Introduction:
This post-visit lesson is designed to take place after the students’ viewing of the video segments.

It includes some activities for simple encryption and links to diverse careers at high tech companies, coding courses, and a virtual tour of the world’s leading microchip maker.

Engage:
• While coding is probably the most well know field in computer science, there are many other careers related to computers that may emphasize different skills and may not focus solely on writing lines of code. Here is a list of some of these careers:
  o Computer programmer
  o Hardware engineer
  o Software developer
  o Systems manager
  o Web developer
  o Web designer
  o Software engineer
  o Database administrator
  o Network architect
  o Network administrator
  o Systems analyst
  o Security analyst
  o Information researcher
  o Video game developer
• Have students research 1-3 computer science careers that seem interesting to them. Some aspects and attributes they could research may include: type of skill(s) required; type of degree required; colleges and universities that offer degree programs in these fields; average salary; major companies that rely on these careers; and the employment opportunities for these careers.

Explore:
• Communication and data security has and continues to be a priority for not only the US Navy and other branches of the US Armed Services, but also online merchants to hospitals, and all businesses in between.
• Included are three activities that introduce some basic types of encryption or data sharing techniques. Have your students try some of these activities and role play as message sender, receiver, and a hacker. Challenge your students to make variations of the encryption types to safeguard against a hacker.
“Intro to Computer Science Tour”
Grade 6-8: Post-Lesson

Resource Links:

- **Million Girls Moonshot**: A program seeking to engage one million more girls in STEM learning opportunities
  - [https://milliongirlsmoonshot.org/](https://milliongirlsmoonshot.org/)

- **Today's Women in Invention**: Qualcomm, a partner in the Moonshot initiative, introduces three modern day inventors and their stories of inspiration and triumph
  - [https://milliongirlsmoonshot.org/inspiring-inventors](https://milliongirlsmoonshot.org/inspiring-inventors)

- **Viasat Careers**: Learn about diverse careers and some of the employees at Viasat
  - [https://careers.viasat.com/](https://careers.viasat.com/)

- **Viasat Virtual Classroom**: Sign up to meet a Viasat employee to discuss STEAM education & careers
  - [https://viasatinavirtualclassroom.splashthat.com/](https://viasatinavirtualclassroom.splashthat.com/)

- **Hologic Careers & Student Internships**: Learn about diverse careers and student internships at Hologic

- **US Naval Academy STEM Center for Education & Outreach**: Learn about opportunities for elementary through high school students and classroom educators to engage in STEM activities and bring them into the classroom
  - [https://www.usna.edu/STEM/index.php](https://www.usna.edu/STEM/index.php)

- **Intel Virtual Museum**: Immersive tour of the Intel Museum to learn about its technology & history
  - [https://virtualmuseum.intel.com/#](https://virtualmuseum.intel.com/#)

- **Code.org**: Learn about this nonprofit devoted to coding and supports and courses for grades K-12
  - [https://code.org/](https://code.org/)

- **SOCAL (Student Opportunities for Career Awareness and Learning)**: A collaborative program between education and industry in northern San Diego County that gives middle school, high school, post-secondary students and transitioning adults an opportunity to gain insights into career pathways
  - [https://socalworkforce.org/](https://socalworkforce.org/)

- **Roadtrip Nation**: Three computer science students meet leaders in the field
The Tap Code uses a 5×5 grid of letters representing all the letters, except for K, which is represented by C. The listener only needs to distinguish the timing of the taps to recognize a number. The pause between each tap is smaller than the pause between tap groupings. The origins of this encoding go back to Ancient Greece but became famous in modern day when it was used by American POWs during the Vietnam War. Below are examples of the Tap Code. One is the more widely used 5x5 grid that is only composed of letters (below left). Other variations include a 5x5 grid where the letters are shuffled randomly for an added level of encryption and another is a 6x6 grid that includes numbers (pictured below right).

<table>
<thead>
<tr>
<th>ROMAN ALPHABET TAP CODE</th>
<th>ROMAN ALPHABET TAP CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Alphabetical)</td>
<td>(Alphanumeric)</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>1 A B C/K D E</td>
<td>1 A B C/K D E F</td>
</tr>
<tr>
<td>2 F G H I J</td>
<td>2 G H I J K L</td>
</tr>
<tr>
<td>3 L M N O P</td>
<td>3 M N O P Q R</td>
</tr>
<tr>
<td>4 Q R S T U</td>
<td>4 S T U V W X</td>
</tr>
<tr>
<td>5 V W X Y Z</td>
<td>5 Y Z 1 2 3 4 5 6 7 8 9 0</td>
</tr>
</tbody>
</table>

To encrypt a message, find the letter you need, then convert it into a series of taps based on its corresponding coordinate pair in the grid. Using the 5x5 grid, here is how a cipher message would look like:

● ●●●● ●●●●● ●●●●● ●●●●● ●●●●● ●●●●●

To decode, group the taps into coordinate pairs which will represent the row and column. Find the corresponding letter based on the coordinate pair. The cipher above would decrypt to:

(● ●●●) (● ●●●●) (● ●●) (●●●●●) (●●●●●) (●●●●●) (1, 4) (1, 5) (1, 3) (3, 4) (1, 4) (1, 5) (1, 4) ➔ DECODED
ENCRIPTION & DECRYPTION: Shift Cipher or Caesar Cipher

In cryptography, a Caesar Cipher, also known as the Shift Cipher, Caesar's code or Caesar shift, is one of the simplest and most widely known encryption techniques. It is a type of substitution cipher in which each letter in the plaintext is replaced by a letter some fixed number of positions (shifted) down the alphabet. For example, with a left shift of 3, “D” would be replaced by “A”, “E” would become “B”, and so on. The method is named after Julius Caesar, who used it in his private correspondence. Note also that the ciphertext is case sensitive and after encryption it is written in all lower case font.

The encryption step performed by a Caesar Cipher is often incorporated as part of more complex schemes, such as the Vigenère Cipher, and still has modern application in the ROT13 system. As with all single-alphabet substitution ciphers, the Caesar Cipher when used by itself is easily broken and in modern practice offers essentially no communications security.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| v | w | x | y | z | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u |

Key:
- plaintext = uppercase letters
- ciphertext = lowercase letters

Plaintext: “EASY TO DECODE”
Ciphertext: zvntojzxjyz
**ENCRYPTION & DECRYPTION: Rail Fence Cipher**

In a **Rail Fence Cipher**, letters are not changed, but only switched around regarding their positioning in the message. This type of cipher is often called a *transposition cipher*, because letters are simply transposed in terms of their placement. Transposition ciphers like the Rail Fence Cipher are relatively weak forms of encoding and can easily be broken, especially with today’s technology. These types of ciphers date back to the Ancient Greeks, but it was used during the American Civil War where soldiers would use the code to send encrypted messages.

The Rail Fence Cipher is sometimes called a **Zigzag Cipher** as a zigzag or “W” pattern in three rows is used to write the plaintext. In other versions the writer enters the plaintext message in descending lines. Typically only three rows (also known as the “key”) are used, but this number can vary as long as both the sender and receiver are in agreement as to the key number. Below are two Rail Fence Cipher types with the same key. One is in the “W” pattern, the other in a vertical rail array. The plaintext message is “Can you decode”.

**KEY = 3  (“W” Pattern)**

<table>
<thead>
<tr>
<th>C</th>
<th>O</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Y</td>
<td>U</td>
</tr>
<tr>
<td>N</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

Ciphertext: **COCAYUEOENDD**

**KEY = 4  (Vertical Rail Array)**

<table>
<thead>
<tr>
<th>C</th>
<th>Y</th>
<th>D</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>O</td>
<td>E</td>
<td>D</td>
</tr>
<tr>
<td>N</td>
<td>U</td>
<td>C</td>
<td>E</td>
</tr>
</tbody>
</table>

Ciphertext: **CYDOAOEDNUCE**