,' turn the wheel four positions to the left.
6. Your bracelet message has a **key of 5.** Decode the message!
7. Now try a few of your own.

Code your name:

Key: _____

Write a short message for your friend:

Key: _____

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