Unit 7: ArrayList

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

UNIT RATIONALE

As students learned in Unit 6, data structures are helpful when storing multiple related data values. Arrays have a static size, which causes limitations related to the number of elements stored, and it can be challenging to reorder elements stored in arrays. The ArrayList object has a dynamic size, and the class contains methods for insertion and deletion of elements, making reordering and shifting items easier. Deciding which data structure to select becomes increasingly important as the size of the data set grows, such as when using a large real-world data set. In this unit, students will also learn about privacy concerns related to storing large amounts of personal data and about what can happen if such information is compromised.

ESSENTIAL QUESTIONS

Why is an ArrayList more appropriate for storing your music playlist, while an array might be more appropriate for storing your class schedule?

How can we use statement execution counts to choose appropriate algorithms?

What personal data is currently being collected, and how?

STANDARDS

NEW JERSEY STUDENT LEARNING STANDARDS: CONTENT AREA

New Jersey (NJSLS) - Grades 9-12 - Computer Science and Design Thinking (2020)

8.1.12.AP.1:
Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.2:
Create generalized computational solutions using collections instead of repeatedly using simple variables.
8.1.12.AP.3:
Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
8.1.12.AP.4:
Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

8.1.12.AP.5:
Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6:
Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

CS.9-12.8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
CS.9-12.8.1.12.AP.2	Create generalized computational solutions using collections instead of repeatedly using simple variables.
CS.9-12.8.1.12.AP.3	Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
CS.9-12.8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.AP.6	Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

NEW JERSEY STUDENT LEARNING STANDARDS: CAREER READINESS, LIFE LITERACIES AND KEY SKILLS

TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

NEW JERSEY STUDENT LEARNING STANDARDS: COMPUTER SCIENCE AND DESIGN THINKING

See content area standards.

PRE-ASSESSMENTS

Discussion Questions:

- What are some limitations of using arrays in regarding to its elements?
- `Given int[] setSize = {1, 2, 3, 4, 5}; explain what would need to be done in order to add a sixth element.`
- Consider the following code segment:

```
int[] setSize = {1, 2, 3, 4, 5};
int[] newSize = new int[6];
for(int i = 0; i < setSize.length; i++)
```

```
{
        // missing command
}
```

What command is needed where it says // missing command?

INSTRUCTIONAL PLAN

MODULE 7

LESSON 7.5

Lesson 7.5: Searching

In this lesson, students will explore and analyze a linear search. Linear Search is an algorithm that searches data sets in a sequential order, checking each value from the 0th index to the end of the data set to see what index a specific element can be located at. This lesson corresponds with AP Computer Science A topic 7.5.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Apply linear search algorithms to search for specific information in array or ArrayList objects
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding

	AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. Thi quiz is a quick check for understanding. • Have students compare their sample pseudocode from before the video to the one demonstrated in the video - was i similar? • Explore the Linear Search example. • Remind students that Arrays and ArrayLists differ in their syntax. • Complete the Linear Search on ArrayList with While Loop exercise. • Complete the Fantasy Football Roster exercise. • Complete the Card Collection FRQ handout.
Suggested Modifications	See Lesson 7.1 above.

LESSON 7.4

Lesson 7.4: Developing Algorithms using ArrayLists

In this lesson, students will develop algorithms using ArrayLists. They will examine standard algorithms for removing and inserting elements while traversing an ArrayList. This lesson corresponds with AP Computer Science A topic 7.4.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Identify standard ArrayLists algorithms such as inserting and deleting elements • Modify standard ArrayLists algorithms • Develop an ArrayLists algorithm
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities

	AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. Thi quiz is a quick check for understanding. • Explore the Traversing ArrayLists Simultaneously example. • Explore the Inserting Elements While Traversing ArrayLists example. • Complete the ArrayList equals exercise. • Complete the Airline Tickets exercise. • Complete the Billboard Top 10 exercise. • Complete the User Data Cleanup exercise.
Suggested Modifications	See Lesson 7.1 above.

LESSON 7.3

Lesson 7.3: Traversing ArrayList

In this lesson, students will learn how to traverse ArrayLists. For ArrayLists, instead of using .length and brackets ([]) to access the elements in a list, size() and get() will be used. This lesson corresponds with AP Computer Science A topic 7.3.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Traverse ArraysLists using a for or while loop • Access elements in an ArrayList using iteration statements • Remove elements in an ArrayList
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities

	AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. Thi quiz is a quick check for understanding. • Explore the Reading List example. • Explore the While Loop ArrayList Transversal example. Explore the ArrayList Traversing Error example. • Complete the Traversing Odds exercise. • Complete the ArrayList Helper Methods exercise. • Complete the Road Trip! exercise.
Suggested Modifications	See Lesson 7.1 above.

LESSON 7.2

Lesson 7.2: ArrayList Methods

In this lesson, students will learn and use methods that allow the state of ArrayLists to be altered. These methods are as follows:

- boolean add(E obj)
- void add(int index, E obj)
- E get(int index)
- int size()
- E set(int index, E obj)
- E remove(int index)

This lesson corresponds with AP Computer Science A topic 7.2.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Use methods associated with ArrayLists
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare

	Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. Thi quiz is a quick check for understanding. • Explore the ArrayList and Java Primitives example. • Explore the ArrayList Methods example. • Explore the Array vs. ArrayList Methods example. • Complete the Get First Element exercise. • Complete the ArrayList of Even Numbers exercise. • Complete the Teacher Class List exercise. • Complete the Teacher Class List Methods exercise.
Suggested Modifications	See Lesson 7.1 above.

LESSON 7.1

Lesson 7.1: ArrayList

In this lesson, students will learn about and use ArrayLists. ArrayLists are similar to arrays, except that they are a mutable list of object references. ArrayLists provide a convenient way to create adjustable arrays. This lesson corresponds with AP Computer Science A topic 7.1.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Represent collections of related object reference data using ArrayList objects
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming

	Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. This quiz is a quick check for understanding. • Explore the Initializing an ArrayList example. • Explore the Array vs. ArrayList Initialization example. • Complete the Arrays vs. ArrayLists free response activity. • Complete the Initializing an ArrayList exercise. • Complete the Car Inventory exercise.
Suggested Modifications	**English Language Learners** **Adjusted Speech**: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly. **Visuals**: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand. **Front-Loading Vocabulary**: The teacher front loads vocabulary This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students. **Students with Individualized Education Plans/504s** **Chunking**: The teacher presents information in a way that make it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is a effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "Hov can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Breal tests down in smaller increments by having a portion of the test i the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

LESSON 7.6

Lesson 7.6: Sorting

In this lesson, students will students will explore and analyze Selection Sort and Insertion Sort. Selection Sort swaps the minimum

value left in an array with the current array index. Insertion Sort shifts the already sorted section of an array to place the current array value in the correct index. This lesson corresponds with AP Computer Science A topic 7.6.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Apply selection sort and insertion sort algorithms to sort the elements of array or ArrayList objects • Compute statement execution counts and informal run-time comparison of sorting algorithms
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the first lesson video and take the corresponding quiz This quiz is a quick check for understanding. • Explore the Selection Sort example. • Watch the second lesson video and take the corresponding quiz. This quiz is a quick check for understanding. • Explore the Insertion Sort example. • Explore the Visualizing Algorithms example. • Complete the Explore Insertion Sort exercise. • Complete the Selection Sort vs. Insertion Sort Run Time exercise. • Complete the Selection Sort vs. Insertion Sort free response activity. • Complete the Phonebook exercise. ▪ This is a culminating activity that can be used as an individual or small group project/lab. • Complete the Sorting handout.

Suggested Modifications	See Lesson 7.1 above.

LESSON 7.7

Lesson 7.7: Ethical Issues Around Data Collection

In this lesson, students will discuss the ethical issues around how and why data is collected. They will look at the risks to personal privacy when working on computer systems and the internet and discuss how computer programs can have beneficial and/or harmful impacts on personal security. Lastly, the importance that programmers have in terms of safeguarding personal privacy will be considered and emphasized. This lesson corresponds with AP Computer Science A topic 7.7.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Explain the risks to privacy from collecting and storing personal data on computer systems • Explain the role that programmers have considering safeguarding personal privacy • Explain the beneficial and harmful impacts that computer use and the creation of programs have on personal security
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. This quiz is a quick check for understanding. • Explore The Curly Fry Conundrum connection. • Complete the Reflection free response activity. • Explore the Guidelines on Ethical Data Use connection.

	• Complete the Issue News Article free response activity.
Suggested Modifications	See Lesson 7.1 above.

INTERDISCIPLINARY CONNECTIONS: NEW JERSEY STUDENT LEARNING STANDARDS FOR ELA, SOCIAL STUDIES, SCIENCE AND/OR MATHEMATICS

CCSS - English-Language Arts

Key Ideas and Details:

CCSS.ELA-LITERACY.RL.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

Integration of Knowledge and Ideas:

CCSS.ELA-LITERACY.W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Production and Distribution of Writing:

CCSS.ELA-LITERACY.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge:

CCSS.ELA-LITERACY.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Range of Writing:

CCSS.ELA-LITERACY.W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

CCSS - Mathematics

Reason quantitatively and use units to solve problems:

CCSS.MATH.CONTENT.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Create equations that describe numbers or relationships:

CCSS.MATH.CONTENT.HSA-CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

Analyze functions using different representations:

CCSS.MATH.CONTENT.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph.

Apply geometric concepts in modeling situations:

CCSS.MATH.CONTENT.HSG-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects

Calculate expected values and use them to solve problems:

CCSS.MATH.CONTENT.HSS-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space;

CCSS.MATH.CONTENT.HSS-MD.A.2 Calculate the expected value of a random variable;

English Language Arts

- Journal writing
- Close reading of industry-related content
- Create a brochure for a specific industry

- Keep a running word wall of industry vocabulary

Social Studies

- Research the history of a given industry/profession
- Research prominent historical individuals in a given industry/profession
- Use historical references to solve problems

World Language

- Translate industry-content
- Create a translated index of industry vocabulary
- Generate a translated list of words and phrases related to information technology

Math

- Compare and contrast use of equations and variables in algebra and programming.
- Program graphics and use the properties of geometric shapes
- Compare the computer graphic coordinate system with the Cartesian coordinate plane in math
- Compare probability and the use of random numbers in computer programming.
- Track and track various data, such as industry's impact on the GDP, career opportunities or among of individuals currently occupying careers

Fine & Performing Arts

- Create a poster recruiting young people to focus their studies on a career in Information Technology

Science

- Research the environmental impact of a given career or industry
- Research latest developments in Information technology
- Investigate applicable-careers in STEM fields

REFLECTIONS