girls4tech

DIGITAL LESSON BUNDLE

All Things Digital

Objectives

Students will

- identify how technology has evolved to what it is today
- understand binary code and how it is used
- apply their understanding of binary code to solve a problem
- explore the role security engineers play in technological innovation

GRADE RANGE

5–9

DURATION

Three class sessions of approximately 45 minutes each

OVERVIEW

With this set of resources, students will first learn the basics of technology and its evolution before moving on to investigate binary code. Through a series of activities, students will discover what technology is, how it is built, how it has evolved, and how it is used. They will learn the purpose and role of binary code before engaging in a binary "rescue mission."

BACKGROUND

Technology is the use of science to invent useful things or solve problems. It is also any application of knowledge toward a practical purpose, and technology is constantly being innovated or changed for the better. For example, if a person wanted a self-portrait, it used to be that they would have to commission an artist to render a painting. Then, someone invented the camera, which went through multiple iterations before becoming digital or electronic—no longer requiring film and able to send photos across multiple digital devices. Now, people can simply use their smart phones. This coming together of multiple functions in a single device thanks to the digitization of data is called digital convergence. The digital language used to make this communication possible is binary code. Binary code uses 0s and 1s to communicate on and between pieces of technology.

MATERIALS

All Sessions

- Computer with camera, microphone, and virtual learning platform—one for educator
- At-home supplies for students who are learning virtually (i.e., pencils, blank paper, crafting materials, etc.)

Session 1

- Sticky note or small square of paper, one per student*

Session 2

- Writing utensil, one per student
- Paper, one per student
- **Binary Alphabet** student handout, (optional) one per student*
- **Crack the Code** student handout, one per student*
- **Crack the Code** answer key, one for educator

Session 3

- **Binary Communication Sheet A** student handout, one each for half of the groups*
- **Binary Communication Sheet B** student handout, one each for half of the groups*
- Flashlights, one per group* and one for educator
- **Binary Alphabet** student handout, one per student*
- **3-2-1 Exit Slip** student handout, one per student*

***Note:** *There are facilitation options below if the students are in a virtual situation. Handouts can be provided electronically to be printed at home or as an editable Microsoft Word template to be submitted via email, learning management systems, or as a live/shared document.*

EDUCATOR PREPARATION

- Before each session, make sure students have access to the required handouts. If students are learning virtually, they can print them out at home or utilize shared online documents. You can also make them available through your chosen virtual learning platform or learning management system.
- If an activity calls for working with a partner or group, students learning virtually can share their answers out loud or write their definitions down to reference later, add to a live/shared document, or comment in a chat box. Alternatively, you can prepare breakout rooms in your learning management system prior to your session.
    - Platforms like Zoom allow you to pre-assign participants to breakout rooms. Google Meet will randomly distribute participants.

USING THIS GUIDE

The goal of this guide is to give educators a complete set of resources for facilitating lessons on technological innovation and binary code. It provides slide-by-slide instructions to ensure educators are prepared to explain, discuss, and facilitate the hands-on content in the presentation. The presentation is designed to cover three class sessions, but it can be flexible depending on the students' needs and the time available. However, sessions should be presented in order.

The accompanying presentation was created with PowerPoint so that it can be used in a variety of classrooms. If you are using a laptop with a projector, simply progress through the PowerPoint by clicking to advance. All of the interactive aspects of the presentation are set to occur on click. This includes images, text boxes, and links which will appear in your Web browser. If you are using an interactive whiteboard, tap each slide with your finger or stylus to activate the interactive aspects of the presentation. Notes for each slide provide information on how to proceed.

PROCEDURE

Session 1 (Slides 1–6)

Overview

Students will be introduced to the basics of technology and digital innovation. They will build their understanding and be given the opportunity to ask questions about how things work. Together, they will brainstorm ways to find answers to their questions.

Slides 1 & 2

- As you distribute a sticky note to each student, direct students' attention to the first slide and introduce the lesson. Move onto the second slide and direct their attention to the question at the top of the slide: "What is technology?"
- Click to display the screen.
- After 2 minutes, ask students to share their six words with the class (either verbally, visually, via chat or any other method used to communicate in your class).

Slide 3

- Reveal the definition of "technology": the use of science to invent useful things or solve problems; any application of knowledge toward a practical purpose.
- As a class, discuss whether any of the Six Word stories were similar to the definition. Acknowledge if any were *examples* of technology.

VIRTUAL FACILITATION OPTIONS

- Allow students to share their answers out loud or encourage students to write their definitions down to reference later, add to a live/shared document, or comment in a chat box.

Slide 4

- Invite students to take a moment to study the images shown on the screen in light of what they just learned about technology.
- Ask 1–2 volunteers to suggest which, if any, images should be removed because they are *not* technology.
- Explain to the class that based on the definition they learned, every picture on this page is technology because all were invented to solve a problem and used knowledge for a purpose.
- Click to arrange the images into one timeline for each piece of technology. This is called "**technological innovation**," or the changing of things for the better. Innovations make technology work better, faster, or more easily.
- Ask students which piece of technology appears to be missing that they are probably very familiar with. Give them the hint that it is also the only piece of technology on the screen that could be the last item in each timeline.

Teacher note: *a smartphone is missing.*

Slide 5

- Remind students that the smartphone can act as a radio, a computer, *and* a camera. Most can perform many more functions!
- Ask students to share out various functions of smartphones. Record original ideas as you hear them on the board or directly on the slide.
- Click to display definition. Explain to students that when multiple functions come together in a single technological device, we call that "**digital convergence**."

VIRTUAL FACILITATION OPTIONS

- Students can share their answers out loud, add to a live/shared document, or comment in a chat box.

Slide 6

- Remind students that inventions and innovations in technology would never happen if there weren't scientists, engineers, inventors, and regular people asking, "How can I make this better?"
- Invite students to work with a partner and brainstorm additional questions they have about the definition of technology. What ideas do *they* have for technological innovations? What technologies do they know and how could those technologies be made even better? Give them approximately 5 minutes.
- At the end of 5 minutes, invite 3–4 volunteers to share their questions. Record them on the slide under "Ask Questions."
- Direct students to spend 3–4 more minutes brainstorming with their partners how or where they might find answers to their questions. Again, invite 3–4 volunteers to share their responses. Record them on the slide under "Find Answers."
- Reinforce that scientists and engineers are constantly asking questions and seeking out resources to find answers.

VIRTUAL FACILITATION OPTIONS

- Consider turning this activity into a whole-class discussion.
- Another option is using breakout rooms to put students into pairs or groups so they can collaborate with each other. You can choose to assign groups manually or automatically depending on how you want students placed and which online platform you are using.

Session 2 (Slides 7–11)

Overview

Students will investigate binary code and how it is used. They will solve binary puzzles to apply their understanding.

Slide 7

- Begin session by reinforcing what students learned about technology, innovation, and digital convergence in the previous session.
- Ask students to comment on the Binary Code example they see on the screen. Does the Bi- in the word Binary give students a clue as to why they only see two digits—0 and 1?
- Invite students to consider what would happen if our smart phone spoke Spanish but the camera spoke Chinese and our credit card spoke Arabic, but our music player spoke French. Would they be able to understand what the others were saying? Ask students, "How could you improve their ability to communicate with one another?"
- Invite volunteers to explain to the class how computers and other digital devices communicate with one another. If no one can provide the correct answer, point again to "Binary Code" on the screen. Lead students to the understanding that Binary Code acts as a "translator." It is a common digital language that allows the functions of a single device or multiple devices to converge and communicate.
- Click to show how binary code works. Signals from one device are translated into a series of zeros and ones. The series is sent to another device, which reassembles the zeros and ones into the original signal.

Slides 8 & 9

- Ask students to think silently about their favorite foods and choose one. Tell them the only condition is that it must have between three and seven letters when you spell it out.
- Click to reveal the binary code alphabet. Show students an example of what this task could look like by moving on to slide 9. Explain that you used the binary code for P-I-E to share your favourite food (you can change to a different food if you'd like).
- Challenge students to write their favorite food in binary code, stacking the series of binary code "letters" into a column, similar to how the code was displayed in the box in the previous slide. You may choose to distribute a **Binary Alphabet** handout to each student.
- After 4–5 minutes, have students exchange papers with a peer to see if they can "reassemble the signal" to determine their partner's favorite food.

Slide 10

- Provide students with an opportunity to demonstrate their understanding of how binary code disassembles and reassembles signals using the **Crack the Code** student handout.
- Direct students to begin with Part 1. Each box includes a pixelated image of empty and filled-in squares. Reinforce the directions that each empty square stands for a 0 and each filled square represents a 1. Instruct students to record the binary code for each image on the lines next to each box.
- Now in Part 2, students will use the right column to practice reassembling messages. They will look at the binary code that is present on each line and fill in the squares accordingly to create their own pixelated images.
- Using the answer key as reference, inform each student if they were able to "crack the code."

VIRTUAL FACILITATION OPTIONS

- Consider reading off the number sequences for Part 1 and informing students that their images for Part 2 should resemble an hourglass, an "X," and a smiley face.

Slide 11

- This slide has the various answers to the puzzles students were working on. It is hidden and mainly for your reference but you can choose to share it with students if you decide it will be helpful.

SESSION 3 (Slides 12–20)

Overview

Students will learn about the role security engineers play and engage in a team-based binary "rescue mission" in which they may communicate only using flashlights and binary code. Can they turn the network back on in time?

Slide 12

- Reinforce that, during this final session, students will use what they have learned so far to take on the role of security engineers.
- Click to reveal and explain the main responsibilities of a security engineer.

Slide 13

- Explain to students that cybercrimes and malicious hacking are the two cyber "disruptions" that they will be focusing on today in their role as security engineers.
- Click to reveal and review the definition of "cybercrime."
- Click again to reveal and review the definition of "malicious hacking."
- Ask students if any of them can think of any examples of cybercrime or hacking they have heard of in the news, read about on the Internet, or seen posts about on social media. If students cannot come up with examples on their own, offer a few of the more recent and relevant data breach cases from the news.

Slide 14

- Tell students that today they will take on the role of security engineers in order to solve a case of malicious hacking at their school.
- Click to reveal the scenario and read it aloud to the class.

Slide 15

- Split the class in half. Designate one half as Side A and the other as Side B. Within each half, organize students into groups of 3. If there are students left over, you can create one group of two or four. Pair each Side A group with a Side B group. Each group should have a **Binary Communication Sheet** and a flashlight. Make sure half of the groups have **Binary Communication Sheet A** and their partner groups have Binary **Communication Sheet B**.
- Explain that they will be using the flashlights to translate their messages into binary code. Similar to Morse code, a short flash represents a "0" and a long hold flash represents a "1."
- Click once to show the Morse code dot. Demonstrate with a flashlight how a short flash would look and emphasize that represents a "0."
- Click again to show the Morse code dash. Demonstrate with a flashlight how a long hold flash would look and emphasize that represents a "1."
- Give students 1–2 minutes to practice shining "0s" and "1s" within their groups.

VIRTUAL FACILITATION OPTIONS

- You may consider using breakout rooms to put students into groups. If they do not have flashlights or smart phone lights available, they can come up with alternative ways to "flash" and "hold" such as holding paper in front of the webcam for short and long periods of time.

Slide 16

- Distribute one **Binary Alphabet** handout to each student if you have not already done so.
- Instruct groups to use their **Binary Alphabet** handouts to translate the messages they need to send into binary code.
  Use the **Binary Communication** answer key to assist as needed.
- Instruct students to assign roles: Flashlight Operator, Recorder, and Decoder. After students have sent and received a message in their initial role, they can rotate, so all students have an opportunity to participate in each role.

Slide 17

- Using the flashlight slide as reference, remind students how to communicate each digit of their binary code messages.
- Teams should take turns sending messages to their partner groups in order. As one group is using the flashlight, the other group should be recording each transmission as a "0" or a "1."

After the first set of sent and received messages, remind students to rotate roles.

- After each transmission has been sent, give the receiving team time to reassemble the signal into a message. Once they have figured out the incoming message, students in that group should use their flashlight to send the next message to their partner team.
- This process should repeat until all six messages have been sent and received. Use the **Binary Communication** answer key to assist as needed.
    - **Optional:** *Some students respond well and remain more engaged when a competition element is added. One suggestion might be to propose to students that the first pair of groups to correctly communicate all messages will be those that get the network back on and receive bonuses in their roles as Security Engineers.*

Slide 18 & 19

- When you believe most students have figured out the code, display slide 18 to help those who are still working to solve the code. Reveal slide 19 when most/all students have expressed to you that they have solved the code.
- Tell them that at the count of three, you want them all to shout out the malicious hacker's password. Say, "1, 2, 3."
- As the students all shout out, "egg," click to show the image of an egg.

Slide 20

- Distribute one **3-2-1 Exit Slip** handout to each student.
- Collect slips from students. If time allows, choose a few questions from the exit slip and discuss with the group. As you are able, follow up with students regarding their exit slips after the conclusion of the series.

RESOURCES

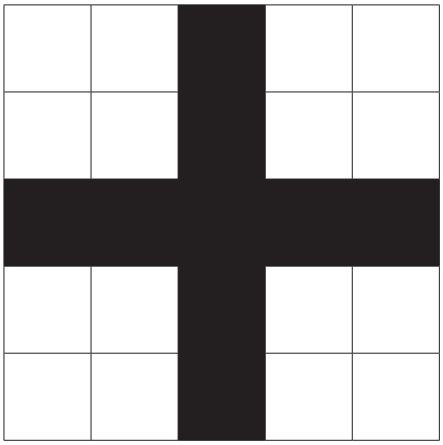
- https://www.globalcompetencies.cmec.ca/global-competencies
- https://www.goodlifegoals.org (UNSDG—student friendly version).

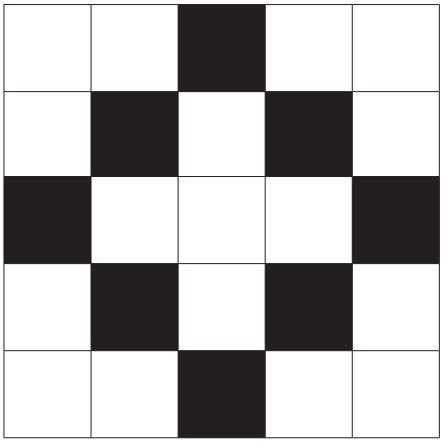
Binary Alphabet

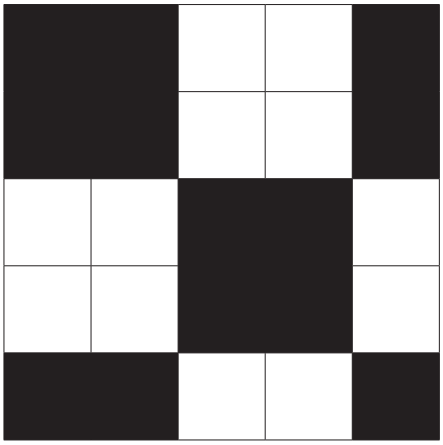
Binary Code					
A	01000001	J	01001010	S	01010011
B	01000010	K	01001011	T	01010100
C	01000011	L	01001100	U	01010101
D	01000100	M	01001101	V	01010110
E	01000101	N	01001110	W	01010111
F	01000110	O	01001111	X	01011000
G	01000111	P	01010000	Y	01011001
H	01001000	Q	01010001	Z	01011010
I	01001001	R	01010010		

Crack the Code

Directions Part 1: Translate each image symbol into binary code. Each empty square represents a "0," and each filled-in square represents a "1."







Crack the Code

Directions Part 2: Reassemble each symbol from binary code into an image. Each "0" represents an empty square, and each "1" represents a filled-in square.

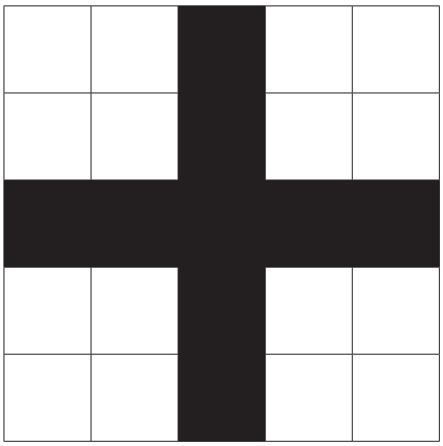
1	1	1	1	1
0	1	1	1	0
0	0	1	0	0
0	1	1	1	0
1	1	1	1	1

1	0	0	0	1
0	1	0	1	0
0	0	1	0	0
0	1	0	1	0
1	0	0	0	1

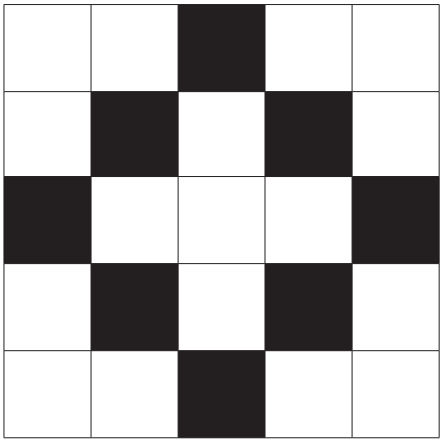
0	1	0	1	0
0	1	0	1	0
0	0	0	0	0
1	0	0	0	1
0	1	1	1	0

Crack the Code | Answer Key

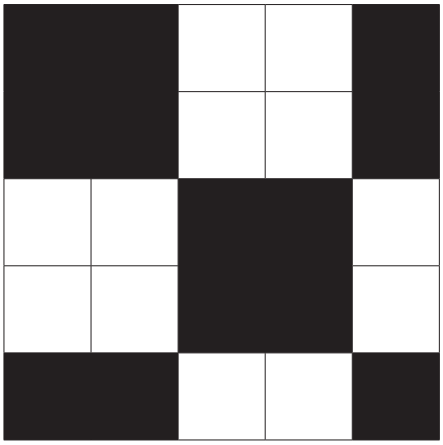
Directions Part 2: Reassemble each symbol from binary code into an image. Each "0" represents an empty square, and each "1" represents a filled-in square.



0	0	1	0	0
0	0	1	0	0
1	1	1	1	1
0	0	1	0	0
0	0	1	0	0

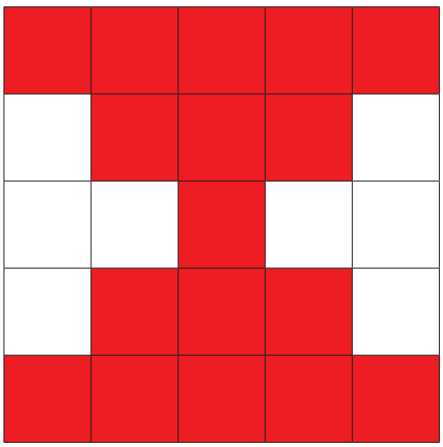


0	0	1	0	0
0	1	0	1	0
1	0	0	0	1
0	1	0	1	0
0	0	1	0	0

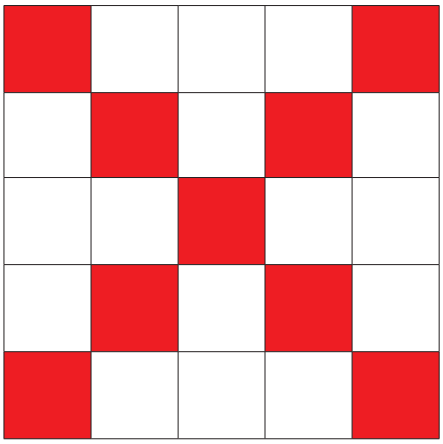


1	1	0	0	1
1	1	0	0	1
0	0	1	1	0
0	0	1	1	0
1	1	0	0	1

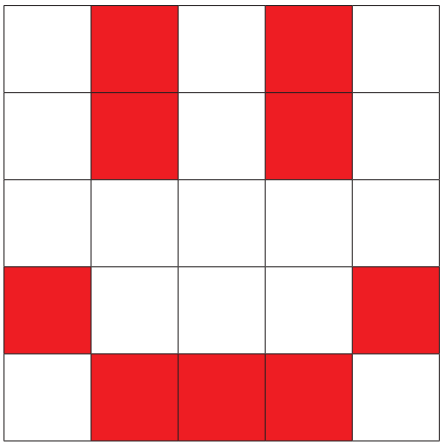
Crack the Code | Answer Key



1	1	1	1	1
0	1	1	1	0
0	0	1	0	0
0	1	1	1	0
1	1	1	1	1



1	0	0	0	1
0	1	0	1	0
0	0	1	0	0
0	1	0	1	0
1	0	0	0	1



0	1	0	1	0
0	1	0	1	0
0	0	0	0	0
1	0	0	0	1
0	1	1	1	0

Binary Communication Sheet A

Send Message 1

Message	Binary Code
NETWORK LOCKED	

Receive Message 2

Binary Code	Message

Send Message 3

Message	Binary Code
MALICIOUS HACKERS NEED PASSWORD	

Receive Message 4

Binary Code	Message

Send Message 5

Message	Binary Code
FOUND CLUE MUST BE BROKEN TO USE	

Receive Message 6

Binary Code	Message

Binary Communication Sheet B

Receive Message 1

Binary Code	Message

Send Message 2

Message	Binary Code
WHO DID IT WHAT DO WE DO	

Receive Message 3

Binary Code	Message

Send Message 4

Message	Binary Code
NEED THEIR PASSWORD	

Send Message 5

Binary Code	Message

Send Message 6

Message	Binary Code
EGG NETWORK BACK ON	

Binary Communication | Answer Key

Message 1

Message	Binary Code
NETWORK LOCKED	01001110 01000101 01010100 01010111 01001111 01010010 01001011 01001100 01001111 01000011 01001011 01000101 01000100

Message 2

Message	Binary Code
WHO DID IT	01010111 01001000 01001111 01000100 01001001 01000100 01001001 01010100

Message 3

Message	Binary Code
MALICIOUS HACKERS	01001101 01000001 01001100 01001001 01000011 01001001 01001111 01010101 01010011 01001000 01000001 01000011 01001011 01000101 01010010 01010011

Message 4

Message	Binary Code
NEED THEIR PASSWORD	01001110 01000101 01000101 01000100 01010100 01001000 01000101 01001001 01010010 01010000 01000001 01010011 01010011 01010111 01001111 01010010 01000100

Message 5

Message	Binary Code
FOUND CLUE	01000110 01001111 01010101 01001110 01000100 01000011 01001100 01010101 01000101
MUST BE BROKEN TO USE	01001101 01010101 01010011 01010100 01000010 01000101 01000010 01010010 01001011 01000101 01001110 01010100 01001111 01010101 01010011 01000101

Send Message 6

Message	Binary Code
EGG	01000101 01000111 01000111
NETWORK BACK ON	01001110 01000101 01010100 01010111 01001111 01010010 01001011 01000010 01000001 01000011 01001011 01001111 01001110

3-2-1 Exit Slip

What are the THREE new things you learned about technology and binary code?

1.

2.

3.

What are TWO things you are interested in researching or learning more about?

1.

2.

What is ONE question you still have about something you learned?

1.