

Lesson # Day 10-12: Counting in Binary

Overview

In this lesson, students will be introduced to the binary number system and how it is used to relay messages in a computer science setting. Students will learn how to calculate using binary numbers and convert data to/from binary to decimal numbers.

Lesson Summary

DAY ONE

- Step 1: The Introduction to Binary will include video introductions of the Binary Number System.
 - The Internet: Wires, Cable, Wifi (Video)
<https://youtu.be/ZhEf7e4kopM>
 - Introduction to Binary (Edit out some of the jokes)
<https://youtu.be/TD6lcllOeic>
- Step 2: Distribute the Binary Cards to Students
- Step 3: Watch Demonstration of calculating with binary cards
 - Counting in Binary: Demonstration
<https://youtu.be/b6vHZ95XDwU>
- Step 4: Binary Practice Formative Assessment Activities
 - Quizlet: Binary Practice:
<https://quizlet.com/363625/flashcards>

DAY TWO

- Step 5: The introduction to Day Two will include an activation video that shows binary numbers applied to the real world
 - Images, Pixels & RGB (Binary in InstaGram)
<https://youtu.be/15aqFQQVBWU>
- Step 6: Practice creating images using binary numbers
 - Bitmap Image Creation:
<http://cse4k12.org/binary/bitmaps.html>
(Students can omit the hexadecimal column)
- Step 7: For fun and further practice, students can choose one of 3 practice worksheets to practice binary counting

CS Content

At the completion of this lesson, students will have practiced calculating and converting numbers from the binary to the decimal system. Through videos that make a real world connection, students will understand how the binary number system relates to computer science.

Objectives

Students will be able to:

- Understand why binary is necessary in computer science
- Calculate using binary numbers
- Convert to/from binary to decimal numbers

Materials and Prep

- Binary Card Sets
- Worksheet handouts
http://csunplugged.org/wp-content/uploads/2014/12/unplugged-01-binary_numbers.pdf

Resources

Student Documents

- Bitmap Image Creation:
<http://cse4k12.org/binary/bitmaps.html>
- Binary Card Practice:
http://csunplugged.org/wp-content/uploads/2014/12/unplugged-01-binary_numbers.pdf

Code Studio

- The Internet: Wires, Cable, Wifi (Video)
<https://youtu.be/ZhEf7e4kopM>
- Images, Pixels & RGB (Binary in InstaGram)
<https://youtu.be/15aqFQQVBWU>

Video

- Introduction to Binary (Edit out some of the jokes)
<https://youtu.be/TD6lcllOeic>
- Counting in Binary: Demonstration
<https://youtu.be/b6vHZ95XDwU>

Assessments

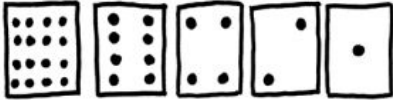
- Quizlet: Binary Practice:
<https://quizlet.com/363625/flashcar>

Binary Numbers

Introduction

Before giving out the worksheet on page 5, it can be helpful to demonstrate the principles to the whole group.

For this activity, you will need a set of five cards, as shown below, with dots on one side and nothing on the other. Choose five children to hold the demonstration cards at the front of the class. The cards should be in the following order:



Discussion

What do you notice about the number of dots on the cards? (Each card has twice as many as the card to its right.)

How many dots would the next card have if we carried on to the left? (32) The next...?

We can use these cards to make numbers by turning some of them face down and adding up the dots that are showing. Ask the children to make 6 (4-dot and 2-dot cards), then 15 (8-, 4-, 2- and 1-dot cards), then 21 (16, 4 and 1)...

Now try counting from zero onwards.

Name _____ Date _____

Bitmaps

PART 1 Create your own 8x8 bitmaps on the grids below. Then convert your bitmap into binary as shown in the example - using a "0" to represent a white pixel and a "1" to represent a black pixel. Finally, convert the binary number into hexadecimal.

	Binary	Hex
	00000000	00
	00011100	1c
	00100010	22
	01000001	41
	01001001	49
	01000001	41
	00100010	22
	00011100	1c

	Binary	Hex
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

	Binary	Hex
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

	Binary	Hex
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

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Notes
