Lesson 12: Arrays and For Loops

Overview

Using a *for loop* to iterate over all of the elements in an array is a really useful construct in most programming languages. In this lesson, students learn the basics of how a *for loop* can be used to repeat code, and then combine it with what they've already learned about arrays to write programs that process all elements in an array. Students use for loops to go through each element in a list one at a time without having to write code for each element. Towards the end of the lesson students will apply this with the `colorLed` list on the board to create an app that changes all of the LEDs each time a button is clicked.

Purpose

As students start using arrays more frequently, a common pattern emerges wherein you want to run some code on each element of an array. While *for loops* are a generally useful structure for repeating code, they are a particularly useful for iterating over an array. In this lesson we build on the understanding of arrays that students have developed in the last two lessons by introducing the *for loop*, which combines a variable, the counter pattern, and a conditional all in a single construct.

Assessment Opportunities

1. **Modify the exit condition of a for loop to control how many times it repeats**

   Code Studio: see rubric on bubble 12

2. **Use a for loop to iterate over an array**

   Code Studio: see rubric on bubble 12

Standards

Full Course Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **AP** - Algorithms & Programming
- ▶ **CS** - Computing Systems

Agenda

Objectives

Students will be able to:

- Modify the exit condition of a for loop to control how many times it repeats
- Use a for loop to iterate over an array

Links

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

For the teachers

- **CSD Unit 6 - Physical Computing** - Slides
- **For Loops** - Resource
- **Modifying Arrays** - Resource

For the students

- **For Loops** - Video (**Download**)

Vocabulary

- **Array** - A data structure in JavaScript used to represent a list.
- **For Loop** - Loops that have a predetermined beginning, end, and increment (step interval).

Introduced Code

- `for (var i = 0; i < 4; i++) { __; }`
- `function myFunction(n) { __; }`
- `myFunction(n)`

Teaching Guide

Warm Up (5 minutes)

Run Code on All Elements of an Array

Discuss: If you had a list full of all of your ToDos and you wanted the computer to print out each one, how might you do it? Don't worry about the specific code, focus on the what information your program would need to know and keep track of. Would your approach still work if you added or removed a ToDo from your list?

Discussion Goal

You shouldn't expect students to know how *exactly* a computer would do this, but to start thinking about what is needed to keep track of where you are in an array (the index), how you would know you've reached the end of the array (the array length), and how you might incrementally increase where you are in the list (the counter pattern).

Remarks

Doing something to every element of an array is a really common problem in Computer Science, and figuring out how to solve this problem will let us write more efficient programs. Today we're going to focus on three things to help us with this problem

1. Using the index to do something to elements in an array
2. Keeping track of a counter so we can move through the elements of an array by index
3. Using the length of an array to know when we've reached the end

Activity (35 minutes)

Arrays and For Loops

Transition: Send students to Code Studio

1-2 **Programs that Repeat**

1 2

Questions to Consider with Video:

- What are loops used for in programming?
- Where do loops go in your code?

3 **Video: For Loops**

Discussion Goal

Discussion Questions

For-loops are a very powerful construct, but this introduction intentionally only covers a small part of their functionality. As students are more comfortable with loops, more functionality will be introduced. For now, students should know that they can use a for loop to repeat a segment of code multiple times. The segment should go wherever in the program that code will be run. (This aspect of loops is highlighted to keep students from treating loops like functions and placing them at the bottom of the code.)

4-8 **For Loops**

4 5 6 7 8

9-12 **For Loops and Color LEDs**

9 10 11 12

Assessment Opportunity

Level 12: You can use this level as a formative assessment for students. Click inside the level to view a rubric and leave feedback to your students

Wrap Up (5 minutes)

Journal

Prompt: Have students reflect on their development of the **five practices of CS Discoveries** (Problem Solving, Persistence, Creativity, Collaboration, Communication). Choose one of the following prompts as you deem appropriate.

- Choose one of the five practices in which you believe you demonstrated growth in this lesson. Write something you did that exemplified this practice.
- Choose one practice you think you can continue to grow in. What's one thing you'd like to do better?
- Choose one practice you thought was especially important for the activity we completed today. What made it so important?