

Lesson 5: Lists of Objects

45 minutes

Overview

Why does an `ArrayList` only store objects?

Students explore generic types in Java and learn why an `ArrayList` can only store objects. Students then practice applying the algorithms they learned with 1D and 2D arrays to `ArrayList`s to find information and perform calculations with `ArrayList` data.

Standards

Full Course Alignment

CSA Conceptual Framework

- **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 (5 minutes)

ArrayList Syntax

Activity (30 minutes)

Arrays of Objects to ArrayLists
ArrayLists and Algorithms

Wrap Up (10 minutes)

Closing the Loop
Assessment: Check for Understanding
AP Classroom Topic Questions

Objectives

Students will be able to:

- Explain the functionality of generic types in Java
- Implement standard algorithms to find information and perform calculations with `ArrayList` data

Preparation

- Create code review groups if you are not reusing the same groups
- 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

- **U6L5 Extra Practice** - Handout

Vocabulary

- **Generic Type** - Allows a class, or type, to be used as the parameter to an `ArrayList` and is indicated by `< >`


Teaching Guide

Warm Up (5 minutes)

ArrayList Syntax

Remarks

We have worked with 1D and 2D arrays in previous units and have been learning about `ArrayList`s over the last few lessons. While an `ArrayList` allows us to store a list of data similar to a 1D array, it has additional capabilities that make it more flexible than a 1D array. It also uses a different syntax than a 1D array.

 **Discuss:** Click through the animated slide to display the prompts. Use the Retrieve-Pair-Share strategy to discuss the prompts.

- *What is unique about the syntax of an `ArrayList`?*
- *What do you think is the purpose of the angle brackets `< >`?*


Discussion Goal: Students note that the angle brackets `< >` are unique to `ArrayList`s. Students recall that the type of data the `ArrayList` can store is specified inside the angle brackets and guess that the purpose of the angle brackets is to specify the reference type.

Activity (30 minutes)


Arrays of Objects to ArrayLists (15 minutes)

Remarks

There is a reason why an `ArrayList` uses this syntax. We have learned that an `ArrayList` can only store objects, like `Integer`, `Double`, `String`, and any other object we choose.

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

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.

 1


Investigate: ArrayList of Objects

 **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 an `ArrayList` can store objects like a 1D and 2D array. Students also notice that an `ArrayList` can be declared and initialized without the `< >` but doing so allows the `ArrayList` to store objects of different and unrelated types. Students may wonder why the `< >` are used instead of the `[]` and why omitting the `< >` allows the `ArrayList` to store different and unrelated objects.


 **Display:** Show the video - *Generic Types*.

 **Do This:** Click through the animated slide to define generic type and explain the functionality of `ArrayList<E>`.

ArrayLists and Algorithms (15 minutes)

Remarks

We have developed and reused standard algorithms to work with 1D and 2D arrays to solve different types of problems. Let's combine our knowledge of standard algorithms with what we've learned about `ArrayList`s.

 **Do This:** Direct students to Level 2 on Code Studio to complete Levels 2 and 3. On Level 2, students translate the given code with a 1D array to an `ArrayList`. On Level 3, students complete a choice level to apply standard algorithms to an `ArrayList`.




2-3

ArrayList Algorithms

2

3

 **Do This:** Click through the animated slide to have students participate in the Code Review Call and Response.

 **Do This:** Direct students to complete a code review on Level 4.

 4

Code Review: ArrayList Algorithms

Wrap Up (10 minutes)

Closing the Loop

Remarks

We have learned a lot about `ArrayList`s and applying standard array algorithms to `ArrayList`s. Let's recap some of the key concepts we have learned.

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

- *When is it best to use an `ArrayList` instead of a 1D array?*
- *How is applying standard algorithms to an `ArrayList` similar to a 1D array? How is it different?*
- *What were you confident about in this lesson? What would you like to practice?*

Discussion Goal: Students share scenarios where an `ArrayList` is best, such as when the size of the list is unknown and may change. Students identify similarities and differences between applying standard algorithms to an `ArrayList` and a 1D array, such as using the same steps but different syntax. Students share concepts they are confident about and that they need more practice.

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

 **Display:** Key Vocabulary

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.



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**.

The following Topic Questions in AP Classroom can be assigned as a formative assessment for this lesson:

- Topic Questions 7.1

Note: *Some Learning Objectives and Essential Knowledge statements in the suggested Topic Questions are covered in later units.*



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