



## Lesson Plan: Data Representation with Binary

**Topic Description:** In this lesson we will introduce the binary number system and how to count in binary. Students will learn how to convert between binary and decimal numbers.

### Objectives:

The student will be able to:

- Count forward and backward in binary.
- Explain why binary numbers are important in computer science.
- Use binary digits to encode and decode messages.

### Outline of the Lesson:

- Journal Entry (5 minutes)
- CS Unplugged Activity 1: Count the Dots—Binary Numbers (counting in binary) (50 minutes)
- CS Unplugged Activity 1: Count the Dots—Binary Numbers (binary number system) (50 minutes)
- Revisit journal entry (5 minutes)
- Journal Entry (5 minutes)
- Discussion of why binary numbers are important in computer science (15 minutes)
- CS Unplugged Activity 1: Count the Dots—Binary Numbers (Email and Modems, Counting Higher than 31) (35 minutes)

### Student Activities

- Complete journal entry.
- Participate in the Count the Dots activities.
- Revisit journal entry.
- Complete journal entry.
- Participate in a discussion of why binary numbers are important in computer science.
- Complete Count the Dots activities.

## Teaching/Learning Strategies:

Journal Entry: How high can you count with your ten fingers?

- How high can you count with 10 fingers? Why?

### CS Unplugged: Count the Dots

- Use the CS Unplugged: Count the Dots activity to introduce binary representation and counting in binary.
- Start with the introductory activity on p. 4 of the activity. It will be helpful to read through the entire activity in advance, so that you can revise questions, add your own questions, and think about how you might want to structure each part of the activity. The goal is for students to be actively involved in some way and for all students to be able to represent numbers and count in binary. What follows is the minimal suggestion.
- Have 5 students come to the front of the room and demonstrate as you follow the instructions and ask the questions. (Each student should receive a large card with one of the numbers of dots—1, 2, 4, 8, 16)

### CS Unplugged: Count the Dots Part 2

- Use the CS Unplugged: Count the Dots activity to explain the binary number system and have the students practice counting forward and backward.
- Complete the Binary Numbers activity on p. 5 and Working with Binary activity on p 7.
- Have 5 students come to the front of the room and try counting as you call out the numbers. (Each student should receive a large card with one of the numbers of dots—1, 2, 4, 8, 16) o Have different groups of 5 students at a time come to the front and have the other students provide counting and representation challenges. You could also have a competition with multiple teams of students each trying to get the answer. There are many other possibilities. Be creative!!

### Journal Entry

- Revisit Journal Entry.
- Journal Entry: Complete the Sending Secret Messages activity on p. 8 of the CS Unplugged: Count the Dots activity. (Solution is on p. 13.)

### Remaining Activities

- Discussion of why binary numbers are important in computer science
- Complete the remaining activities in CS Unplugged: Count the Dots. (Email and Modems—p. 9, Counting Higher than 31—p. 10, and/or More on Binary Numbers—p. 11)

## Resources:

- Bell, Tim, Ian Witten and Mike Fellows. Computer Science Unplugged. Canterbury, New Zealand: 2002.
- Computer Science Unplugged Activity 1: Count the Dots—Binary Numbers, pp. 3-13

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- Binary number cards for each student
- Large binary number cards for the demonstrations