

# Lesson 7: Keeping Data Secret

## Overview

**Question of the Day: How can we keep data secret and protect it from misuse?**

Students continue to explore how data is represented in a punchcard, and begin considering whether some data should be protected from public view because it is too personal or sensitive. Once students understand the reasons for protecting data, they learn a binary encryption system that lets them encrypt and decrypt data in their punchcards, and eventually they are able to send secret messages to one another using this method. Class concludes with a discussion on the importance of protecting our information and how encryption is one way we can accomplish this.

## Purpose

As students have been encoding and decoding with data, they have not been worried about the securing of the data that they are using even when that information has been highly personal or sensitive (such as addresses or phone numbers). In this lesson, they begin to think about how they can ensure that only the intended recipient can read the data that they send. The lesson is framed around the real-world issues of keeping medical history protected, allowing students to see how this issue extends to real-world scenarios and may be impacting their lives without them being aware of it.

## Assessment Opportunities

1. **Describe the reasons encryption is needed to protect personal data**

Activity Guide Page 1: Students describe the data within a medical card that should be kept secret because it is too personal and brainstorm ways personal data could be used inappropriately if revealed.

2. **Apply a method of encryption to ensure the secure transmission of data**

Activity Guide, page 2: Students decrypt several medical records to reveal the conditions of their users. Use the answer key to check whether students have completed each decryption successfully.

## Objectives

Students will be able to:

- Apply a method of encryption to ensure the secure transmission of data.
- Describe the reasons encryption is needed to protect personal data

## Links

**Heads Up!** Please make a copy of any documents you plan to share with students.

For the teachers

- **Unit 5 Data & Society** - Slides

For the students

- **Medical Records** - Activity Guide
- **Secret Messages 2021** - Activity Guide

## Vocabulary

- **Decrypt** - to change information so that its hidden meaning is shown
- **Encrypt** - to change information so that its meaning is hidden

## CSTA K-12 Computer Science Standards (2017)

- **NI** - Networks & the Internet

## Agenda

**Warm Up (5 minutes)**

**Journal**

**Activity (35 minutes)**

**Wrap Up (5 minutes)**

**Journal**

## Teaching Guide

### Warm Up (5 minutes)

#### Journal

**Prompt:** A school keeps track of several pieces of information about each student, including:

- Their name
- Their age
- Their address
- A home phone number
- Any allergies they have
- Emergency contact information

What information in this list do you think is okay to be accessed by anyone who is interested? What about just your teachers? What about only you and your family?

**Discuss:** Have students write their responses individually in their journals, then share with a neighbor before finally having a full-class discussion.

#### Discussion Goal

**Goal:** Students should determine that not all information in this record should be made public, but that there are also times when this information could be useful to specific people. For example: maybe allergies or emergency contact shouldn't be available widely, but they could be useful for a teacher in case there's an issue. There is no definitive right-or-wrong answer to this - it's more important to let students explain their reasoning and hear different opinions that may cause them to consider new situations for how this information could be used.

#### Remarks

We've seen how to represent data using different binary systems, but we haven't talked about who has access to this data or how it could be used. In today's lesson, we'll look at situations where it could be important to protect our data and strategies we can use to keep data secret.

**Question of the Day:** How can we keep data secret and protect it from misuse?

## Activity (35 minutes)

**Distribute:** Medical Record Activity Guide. Read through the introduction of the activity guide together, introducing the new Medical Punchcard.

### *Medical Record Activity Guide*

**Display:** Show the example of the medical punchcard, emphasizing how to decode the last row of Medical History. Emphasize that each square corresponds to a specific question, and that white represents a “yes” answer and black represents a “no” answer.

#### 💡 Teaching Tip

The focus in this lesson is on the Medical History section of the card, which is why students are not asked to decode the Binary numbers or ASCII codes. However, if students still need a bit more practice with these skills, this can also be an opportunity to reinforce these skills by talking through the other rows of the medical card.

**Additional Practice:** Ask students to talk with a partner to decode two more examples of medical history displayed in the unit slides. Clicking the animation in the slide will reveal the answers when ready.

**Prompt:** What are situations where this information would be useful for someone when making a decision? What are situations where this information could be inappropriate for someone when making a decision?

**Discuss:** Have students write their thoughts in their activity guide first, then share with a partner, and then bring to a full-class discussion.

#### 💡 Teaching Tip

**Goal:** Students may discuss useful situations where doctors or nurses can use the medical information within the hospital. They may also mention that the information could be used in emergency situations outside of the hospital.

When brainstorming inappropriate situations, try to guide the conversation towards places where these decisions can be exclusionary or discriminatory. For example, when applying for a job, it is inappropriate for an employer to not hire you if you have asthma. Or, when trying out for a sports team, it is inappropriate to be rejected because you broke a bone several years ago but it's healed up now.

### 🎤 *Remarks*

Keeping track of personal or sensitive data is important for very specific uses, but it's also important to protect that data to make sure only the right people can view it. One way we can do that is by using a process called encryption.

**Vocabulary:** Display the following vocabulary terms:

- **Encrypt** - to change information so that its meaning is hidden
- **Decrypt** - to change information so that its hidden meaning is shown

**Display:** Have students turn to the second page of their activity guide. Read through the introduction together to define the algorithm and key

Students may be initially confused about the difference between encoding/decoding and encryption/decryption. The main thing for students to understand is that the intentions between the two are very different.

Encoding is used to change the form of data, not to hide its meaning from others. For example, ASCII is used to encode characters into binary, but the intention is that everyone can decode the information. The purpose is to make it easier to store and process information.

Encryption is used to ensure that only the intended recipient of the information can read it using a secret key that only they know. It is used for security and privacy.

**Display:** Model the encryption algorithm as a class and demonstrate how the first four boxes of the example have been done for students. Have students complete the next four boxes on their own, then click the animation in the slide to check the answer together.

**Do This:** Have students complete the other four examples, decrypting each row of medical history and using it to answer the questions below.

**Circulate:** Monitor student progress, checking to make sure students are correctly applying the algorithm to the first square before continuing to the others. Encourage students to check in with their partners and talk through any inconsistencies between their work.

**Extension:** For students who finish up early, distribute copies of the Secret Messages activity guide. Encourage students to create their own secret messages using ASCII, then trade them with another student and challenge them to decrypt it.

## Wrap Up (5 minutes)

### Journal

**Prompt:** What is another piece of personal information you think should be protected? How could it be used inappropriately when making a decision if it ever became public?

**Discuss:** Have students reflect individually before sharing with a partner and as a class.

### Discussion Goal

**Goal:** Students may come up with a variety of ideas beyond medical or personal information, such as personal profile pictures, family income information, or ancestral or historical information. Encourage them to reflect on situations where it would be inappropriate for that information to be used to make a decision.