Unit 5: Writing Classes

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

UNIT RATIONALE

This unit will pull together information from all previous units to create new, user-defined reference data types in the form of classes. The ability to accurately model real-world entities in a computer program is a large part of what makes computer science so powerful. This unit focuses on identifying appropriate behaviors and attributes of real-world entities and organizing these into classes. Students will build on what they learn in this unit to represent relationships between classes through hierarchies, which appear in Unit 9. The creation of computer programs can have extensive impacts on societies, economies, and cultures. The legal and ethical concerns that come with programs and the responsibilities of programmers are also addressed in this unit.

ESSENTIAL QUESTIONS

How can using a model of traffic patterns improve travel time?

How can programs be written to protect your bank account balance from being inadvertently changed?

What responsibility do programmers have for the consequences of programs they create, whether intentional or not?

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 is abstraction?
- Consider the following code segment:

```
public class Rectangle
{
    private int width;
    private int height;
}
```

Why do you think the instance variables are set to private? Why might a programmer want to keep parts of their code private? Can you give an example?

INSTRUCTIONAL PLAN

MODULE 5

LESSON 5.1

Lesson 5.1: Writing Classes

In this lesson, students will explore and learn the anatomy of classes. They will take a deeper dive into what the access specifier does, and how it can be used within programs to make data public or private. Students will learn about encapsulation and the responsibility programmers have to choose whether data should be accessible, modifiable, both or neither. This lesson corresponds with AP Computer Science A topic 5.1.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Designate access and visibility constraints to classes, data, constructors, and methods • Designate private visibility of instance variables to encapsulate the attributes of an object
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 *Rectangle Getter Methods* example. • Complete the *Access for DNA Class* exercise. • Complete the *Access for Employee Class* exercise. • Complete the *Fixing Circle* 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 makes 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 t 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, "How 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. Break 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 5.2

Lesson 5.2: Constructors

In this lesson, students will expand their knowledge of constructors. They will create constructors that take objects as a formal parameter. This lesson corresponds with AP Computer Science A topic 5.2..

Student Learning Intentions (SLI) WALT: (We are learning to…)	○ Define instance variables for the attributes to be initialized through the constructors of a class
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 *Rectangle Getter Methods* example. • Complete the *Access for DNA Class* exercise. • Complete the *Access for Employee Class* exercise. • Complete the *Fixing Circle* exercise.
Suggested Modifications	See Lesson 5.1 above.

REFLECTIONS

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