

Lesson 4: Manipulating Elements

45 minutes

Overview

How am I able to work with the data stored in an `ArrayList`?

Students work with the `get()` and `set()` methods to retrieve and modify elements in an `ArrayList` and learn about the `String` method `length()` to return the number of characters in a `String` object. They apply the standard algorithms they developed with 1D and 2D arrays to obtain and modify elements in an `ArrayList`.

Standards

Full Course Alignment

CSA Conceptual Framework

- **CON-2** - Programmers incorporate iteration and selection into code as a way of providing instructions for the computer to process each of the many possible input values
- **VAR-1** - To find specific solutions to generalizable problems, programmers include variables in their code so that the same algorithm runs using different input values
- **VAR-2** - To manage large amounts of data or complex relationships in data, programmers write code that groups the data together into a single data structure without creating individual variables for each value.

Agenda

Warm Up (10 minutes)

CS Bingo

Activity (30 minutes)

Getting Values

Working with Strings

Wrap Up (5 minutes)

Glows, Grows, Want-to-Knows

Assessment: Check for Understanding

AP Classroom Topic Questions

Objectives

Students will be able to:

- Apply standard algorithms used with 1D arrays to an `ArrayList`
- Use methods in the `ArrayList` class to retrieve and set values
- Use methods in the `String` class to obtain the length of a `String`

Preparation

- Check the **Teacher's Lounge** for verified teachers on the CSA Forum to find additional strategies or resources shared by fellow teachers

Links

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

For the students

- **CS Bingo Cards** - Handout
- **U6L4 Extra Practice** - Handout

Teaching Guide


Warm Up (10 minutes)


CS Bingo

Remarks

We have learned a lot of new terms so far! Let's review some of these terms through a game of CS Bingo.

 **Distribute:** Give each student a unique CS Bingo Card.

 **Do This:** Review the instructions for playing CS Bingo.

 **Do This:** Play the music clip to cue the CS Bingo activity. Choose a random definition and read it aloud to the class. Give students a moment to check their bingo card for the correct term, then state the correct term. Repeat until a student yells "Java."

Teaching Tip


To allow for multiple students to "win" the game, continue pulling definitions until a couple more students win as well.


Activity (30 minutes)

Getting Values (15 minutes)

Remarks

An `ArrayList` has methods that can change the state of an `ArrayList`. Today, you will explore other useful methods for working with the data stored in an `ArrayList`.


 **Do This:** Review the lesson objectives.

 **Discuss:** Click through the animated slide to display the prompts. Use the Hold That Thought strategy to discuss the prompts.

- *How do we get an individual element from an array?*
- *How can we do this with an `ArrayList` based on what we know about its structure?*

Discussion Goal: Students recall accessing the array element by referring to the index number. Students guess that the `ArrayList` class has methods they can use to access an element.

Group: Place students in pairs.

 **Do This:** Direct students to Level 1 on Code Studio to investigate the program with a partner. Students make the changes to the program as prompted.

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Investigate: Working with ArrayList Data

 **Discuss:** Click through the animated slide to display the prompts.

- What do you notice about the code in this program?
- What do you wonder about the code in this program?

Discussion Goal: Students notice that the `get()` method retrieves items from the `ArrayList` and the `set()` method sets the value at a specific index to a specified value. Students also notice that both methods are similar to indexing arrays because they retrieve a value or assign a new value at a specified index. Students may wonder if there is a method to change an element to a new value or how they might use these methods inside of a loop to obtain or change multiple elements.

Display: Show the video – *Working with ArrayList Data*.

Do This: Click through the animated slide to demonstrate the `get()` and `set()` methods.

Teaching Tip

Step through each line of code with students and discuss the updates to the `ArrayList` after each command.

If students are struggling to understand the methods, explain that `ArrayList`s use `get()` and `set()` methods instead of using the square brackets `array[index]` that arrays use because `ArrayList` is a class with methods that provide access to its array instance variable.

Remarks

We can traverse an `ArrayList` similar to how we traverse a 1D array. We can use either a `for` or a `while` loop and use the loop control variable to refer to the index of a value in the list. Let's take a look at how a `for` loop can be used to access each element in an `ArrayList`.

Do This: Click through the animated slide to demonstrate traversing an `ArrayList` and review the `ArrayIndexOutOfBoundsException`.

Working with Strings (15 minutes)

Remarks

What if we wanted to find words in a list that met certain criteria, like words with a certain number of characters? Since a `String` is an object, the `String` class has a method to help us solve this problem!

Do This: Click through the animated slide to demonstrate the `length()` method.

Discuss: Click through the animated slide to display the prompts.

- How many characters will `teamList1.length()` return?
- How many characters will `teamList3.length()` return?
- Why does the `length()` method not return the last index in the `String`?

Discussion Goal: Students note the code segments return 7 for `teamList1` and 17 for `teamList3`. Students recall that the last index of an array is one less than its size, so the value for `length()` is one more than the last index.

Do This: Direct students to Level 2 on Code Studio to complete Levels 2 and 3. Students complete a choice level to obtain the length of a `String` on Level 2, then continue to Level 3 to complete a choice level to apply standard algorithms to obtain and modify elements in an `ArrayList`.



Wrap Up (5 minutes)

Glows, Grows, Want-to-Knows

Remarks

You have used your software engineering skills to work with `ArrayList`s and solve a variety of problems.

 **Discuss:** Click through the animated slide to display the prompts.

- *What was awesome about writing your code?*
- *What is one action you can take to improve your code?*
- *What questions do you have about today?*

Discussion Goal: Students share aspects of their program they enjoyed or strengths of writing algorithms and identify areas of improvement to strengthen their programming skills. Students also share any questions or misconceptions they may have.

 **Do This:** Review the concepts covered in this lesson.

Assessment: Check for Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.

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Check for Understanding

AP Classroom Topic Questions

To assign questions from the AP Classroom Question Bank that align with this lesson, create a custom quiz in AP Classroom by searching the Question Bank for the Essential Knowledge statements listed at the top of this lesson plan. You can find instructions and video demonstrations to do this on **AP Central**.



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