SUGGESTED SKILLS

1.B

Determine code that would be used to complete code segments.

3.D

Write program code to create, traverse, and manipulate elements in 1D array or `ArrayList` objects.

AVAILABLE RESOURCES

- Java Quick Reference (see Appendix)
- **Runestone Academy: AP CSA—Java Review: 9.7—The ArrayList Class**
- **Practice-It!: BJP4 Chapter 10: ArrayLists—Self-Check 10.2**

TOPIC 7.1
Introduction to `ArrayList`

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

VAR-2.D

Represent collections of related object reference data using `ArrayList` objects.

ESSENTIAL KNOWLEDGE

VAR-2.D.1

An `ArrayList` object is mutable and contains object references.

VAR-2.D.2

The `ArrayList` constructor `ArrayList()` constructs an empty list.

VAR-2.D.3

Java allows the generic type `ArrayList<E>`, where the generic type `E` specifies the type of the elements.

VAR-2.D.4

When `ArrayList<E>` is specified, the types of the reference parameters and return type when using the methods are type `E`.

VAR-2.D.5

`ArrayList<E>` is preferred over `ArrayList` because it allows the compiler to find errors that would otherwise be found at run-time.

TOPIC 7.2
ArrayList Methods

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

VAR-2.D

Represent collections of related object reference data using `ArrayList` objects.

ESSENTIAL KNOWLEDGE

VAR-2.D.6

The `ArrayList` class is part of the `java.util` package. An import statement can be used to make this class available for use in the program.

VAR-2.D.7

The following `ArrayList` methods—including what they do and when they are used—are part of the Java Quick Reference:

- `int size()` – Returns the number of elements in the list
- `boolean add(E obj)` – Appends `obj` to end of list; returns `true`
- `void add(int index, E obj)` – Inserts `obj` at position `index` (`0 <= index <= size`), moving elements at position `index` and higher to the right (adds 1 to their indices) and adds 1 to size
- `E get(int index)` – Returns the element at position `index` in the list
- `E set(int index, E obj)` — Replaces the element at position `index` with `obj`; returns the element formerly at position `index`

continued on next page

SUGGESTED SKILLS

2.C

Determine the result or output based on the statement execution order in a code segment containing method calls.

3.D

Write program code to create, traverse, and manipulate elements in 1D array or `ArrayList` objects.

AVAILABLE RESOURCES

- Java Quick Reference (see Appendix)
- **Practice-It!: BJP4 Chapter 10: ArrayLists—Exercises 10.2–10.17**
- The Exam > **2017 AP Computer Science A Exam Free-Response Question #1, Part A (Digits)**

ArrayList

LEARNING OBJECTIVE

VAR-2.D

Represent collections of related object reference data using `ArrayList` objects.

ESSENTIAL KNOWLEDGE

- `E remove(int index)`—Removes element from position `index`, moving elements at position `index + 1` and higher to the left (subtracts 1 from their indices) and subtracts 1 from size; returns the element formerly at position `index`

TOPIC 7.3
Traversing ArrayLists

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

VAR-2.E

For `ArrayList` objects:

a. Traverse using a `for` or `while` loop

b. Traverse using an enhanced `for` loop

ESSENTIAL KNOWLEDGE

VAR-2.E.1

Iteration statements can be used to access all the elements in an `ArrayList`. This is called traversing the `ArrayList`.

VAR-2.E.2

Deleting elements during a traversal of an `ArrayList` requires using special techniques to avoid skipping elements.

VAR-2.E.3

Since the indices for an `ArrayList` start at 0 and end at the number of elements − 1, accessing an index value outside of this range will result in an `IndexOutOfBoundsException` being thrown.

VAR-2.E.4

Changing the size of an `ArrayList` while traversing it using an enhanced `for` loop can result in a `ConcurrentModificationException` being thrown. Therefore, when using an enhanced `for` loop to traverse an `ArrayList`, you should not add or remove elements.

SUGGESTED SKILLS

2.C

Determine the result or output based on the statement execution order in a code segment containing method calls.

3.D

Write program code to create, traverse, and manipulate elements in 1D array or `ArrayList` objects.

AVAILABLE RESOURCES

- Runestone Academy: AP CSA—Java Review: 9.14—Looping through a List
- Practice-It!: BJP4 Chapter 10: ArrayLists—Exercises 10.2–10.17
- The Exam > 2018 AP Computer Science A Exam Free-Response Question #2 (WordPair)

SUGGESTED SKILLS

3.D

Write program code to create, traverse, and manipulate elements in 1D array or `ArrayList` objects.

4.A

Use test-cases to find errors or validate results.

AVAILABLE LAB

- Classroom Resources > AP Computer Science A: Data Lab

AVAILABLE RESOURCES

- Runestone Academy: AP CSA—Java Review: 9.13—Removing an Object at an Index
- Practice-It!: BJP4 Chapter 10: ArrayLists—Exercises 10.2–10.17
- The Exam >
  - 2017 AP Computer Science A Exam Free-Response Question 1, Part B (Digits)
  - Past AP Free-Response Exam Questions on Array/`ArrayList` on AP Question Bank

TOPIC 7.4
Developing Algorithms Using ArrayLists

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

CON-2.J

For algorithms in the context of a particular specification that requires the use of `ArrayList` traversals:

a. Identify standard algorithms.

b. Modify standard algorithms.

c. Develop an algorithm.

ESSENTIAL KNOWLEDGE

CON-2.J.1

There are standard `ArrayList` algorithms that utilize traversals to:

- Insert elements
- Delete elements
- Apply the same standard algorithms that are used with 1D arrays

CON-2.J.2

Some algorithms require multiple `String`, array, or `ArrayList` objects to be traversed simultaneously.

TOPIC 7.5
Searching

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

CON-2.K

Apply sequential/linear search algorithms to search for specific information in array or `ArrayList` objects.

ESSENTIAL KNOWLEDGE

CON-2.K.1

There are standard algorithms for searching.

CON-2.K.2

Sequential/linear search algorithms check each element in order until the desired value is found or all elements in the array or `ArrayList` have been checked.

SUGGESTED SKILLS

3.D

Write program code to create, traverse, and manipulate elements in 1D array or ArrayList objects.

5.C

Explain how the result of program code changes, given a change to the initial code.

AVAILABLE RESOURCES

- Practice-It!: BJP4 Chapter 10: ArrayLists—Exercises 10.2–10.17
- Runestone Academy: AP CSA—Java Review: 13—Searching and Sorting
- Practice-It!: BJP4 Chapter 13: Searching and Sorting

SUGGESTED SKILL

2.D

Determine the number of times a code segment will execute.

TOPIC 7.6
Sorting

AVAILABLE LAB

- Classroom Resources > AP Computer Science A: Data Lab

AVAILABLE RESOURCES

- Runestone Academy: AP CSA—Java Review: 13—Searching and Sorting
- Practice-It!: BJP4 Chapter 13: Searching and Sorting—Self-Check 13.29 and 13.30
- Visualgo.net: Sorting
- Sorting.at

Required Course Content

ENDURING UNDERSTANDING

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.

LEARNING OBJECTIVE

CON-2.L

Apply selection sort and insertion sort algorithms to sort the elements of array or `ArrayList` objects.

CON-2.M

Compute statement execution counts and informal run-time comparison of sorting algorithms.

ESSENTIAL KNOWLEDGE

CON-2.L.1

Selection sort and insertion sort are iterative sorting algorithms that can be used to sort elements in an array or `ArrayList`.

CON-2.M.1

Informal run-time comparisons of program code segments can be made using statement execution counts.

TOPIC 7.7
Ethical Issues Around Data Collection

Required Course Content

ENDURING UNDERSTANDING

IOC-1

While programs are typically designed to achieve a specific purpose, they may have unintended consequences.

LEARNING OBJECTIVE

IOC-1.B

Explain the risks to privacy from collecting and storing personal data on computer systems.

ESSENTIAL KNOWLEDGE

IOC-1.B.1

When using the computer, personal privacy is at risk. Programmers should attempt to safeguard personal privacy.

IOC-1.B.2

Computer use and the creation of programs have an impact on personal security. These impacts can be beneficial and/or harmful.

AVAILABLE RESOURCES

- Classroom Resources >
  - Ethical Use of the Computer
  - Ethical Issues: Internet Content Providers and Internet Service Providers