

# Lesson 8: Create a Representation

## Overview

**Question of the Day: How can I represent complex information using binary systems?**

In this lesson students design a structure to represent their perfect day using the binary representation systems they've learned in this chapter. Students will first write a short description of their perfect day and then review with a partner to identify the key pieces of information they think a computer could capture. As a class students will decide how a punch card of bytes of information will be interpreted to represent those pieces of information. Students will then use the ASCII, binary number, and image formats they have learned to represent their perfect days. Students then trade punch cards and try to decode what the other student's perfect day is like. The lesson ends with a reflection.

## Purpose

This lesson forces students to grapple with some of the challenges of representing information to a computer. Computers are good at representing some kinds of information like numbers or characters, but this forces people to represent information in ways that might not always capture the full analog experience of an object or event. The project also serves as a cumulative project for the chapter, bringing together the different representation systems students have learned. As students move into the next chapter they'll look more closely at how information is used to make decisions once it's in a format that can be input to a computer.

## Assessment Opportunities

Use the project rubric attached to this lesson to assess student mastery of learning goals of this chapter.

## Standards

Full Course Alignment

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

- ▶ **AP** - Algorithms & Programming
- ▶ **DA** - Data & Analysis

## Agenda

## Objectives

Students will be able to:

- Choose and justify the use of different binary representation systems depending on the information being represented
- Create a generalized representation system for many instances of a complex type of information
- Encode and decode information represented in binary numbers and ASCII text

## 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

- **Computer Science Practices** - Reflection
- **Create a Representation**
- **Create a Representation** - Rubric
- **Create a Representation** - Student Checklist

Warm Up (5 minutes)

Journal

Activity (35 minutes)

Wrap Up (5 minutes)

## Teaching Guide

### Warm Up (5 minutes)

#### Journal

**Prompt:** Throughout this unit, we've used binary systems to represent a wide variety of information from our world. Make a list of all the information we've represented in this unit so far.

**Discuss:** Have students write in their journals individually, then call on different students to share items from their list with the whole class. Keep track of the items they suggest in front of the room.

#### Discussion Goal

**Goal:** Students may remember that they've represented personal information like names, age, weight, etc using binary systems. They've also represented images using pixels, and represented text using ASCII. This brainstorm helps students review all of the tasks from this past unit, which they will need to rely on for today's project.

#### Remarks

This is a great list, and it shows that there are a lot of things in our lives that we can represent using the binary systems we've learned. Today, we're going to challenge ourselves and try to represent something more complex using just binary: we're going to try and represent a story about our perfect day using just a binary system.

**Question of the Day:** How can I represent complex information using binary systems?

### Activity (35 minutes)

**Group:** Have students sit in pairs so they can work collaboratively on this project.

**Prompt:** Close your eyes and think about your perfect day. What is the weather like? What will you do? Who's there with you? Spend a minute thinking about as many details as you can. You don't need to write down anything yet.

**Distribute:** Give students copies of the Project Guide

#### ***Project Guide - Create a Representation***

**Step 1 - Describe Your Perfect Day:** Have students write down all the key details of their perfect day on their activity guides. It is fine for students to mix between bullets and complete sentences.

**Step 2 - Share with a Partner:** Have students pick a neighbor to share their perfect day with. They should continue to update their information from Step 1 as they come up with more information about their perfect day.

**Step 3 - Identify Information:** Have students assign the information about their perfect day to one of three categories, Numbers, Characters, or Images.

#### 💡 Teaching Tip

**Choosing Representations:** The goal here is to break up the “perfect day” into individual items, which can then be represented individually with a binary system. You may wish to model how to assign different information to different categories or as a class assign information from a few volunteers’ perfect days.

**Step 4 - Review Information Choices:** Students should get back together with their partner and compare notes on how they assigned different pieces of information to different categories.

#### 🗣️ Remarks

Hopefully, you noticed both you and your partner had some common information when describing your perfect day. I wonder if there are more things we have in common as an entire class? Let’s see if we can find enough pieces of common information that we can use to create a class-wide punchcard for all of us to represent our perfect day

**Display:** Display the punch card from the project guide. Emphasize that the card has space for three numbers, an eight-character word, and an image. Explain that the class will need to agree on how they are going to use each row from the numbers, characters, and image sections of the punch card.

**Step 5 - Full Class Activity - Agree on Classwide Punch Card:** Have partners share the categories of information they wish to represent, recording them in the front of the room. Have the class decide what information they want to use for each number, their word, and their image.

#### 💬 Discussion Goal

**Possible Systems:** Here’s one possible system for the punch cards

- Number 1: Temperature that day
- Number 2: How many other people are there
- Number 3: How long you’re there in hours
- Characters 1-10: Name of activity or location
- Image: Image of the activity

**Facilitating the Discussion:** Students will likely want to create systems that work really well for their information but not a classmates. Emphasize that systems are only useful if they’re universal. A system that only works for one person isn’t very useful and all systems will involve some tradeoffs.

**Step 6 - Fill Out Punch Card:** Display the system somewhere all students can see it. Have students fill out their punch cards using this class system.

**Step 7 - Trade and Decode Punch Cards:** Students should find a new partner who is unfamiliar with their perfect day. They should trade punch cards and decode the information encoded their. There is space on the back of the activity guide to write

- The number information and its meaning
- The character information and its meaning
- What they believe the image is showing

Afterwards students should write what they believe happens in their classmate’s perfect day in the space provided

**Step 8 - Share and Reflect:** Partners should meet back up and compare their description of their classmate's perfect day to what they originally intended. what were they still able to capture? What was lost?

## Wrap Up (5 minutes)

**Collect:** Students' project guides and punch cards. Make sure to keep track of who students have partnered with so that you can grade both their encoding and decoding work.

**Code Studio:** Send students to Code Studio to complete their reflection on their attitudes toward computer science. Although their answers are anonymous, the aggregated data will be available to you once at least five students have completed the survey.



Reflection