

TOWNSHIP OF UNION PUBLIC SCHOOLS



AP Computer Science A

Adopted March 17, 2020

Mission Statement

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Course Description

AP Computer Science A introduces students to computer science through programming. Fundamental topics in this course include the design of solutions to problems, the use of data structures to organize large sets of data, the development and implementation of algorithms to process data and discover new information, the analysis of potential solutions, and the ethical and social implications of computing systems. The course emphasizes object-oriented programming and design using the Java programming language.

Curriculum Units/Pacing Guide

Unit # / Title	Number of Days
Unit 1: Primitive Types	10
Unit 2: Using Objects	15
Unit 3: Boolean Expressions and If Statements	13
Unit 4: Iteration	16
Unit 5: Writing Classes	14
Unit 6: Array	8
Unit 7: Array List	12
Unit 8: 2D Array	12
Unit 9: Inheritance	15
Unit 10: Recursion	5

Unit Standards Overview

Overview	Standards	Unit Skills Focus	Content-Specific Practices (when applicable)
<p>Unit 1: Primitive Types</p>	<p>MOD-1.A: Call System class methods to generate output to the console.</p> <p>VAR-1.A: Create String literals.</p> <p>VAR-1.B: Identify the most appropriate data type category for a particular specification.</p> <p>VAR-1.C: Declare variables of the correct types to represent primitive data.</p> <p>CON-1.B: Evaluate what is stored in a variable as a result of an expression with an assignment statement</p> <p>CON-1.C: Evaluate arithmetic expressions that use casting.</p>	<ul style="list-style-type: none"> • Introduction to Java programming and use of classes • Writing the main methods • Calling pre-existing methods to produce output • Introduction to built-in data types • Creating variables, storing values, and interacting with those variables using basic operations. 	<p>1.A Determine an appropriate program design to solve a problem or accomplish a task (not assessed)</p> <p>1.B Determine code that would be used to complete code segments.</p> <p>1.C Determine code that would be used to interact with completed program code.</p> <p>2.A Apply the meaning of specific operators.</p> <p>2.B Determine the result or output based on statement execution order in a code segment without method calls (other than output).</p> <p>2.C Determine the result or output based on the statement execution order in a code segment containing method calls.</p> <p>2.D Determine the number of times a code segment will execute.</p>
<p>Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 1 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-4 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 1 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p>	<p>3.A Write program code to create objects of a class and call methods.</p> <p>3.B Write program code to define a new type by creating a class.</p> <p>3.C Write program code to satisfy method specifications using</p>	

	<ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		<p>expressions, conditional statements, and iterative statements.</p>
<p>Unit 2: Using Objects</p>	<p>MOD-1.D: For creating objects: a. Create objects by calling constructors without parameters.b. Create objects by calling constructors with parameters</p> <p>VAR-1.D: Define variables of the correct types to represent reference data.</p> <p>MOD-1.C: Identify, using its signature, the correct constructor being called.</p> <p>MOD-1.E: Call non-static void methods without parameters.</p> <p>MOD-1.F: Call non-static void methods with parameters</p> <p>MOD-1.G: Call non-static non-void methods with or without parameters.</p> <p>VAR-1.E: For Wrapper classes, create Integer objects, call Integer methods, create Double objects, call Double methods.</p> <p>VAR-1.F: For wrapper classes:a. Create Integer objects.b. Call Integer methods.c. Create Double objects.d. Call Double methods.</p> <p>MOD-1.H: Call static methods</p> <p>CON-1.D: Evaluate expressions that use the Math class methods.</p>	<ul style="list-style-type: none"> • Introduction to reference data. • Using the Math class to write expressions for generating random numbers. • Using Strings and existing methods within the String class • Declaring variables • Calling methods on objects 	<p>3.D Write program code to create, traverse, and manipulate elements in 1D array or ArrayList objects.</p> <p>3.E Write program code to create, traverse, and manipulate elements in 2D array objects.</p> <p>4.A Use test-cases to find errors and validate results.</p> <p>4.B Identify errors in program code.</p> <p>4.C Determine if two or more code segments yield equivalent results.</p> <p>5.A Describe the behavior of a given segment of program code.</p> <p>5.B Explain why a code segment will not compile or work as intended.</p> <p>5.C Explain how the result of program code changes, given a change to the initial code.</p> <p>5.D Describe the initial conditions that must be met for a program segment to works as intended.</p>
<p>Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 2 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-3 <p>Summative Evaluations:</p>		

	<ul style="list-style-type: none"> • Unit 2 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p>Unit 3: Boolean Expressions and If Statements</p>	<p>CON-1.E: Evaluate Boolean expressions that use relational operators in program code.</p> <p>CON-2.A: Represent branching logical processes by using conditional statements.</p> <p>CON-2.B: Represent branching logical processes by using nested conditional statements.</p> <p>CON-1.F: Evaluate compound Boolean expressions in program code.</p> <p>CON-1.G: Compare and contrast equivalent Boolean expressions.</p> <p>CON-1.H: Compare object references using Boolean expressions in program code.</p>	<ul style="list-style-type: none"> • Representing selection using conditional statements • Using the syntax of conditional statements • Writing Boolean expressions with relational and logical operators 	
<p>Suggested Resources Provide links to specific resources/activities</p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 3 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-5 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 3 Test/Retest 		

	<p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p>Unit 4: Iteration</p>	<p>CON-2.C: Represent iterative processes using a while loop.</p> <p>CON-2.E: Represent iterative processes using a for loop.</p> <p>CON-2.F: For algorithms in the context of a particular specification that involves String objects:</p> <ul style="list-style-type: none"> - Identify standard algorithms. - Modify standard algorithms. - Develop an algorithm. <p>CON-2.G: Represent nested iterative processes.</p> <p>CON-2.H: Compute statement execution counts and informal run-time comparison of iterative statements.</p>	<ul style="list-style-type: none"> • Introduction to standard algorithms that use iteration. • Understanding Boolean expressions • Modifying algorithms or combining them to suit new situations • Traversing data structures 	
<p>Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 4 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-3 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 4 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p>Unit 5: Writing Classes</p>	<p>MOD-2.A: Designate access and visibility constraints to classes, data, constructors, and methods.</p>	<ul style="list-style-type: none"> • Creating new, user-defined reference data types in the form of classes • Modeling real-world entities in a computer program 	

	<p>MOD-3.A: Designate private visibility of instance variables to encapsulate the attributes of an object.</p> <p>MOD-2.B: Define instance variables for the attributes to be initialized through the constructors of a class.</p> <p>MOD-2.C: Describe the functionality and use of program code through comments.</p> <p>MOD-2.D: Define behaviors of an object through non-void methods without parameters written in a class.</p> <p>MOD-2.E: Define behaviors of an object through void methods with or without parameters written in a class.</p> <p>MOD-2.F: Define behaviors of an object through non-void methods with parameters written in a class.</p> <p>MOD-2.G: Define behaviors of a class through static methods.</p> <p>MOD-2.H: Define the static variables that belong to the class.</p> <p>VAR-1.G: Explain where variables can be used in the program code.</p> <p>VAR-1.H: Evaluate object reference expressions that use the keyword this.</p> <p>IOC-1.A: Explain the ethical and social implications of computing systems.</p>	<ul style="list-style-type: none"> • Identifying appropriate behaviors and attributes of real-world entities and organizing them into classes • Representing relationships between classes through hierarchies • Understanding the legal and ethical concerns that come with programs and the responsibilities of programmers 	
<p>Suggested Resources Provide links to specific resources/activities</p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 5 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-4 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 5 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank 		

	<ul style="list-style-type: none"> AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p align="center">Unit 6: Array</p>	<p>VAR-2.A: Represent collections of related primitive or object reference data using 1D array objects.</p> <p>VAR-2.B: Traverse the elements in a 1D array.</p> <p>VAR-2.C: Traverse the elements in a 1D array object using an enhanced for loop.</p> <p>CON-2.I: For algorithms in the context of a particular specification that requires the use of array traversals:</p> <ul style="list-style-type: none"> - Identify standard algorithms. - Modify standard algorithms. - Develop an algorithm. 	<ul style="list-style-type: none"> Using data structure along with iterative statements Applying standard algorithms to arrays 	
<p align="center">Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> Formative Assessment with polling Quizzes codeIt! Nows Unit 6 Homework Practice Problems College Board Progress Checks College Board Activities 1-4 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> Unit 6 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> College Board Problem Bank AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p align="center">Unit 7: ArrayList</p>	<p>VAR-2.D Represent collections of related object reference data using ArrayList objects.</p> <p>VAR-2.E For ArrayList objects:</p> <ul style="list-style-type: none"> -Traverse using a for or while loop. -Traverse using an enhanced for loop. 	<ul style="list-style-type: none"> Introduction to ArrayList object Understanding that ArrayList object has a dynamic size and that it contains methods for insertion and deletion of elements, making reordering and shifting items easier Understanding privacy 	

	<p>CON-2.J For algorithms in the context of a particular specification that requires the use of ArrayList traversals:</p> <ul style="list-style-type: none"> -Identify standard algorithms. -Modify standards algorithms. -Develop an algorithm. <p>CON-2.K Apply sequential/linear search algorithms to search for specific information in an array or ArrayList objects.</p> <p>CON-2.M Compute statement execution counts and informal run-time comparison of sorting algorithms.</p> <p>IOC-1.B Explain the risks to privacy from collecting and storing personal data on computer systems.</p>	<p>concerns related to storing large amounts of personal data and what can happen if such information is compromised</p>	
<p>Suggested Resources Provide links to specific resources/activities</p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 7 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-3 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 7 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p>Unit 8: 2D Array</p>	<p>VAR-2.F Represent collections of related primitive or object reference data using 2D array objects.</p> <p>VAR-2.G For 2D array objects:</p> <ul style="list-style-type: none"> -Traverse using nested for loops. -Traverse using nested enhanced for loops. 	<ul style="list-style-type: none"> • Introduction to 2D array • Understand how to traverse and access all the elements in a 2D array • Understand different traversal patterns, such as back and forth or column-major/ row- 	

	<p>CON-2.N For algorithms in the context of a particular specification that requires the use of 2D array traversals:</p> <ul style="list-style-type: none"> -Identify standard algorithms. -Modify standard algorithms. -Develop an algorithm. 	<p>major</p>	
<p>Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 8 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-2 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 8 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p>Unit 9: Inheritance</p>	<p>MOD-3.B Create an inheritance relationship from a subclass to the superclass.</p> <p>MOD-3.C Define reference variables of a superclass to be assigned to an object of a subclass in the same hierarchy.</p> <p>MOD-3.D Call methods in an inheritance relationship.</p> <p>MOD-3.E Call Object class methods through inheritance.</p>	<ul style="list-style-type: none"> • Creating objects, calling methods on the objects created, and being able to define new data type by creating a class. • Being able to categorize classes into hierarchies through inheritance. • Recognizing common attributes and behaviors that can be used in a superclass and creating a hierarchy by writing subclasses to extend a superclass. 	
<p>Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 9 Homework Practice Problems • College Board Progress Checks 		

	<ul style="list-style-type: none"> • College Board Activities 1-4 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 9 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		
<p align="center">Unit 10: Recursion</p>	<p>CON-2.O Determine the result of executing recursive methods.</p> <p>CON-2.P Apply recursive search algorithms to information in String, 1D array, or ArrayList objects.</p> <p>CON-2.Q Apply recursive algorithms to sort elements of array or ArrayList objects.</p>	<ul style="list-style-type: none"> • Introduction to recursion • Determine the purpose or output of a recursive method. • Write recursive methods and determine the purpose or output by tracing. 	
<p align="center">Suggested Resources <i>Provide links to specific resources/activities</i></p>	<p>Formative Evaluations:</p> <ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 10 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-3 <p>Summative Evaluations:</p> <ul style="list-style-type: none"> • Unit 10 Test/Retest <p>All above resources are available on www.njctl.org or College Board AP Central</p> <ul style="list-style-type: none"> • College Board Problem Bank • AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html 		

Curricular Units

Unit 1: Primitive Types			
Content Standards	Critical Knowledge & Skills (“Unpacked” Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>MOD-1.A: Call System class methods to generate output to the console.</p> <p>VAR-1.A: Create String literals.</p> <p>VAR-1.B: Identify the most appropriate data type category for a particular specification.</p> <p>VAR-1.C: Declare variables of the correct types to represent primitive data.</p> <p>CON-1.B: Evaluate what is stored in a variable as a result of an expression with an assignment statement</p> <p>CON-1.C: Evaluate arithmetic expressions that use casting.</p>	<ul style="list-style-type: none"> ● Introduction to Java programming and use of classes ● Writing the main methods ● Calling pre-existing methods to produce output ● Introduction to built-in data types ● Creating variables, storing values, and interacting with those variables using basic operations. 	<p>2.B, 4.B, 1.A, 1.B, 2.A, 5.A, 5.B</p>	<p>Error Analysis: Provide students with code that contains syntax errors. Ask students to identify and correct the errors in the provided code. Have them verify their conclusion by using a compiler and an IDE.</p> <hr/> <p>Activating Prior Knowledge: Give students a list of expressions and ask them to apply what they know from math class to evaluate the meaning of the expressions.</p> <hr/> <p>Sharing and Responding: Put students into groups of two. Provide each student with a different set of statements. In each pair one student should have a list of statements that contain compound assignment operators while the other student should have a list of statements that accomplish the same thing without using compound statements. Students should take turns describing what each statement does to their partner, and partner should determine which statement of theirs is equivalent to the one being described.</p>

Unit 1 Assessment Plan	
Formative Assessment	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>

<i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	
<ul style="list-style-type: none"> ● Formative Assessment with polling ● Quizzes ● codelt! Nows ● Unit 1 Homework Practice Problems ● College Board Progress Checks ● College Board Activities 1-4 	<ul style="list-style-type: none"> ● Unit 1 Test/Retest ● Unit 1 Labs

Unit 1 Suggested Modifications/Accommodations/Extension Activities

English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Teacher Modeling ● Gestures ● Pictures/Photos ● Word Wall ● Native language Supports ● Partner Work 	<ul style="list-style-type: none"> ● Change in pace ● Alternative assessments ● Accommodations as per IEP ● Modifications as per IEP ● Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties ● Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task ● Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence ● Use technology and/or hands on devices ● Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction ● Word Wall ● Native language Supports 	<ul style="list-style-type: none"> ● “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/publicshed/apcsareview/index.html

Unit 1 Connections

<p style="text-align: center;">NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards</p>	<p style="text-align: center;">Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices</p>
<ul style="list-style-type: none"> ● 8.1 and 8.2 ● Khan Academy ● code.org ● https://runestone.academy/runestone/books/published/apcsareview/index.html ● Live CodeIt! Problems 	<ul style="list-style-type: none"> ● CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 ● In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. ● Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. ● Use pair programming to have students develop a program to process information from a large, real world data set.
<p style="text-align: center;">21st Century Skills <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the 21st Century Life and Skills</p>	<p style="text-align: center;">Interdisciplinary Connections <i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i> Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> ● Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 2: Using Objects

Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>MOD-1.D: For creating objects: a. Create objects by calling constructors without parameters.b. Create objects by calling constructors with parameters</p> <p>VAR-1.D: Define variables of the correct types to represent reference data.</p> <p>MOD-1.C: Identify, using its signature, the correct constructor being called.</p> <p>MOD-1.E: Call non-static void methods without parameters.</p> <p>MOD-1.F: Call non-static void methods with parameters</p> <p>MOD-1.G: Call non-static non-void methods with or without parameters.</p> <p>VAR-1.E: For Wrapper classes, create Integer objects, call Integer methods, create Double objects, call Double methods.</p> <p>VAR-1.F: For wrapper classes:a. Create Integer objects.b. Call Integer methods.c. Create Double objects.d. Call Double methods.</p> <p>MOD-1.H: Call static methods</p> <p>CON-1.D: Evaluate expressions that use the Math class methods.</p>	<ul style="list-style-type: none"> ● Introduction to reference data. ● Using the Math class to write expressions for generating random numbers. ● Using Strings and existing methods within the String class ● Declaring variables ● Calling methods on objects 	<p>5.A, 1.C, 3.A, 2.C, 2.A, 1.B,</p>	<p>Using Manipulatives: When introducing students to the idea of creating objects, you can use cookie cutter and modeling clay or dough, with the cutter representing the class and the cut dough representing the objects. For each object cut, write the instantiation. Ask students to describe what the code is doing and how the different parameter values change the object that was created.</p>
			<p style="text-align: center;">Making the Text: Provide students with several statements that define a variable and create an object on a single line. Have students mark up the statements by circling the assignment operator and the new keyword. Then, have students underline the variable type and the constructor. Lastly, have them draw a rectangle around the list of actual parameters being passed to the constructor.</p>
			<p style="text-align: center;">Think Pair Share: Provide student with several code segments, each with missing expression that would</p>

			<p>contain a call to a method in the Math class and a description of the intended outcome of each code segment. Ask them which statement should be used to complete the code segment. Have them share their responses with a partner and come to agreement, and then have groups share with the entire class.</p>
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Unit 2 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Formative Assessment with polling Quizzes codeIt! Nows Unit 2 Homework Practice Problems College Board Progress Checks College Board Activities 1-3 	<ul style="list-style-type: none"> Unit 2 Test/Retest Unit 2 Labs

Unit 2 Suggested Modifications/Accommodations/Extension Activities		
English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Teacher Modeling Gestures Pictures/Photos 	<ul style="list-style-type: none"> Change in pace Alternative assessments Accommodations as per IEP 	<ul style="list-style-type: none"> “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/public/apcsareview/index.html

<ul style="list-style-type: none"> • Word Wall • Native language Supports • Partner Work 	<ul style="list-style-type: none"> • Modifications as per IEP • Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties • Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task • Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence • Use technology and/or hands on devices • Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction • Word Wall • Native language Supports 	
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Unit 2 Connections	
<p align="center">NJSLS - Technology</p> <p align="center"><i>When possible, provide links to specific samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the NJ Technology Standards</p>	<p align="center">Career Readiness Practices</p> <p align="center"><i>When possible, provide links to specific samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the NJ Career Readiness Practices</p>
<ul style="list-style-type: none"> • 8.1 and 8.2 • Khan Academy • code.org • https://runestone.academy/runestone/books/published/apcsareview/index.html • Live CodeIt! Problems 	<ul style="list-style-type: none"> • CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 • In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. • Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. • Use pair programming to have students develop a program to process information from a large, real world data set.
<p align="center">21st Century Skills</p> <p align="center"><i>When possible, provide links to specific samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the 21st Century Life and Skills</p>	<p align="center">Interdisciplinary Connections</p> <p align="center"><i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the NJ Student Learning Standards</p>

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

- Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 3: Boolean Expressions and If Statements

Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>CON-1.E: Evaluate Boolean expressions that use relational operators in program code.</p> <p>CON-2.A: Represent branching logical processes by using conditional statements.</p> <p>CON-2.B: Represent branching logical processes by using nested conditional statements.</p> <p>CON-1.F: Evaluate compound Boolean expressions in program code.</p> <p>CON-1.G: Compare and contrast equivalent Boolean expressions.</p> <p>CON-1.H: Compare object references using Boolean expressions in program code.</p>	<ul style="list-style-type: none"> • Representing selection using conditional statements • Using the syntax of conditional statements • Writing Boolean expressions with relational and logical operators 	<p>2.A, 3.C, 4.A, 4.C, 2.B, 2.C, 3.A</p>	<p>Code Tracing: Provide students with several code segments that contain conditional statements. Have students trace various sample inputs, keeping track of statements that get executed and the order in which they are executed.</p> <hr/> <p>Pair Programming: Have students work with a partner to create a guess checker that could be used as part of a larger game. Students compare four given digits to a preexisting four digit code that is stored in individual variables. Their program should provide output containing the number of correct digits in correct locations as well as the number of correct digits in incorrect locations.</p> <hr/> <p>Diagramming: Have students create truth tables by listing all the possible true and false combinations and corresponding Boolean values for a given compound Boolean expression.</p> <hr/> <p>Student Response System: Provide students with a code segment that utilizes conditional statements and a compound Boolean expression, and ask them to choose an equivalent code segment that uses a nested conditional statement. Have them report their responses using a student response system.</p>

Predict and Compare: Have students predict the output of several different code segments that compare object references.

Unit 3 Assessment Plan

Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Formative Assessment with polling Quizzes codelt! Nows Unit 3 Homework Practice Problems College Board Progress Checks College Board Activities 1-5 	<ul style="list-style-type: none"> Unit 3 Test/Retest Unit 3 Labs

Unit 3 Suggested Modifications/Accommodations/Extension Activities

English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Teacher Modeling Gestures Pictures/Photos Word Wall Native language Supports Partner Work 	<ul style="list-style-type: none"> Change in pace Alternative assessments Accommodations as per IEP Modifications as per IEP Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence Use technology and/or hands on devices 	<ul style="list-style-type: none"> "Medium" and "Hard" Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/publicshed/apcsareview/index.html

- Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction
- Word Wall
- Native language Supports

Unit 3 Connections

NJSLS - Technology

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Technology Standards](#)

- 8.1 and 8.2
- Khan Academy
- code.org
- <https://runestone.academy/runestone/books/published/apcsareview/index.html>
- Live CodeIt! Problems

Career Readiness Practices

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Career Readiness Practices](#)

- CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12
- In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning.
- Have students generate and pose questions about a set of data and use sharing and responding to refine those questions.
- Use pair programming to have students develop a program to process information from a large, real world data set.

21st Century Skills

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [21st Century Life and Skills](#)

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Interdisciplinary Connections

When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.

Refer to the [NJ Student Learning Standards](#)

- Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.



Unit 4: Iteration

Content Standards	Critical Knowledge & Skills (“Unpacked” Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>CON-2.C: Represent iterative processes using a while loop.</p> <p>CON-2.E: Represent iterative processes using a for loop.</p> <p>CON-2.F: For algorithms in the context of a particular specification that involves String objects:</p> <ul style="list-style-type: none"> - Identify standard algorithms. - Modify standard algorithms. - Develop an algorithm. <p>CON-2.G: Represent nested iterative processes.</p> <p>CON-2.H: Compute statement execution counts and informal run-time comparison of iterative statements.</p>	<ul style="list-style-type: none"> • Introduction to standard algorithms that use iteration. • Understanding Boolean expressions • Modifying algorithms or combining them to suit new situations • Traversing data structures 	<p align="center">1.B, 2.B, 3.C, 4.C, 5.C, 2.C, 2.D</p>	<p>Jigsaw: As a whole class, look at a code segment containing iteration and the resulting output. Afterward, divide students into groups and provide each group with a slightly modified code segment. After groups have determined how the result changes based on their modified segment, have them get together with students who investigated a different version of the code segment and share their conclusions.</p> <p>Note-Taking: Provide students with a method that, when given an integer, returns the month name from a String that includes all the month names in order, each separated by a space. Have them annotate what each statement does in the method. Then, ask the students to use their annotated method as a guide to write similar method that, given a student number as input, returns the name of a student from a String containing the</p>

			<p>first name of all students in the class, each separated by a space.</p>
			<p>Simplify the problem: Provide students with several code segments containing iteration. For each segment, have students trace through the execution of a loop with smaller bounds to see what boundary cases are considered, then use that information to determine the number of times each loop executes with the original bounds.</p>

Unit 4 Assessment Plan

Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Formative Assessment with polling ● Quizzes ● codeIt! Nows ● Unit 4 Homework Practice Problems ● College Board Progress Checks ● College Board Activities 1-3 	<ul style="list-style-type: none"> ● Unit 4 Test/Retest ● Unit 4 Labs

Unit 4 Suggested Modifications/Accommodations/Extension Activities

English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Teacher Modeling ● Gestures ● Pictures/Photos ● Word Wall ● Native language Supports ● Partner Work 	<ul style="list-style-type: none"> ● Change in pace ● Alternative assessments ● Accommodations as per IEP ● Modifications as per IEP ● Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties ● Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task ● Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence ● Use technology and/or hands on devices ● Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction ● Word Wall ● Native language Supports 	<ul style="list-style-type: none"> ● “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html

Unit 4 Connections	
NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards	Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices
<ul style="list-style-type: none"> ● 8.1 and 8.2 ● Khan Academy ● code.org ● https://runestone.academy/runestone/books/published/apcsareview/index.html ● Live Codelt! Problems 	<ul style="list-style-type: none"> ● CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 ● In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. ● Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. ● Use pair programming to have students develop a program to process information from a large, real world data set.

<p style="text-align: center;">21st Century Skills <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the 21st Century Life and Skills</p>	<p style="text-align: center;">Interdisciplinary Connections <i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i> Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 5: Writing Classes			
Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>MOD-2.A: Designate access and visibility constraints to classes, data, constructors, and methods.</p> <p>MOD-3.A: Designate private visibility of instance variables to encapsulate the attributes of an object.</p> <p>MOD-2.B: Define instance variables for the attributes to be initialized through the constructors of a class.</p> <p>MOD-2.C: Describe the functionality and use of program code through comments.</p> <p>MOD-2.D: Define behaviors of an object through non-void methods without parameters written in a class.</p>	<ul style="list-style-type: none"> Creating new, user-defined reference data types in the form of classes Modeling real-world entities in a computer program Identifying appropriate behaviors and attributes of real-world entities and organizing them into classes Representing relationships between classes through hierarchies Understanding the legal and ethical concerns that come with programs and the responsibilities of programmers 	<p>1.A, 3.B, 5.A, 5.B, 5.D</p>	<p>Kinesthetic Learning: Have students break into groups to play a board game. Ask them to play for about 10 minutes. While they play the game, they should keep track of various nouns they encounter and actions that happen. The nouns can be represented in the computer as classes, and the actions are the behaviors.</p> <p>Marking the Text: Present students with specifications and have them highlight or underline the preconditions that exist for the method to function. This includes information about parameters such as object references not being null.</p>

<p>MOD-2.E: Define behaviors of an object through void methods with or without parameters written in a class.</p> <p>MOD-2.F: Define behaviors of an object through non-void methods with parameters written in a class.</p> <p>MOD-2.G: Define behaviors of a class through static methods.</p> <p>MOD-2.H: Define the static variables that belong to the class.</p> <p>VAR-1.G: Explain where variables can be used in the program code.</p> <p>VAR-1.H: Evaluate object reference expressions that use the keyword this.</p> <p>IOC-1.A: Explain the ethical and social implications of computing systems.</p>			<p>Create a Plan: When asked to write a method, have students write an outline using pseudocode with paper and pencil. Then go through it step by step with sample input to ensure the process is correct and to determine if any additional information is needed before beginning to program a solution.</p> <p>Paraphrase: Provide students with several example classes that utilize static variables for unique identification numbers or for counting the number of objects that have been created, but do not provide any description or documentation for the code. Have students spend time creating objects and calling the static methods to investigate how the static variables behave, then have them document the code appropriately to describe how each class utilizes static variables and methods.</p>
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Unit 5 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Formative Assessment with polling ● Quizzes ● codelt! Nows ● Unit 5 Homework Practice Problems ● College Board Progress Checks ● College Board Activities 1-4 	<ul style="list-style-type: none"> ● Unit 5 Test/Retest ● Unit 5 Labs

Unit 5 Suggested Modifications/Accommodations/Extension Activities		
English Language Learners (ELL)	Special Education / 504	Gifted and Talented

<i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	<i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	<i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Teacher Modeling ● Gestures ● Pictures/Photos ● Word Wall ● Native language Supports ● Partner Work 	<ul style="list-style-type: none"> ● Change in pace ● Alternative assessments ● Accommodations as per IEP ● Modifications as per IEP ● Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties ● Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task ● Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence ● Use technology and/or hands on devices ● Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction ● Word Wall ● Native language Supports 	<ul style="list-style-type: none"> ● “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html

Unit 5 Connections	
<p style="text-align: center;">NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards</p>	<p style="text-align: center;">Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices</p>
<ul style="list-style-type: none"> ● 8.1 and 8.2 ● Khan Academy ● code.org ● https://runestone.academy/runestone/books/published/apcsareview/index.html ● Live Codelt! Problems 	<ul style="list-style-type: none"> ● CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 ● In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. ● Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. ● Use pair programming to have students develop a program to process information from a large, real world data set.

<p align="center">21st Century Skills</p> <p align="center"><i>When possible, provide links to specific samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the 21st Century Life and Skills</p>	<p align="center">Interdisciplinary Connections</p> <p align="center"><i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i></p> <p align="center">Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.</p> <p>9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.</p> <p>9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 6: Array			
Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>VAR-2.A: Represent collections of related primitive or object reference data using 1D array objects.</p> <p>VAR-2.B: Traverse the elements in a 1D array.</p> <p>VAR-2.C: Traverse the elements in a 1D array object using an enhanced for loop.</p> <p>CON-2.I: For algorithms in the context of a particular specification that requires the use of array traversals:</p> <ul style="list-style-type: none"> - Identify standard algorithms. - Modify standard algorithms. - Develop an algorithm. 	<ul style="list-style-type: none"> Using data structure along with iterative statements Applying standard algorithms to arrays 	<p align="center">3.D, 4.B</p>	<p>Diagramming: Provide students with several prompts to create and access elements in an array. After they have determined the code for each prompt, have students draw a memory diagram that shows references and the arrays they point to. Have students update the diagram with each statement to demonstrate how changing the contents through one array reference affects all the array references.</p> <p>Error Analysis: Provide students with several error-ridden code segments containing array traversals along with the expected output of each segment. Ask them to identify any errors that they see on paper and to suggest fixes to provide the expected output. Have them type up their solutions in an IDE.</p>

			<p>Think Pair Share: Ask students to consider two program code segments that are meant to yield the same result; one using traditional for loop and one using a for each loop. Have them think independently whether the two segments accomplish the same result and if not, what changes could be made in order for that to happen. Then ask them to work with partners to come up with situations where it would make sense to use one type of loop over the other.</p> <p>Pair Programming: Have students use pair programming to solve an array-based free-response question.</p>
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Unit 6 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> • Formative Assessment with polling • Quizzes • codeIt! Nows • Unit 6 Homework Practice Problems • College Board Progress Checks • College Board Activities 1-4 	<ul style="list-style-type: none"> • Unit 6 Test/Retest • Unit 6 Labs

Unit 6 Suggested Modifications/Accommodations/Extension Activities		
English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>

<ul style="list-style-type: none"> • Teacher Modeling • Gestures • Pictures/Photos • Word Wall • Native language Supports • Partner Work 	<ul style="list-style-type: none"> • Change in pace • Alternative assessments • Accommodations as per IEP • Modifications as per IEP • Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties • Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task • Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence • Use technology and/or hands on devices • Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction • Word Wall • Native language Supports 	<ul style="list-style-type: none"> • “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html
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Unit 6 Connections	
<p align="center">NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards</p>	<p align="center">Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices</p>
<ul style="list-style-type: none"> • 8.1 and 8.2 • Khan Academy • code.org • https://runestone.academy/runestone/books/published/apcsareview/index.html • Live Codelt! Problems 	<ul style="list-style-type: none"> • CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 • In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. • Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. • Use pair programming to have students develop a program to process information from a large, real world data set.
<p align="center">21st Century Skills</p>	<p align="center">Interdisciplinary Connections</p>

<p><i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the 21st Century Life and Skills</p>	<p><i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i> Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 7: ArrayList			
Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>VAR-2.D Represent collections of related object reference data using ArrayList objects.</p> <p>VAR-2.E For ArrayList objects: -Traverse using a for or while loop. -Traverse using an enhanced for loop.</p> <p>CON-2.J For algorithms in the context of a particular specification that requires the use of ArrayList traversals: -Identify standard algorithms. -Modify standards algorithms. -Develop an algorithm.</p> <p>CON-2.K Apply sequential/linear search algorithms to search for</p>	<ul style="list-style-type: none"> Introduction to ArrayList object Understanding that ArrayList object has a dynamic size and that it contains methods for insertion and deletion of elements, making reordering and shifting items easier Understanding privacy concerns related to storing large amounts of personal data and what can happen if such information is compromised 	<p>2.C, 2.D, 3.D, 5.C</p>	<p>Predict and Compare: Have students look at the code they wrote to solve the free response question in Unit 6 on paper and have them rewrite is using an ArrayList. Have them highlight the parts that need to be changed. Have them code those changes.</p> <p>Identify a Subtask: Have students read through an ArrayList based free response question in groups and have them identify all subtasks. Once they identify them, divide the subtasks among group members and have students implement their given subtask. Combine all subtasks into one solution.</p>

<p>specific information in an array or ArrayList objects.</p> <p>CON-2.M Compute statement execution counts and informal run-time comparison of sorting algorithms.</p> <p>IOC-1.B Explain the risks to privacy from collecting and storing personal data on computer systems.</p>			<p>Discussion Group: Discuss the algorithm necessary to search for the smallest value in an ArrayList. Without explaining what you're doing, change the Boolean expression so that it will find the largest value and ask students to describe what the resulting algorithm will do.</p>
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Unit 7 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Formative Assessment with polling Quizzes codelt! Nows Unit 7 Homework Practice Problems College Board Progress Checks College Board Activities 1-3 	<ul style="list-style-type: none"> Unit 7 Test/Retest Unit 7 Labs

Unit 7 Suggested Modifications/Accommodations/Extension Activities		
English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Teacher Modeling Gestures Pictures/Photos Word Wall Native language Supports Partner Work 	<ul style="list-style-type: none"> Change in pace Alternative assessments Accommodations as per IEP Modifications as per IEP 	<ul style="list-style-type: none"> "Medium" and "Hard" Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/publicshed/apcsareview/index.html

- Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties
- Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task
- Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence
- Use technology and/or hands on devices
- Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction
- Word Wall
- Native language Supports

Unit 7 Connections

NJSLS - Technology

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Technology Standards](#)

- 8.1 and 8.2
- Khan Academy
- code.org
- <https://runestone.academy/runestone/books/published/apcsareview/index.html>
- Live Codelt! Problems

Career Readiness Practices

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Career Readiness Practices](#)

- CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12
- In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning.
- Have students generate and pose questions about a set of data and use sharing and responding to refine those questions.
- Use pair programming to have students develop a program to process information from a large, real world data set.

21st Century Skills

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [21st Century Life and Skills](#)

Interdisciplinary Connections

When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.

Refer to the [NJ Student Learning Standards](#)

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

- Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice,

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 8: 2D Array

Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>VAR-2.F Represent collections of related primitive or object reference data using 2D array objects.</p> <p>VAR-2.G For 2D array objects: -Traverse using nested for loops. -Traverse using nested enhanced for loops.</p> <p>CON-2.N For algorithms in the context of a particular specification that requires the use of 2D array traversals: -Identify standard algorithms. -Modify standard algorithms. -Develop an algorithm.</p>	<ul style="list-style-type: none"> • Introduction to 2D array • Understand how to traverse and access all the elements in a 2D array • Understand different traversal patterns, such as back and forth or column-major/ row-major 	<p>1.B, 2.B, 2.D, 3.E</p>	<p>Using Manipulatives: Use different sized egg cartons or ice cube trays with random compartments filled with small toys or candy. Create laminated cards with the code for the construction and access to a 2D array leaving blanks for the name and size dimensions. Have students fill in the missing code that would be used to represent the physical 2D array objects and access the randomly stored elements.</p> <p>Activating Prior Knowledge: When first introducing 2D arrays and row-major traversal, ask students which part of the nested for loop structure loops over a 1D array. Based on what they know, ask them to calculate the number of times the inner loop executes.</p> <p>Sharing and Responding: As a class, create a set of test cases with answers to a free-response question.</p>

			Have students write answers and exchange with other students.
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Unit 8 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Formative Assessment with polling Quizzes codelt! Nows Unit 8 Homework Practice Problems College Board Progress Checks College Board Activities 1-3 	<ul style="list-style-type: none"> Unit 8 Test/Retest Unit 8 Labs

Unit 8 Suggested Modifications/Accommodations/Extension Activities		
English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Teacher Modeling Gestures Pictures/Photos Word Wall Native language Supports Partner Work 	<ul style="list-style-type: none"> Change in pace Alternative assessments Accommodations as per IEP Modifications as per IEP Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence Use technology and/or hands on devices 	<ul style="list-style-type: none"> "Medium" and "Hard" Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/publicshed/apcsareview/index.html

- Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction
- Word Wall
- Native language Supports

Unit 8 Connections

NJSLS - Technology

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Technology Standards](#)

- 8.1 and 8.2
- Khan Academy
- code.org
- <https://runestone.academy/runestone/books/published/apcsareview/index.html>
- Live CodeIt! Problems

Career Readiness Practices

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [NJ Career Readiness Practices](#)

- CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12
- In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning.
- Have students generate and pose questions about a set of data and use sharing and responding to refine those questions.
- Use pair programming to have students develop a program to process information from a large, real world data set.

21st Century Skills

When possible, provide links to specific samples/ documents/ assignments/etc.

Refer to the [21st Century Life and Skills](#)

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Interdisciplinary Connections

When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.

Refer to the [NJ Student Learning Standards](#)

- Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 9: Inheritance

Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<p>MOD-3.B Create an inheritance relationship from a subclass to the superclass.</p> <p>MOD-3.C Define reference variables of a superclass to be assigned to an object of a subclass in the same hierarchy.</p> <p>MOD-3.D Call methods in an inheritance relationship.</p> <p>MOD-3.E Call Object class methods through inheritance.</p>	<ul style="list-style-type: none"> • Creating objects, calling methods on the objects created, and being able to define new data type by creating a class. • Being able to categorize classes into hierarchies through inheritance. • Recognizing common attributes and behaviors that can be used in a superclass and creating a hierarchy by writing subclasses to extend a superclass. 	<p>1.A, 1.C, 3.A, 3.B, 5.A, 5.B, 5.D</p>	<p>Activating Prior Knowledge: Have students review what they know about classes, methods, and the scope of variables by having them write a class based on specifications that can easily be extended by subclasses. This class will become the superclass for subclasses they write later in the unit.</p> <p>Create a Plan: Given a class design problem that requires the use of multiple classes in an inheritance hierarchy, students identify the common attributes and behaviors among these classes and write these into a superclass. Any additional information that does not belong in the superclass will be categorized to determine the additional classes that might be necessary and what methods will need to be added or overridden in the subclasses.</p> <p>Think Aloud: Provide students with a code segment that contains method calls using the super keyword. Have students describe the code segment out loud to themselves. Give students several individual statements that attempt to interact with the given code segment and have them talk through each one, describing which statements would work and which ones would not.</p>

Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Formative Assessment with polling ● Quizzes ● codeIt! Nows ● Unit 9 Homework Practice Problems ● College Board Progress Checks ● College Board Activities 1-4 	<ul style="list-style-type: none"> ● Unit 9 Test/Retest ● Unit 9 Labs

Unit 9 Suggested Modifications/Accommodations/Extension Activities

English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Teacher Modeling ● Gestures ● Pictures/Photos ● Word Wall ● Native language Supports ● Partner Work 	<ul style="list-style-type: none"> ● Change in pace ● Alternative assessments ● Accommodations as per IEP ● Modifications as per IEP ● Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties ● Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task ● Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence ● Use technology and/or hands on devices ● Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction ● Word Wall ● Native language Supports 	<ul style="list-style-type: none"> ● “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/public/apcsareview/index.html

Unit 9 Connections

<p align="center">NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards</p>	<p align="center">Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices</p>
<ul style="list-style-type: none"> ● 8.1 and 8.2 ● Khan Academy ● code.org ● https://runestone.academy/runestone/books/published/apcsareview/index.html ● Live CodeIt! Problems 	<ul style="list-style-type: none"> ● CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. ● Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. ● Use pair programming to have students develop a program to process information from a large, real world data set.
<p align="center">21st Century Skills <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the 21st Century Life and Skills</p>	<p align="center">Interdisciplinary Connections <i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i> Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> ● Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.

Unit 10: Recursion			
Content Standards	Critical Knowledge & Skills ("Unpacked" Standards)	Content-Specific Practices (when applicable)	Standard Mastery Examples <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
CON-2.O Determine the result of executing recursive methods.	<ul style="list-style-type: none"> ● Introduction to recursion ● Determine the purpose or output of a recursive method. 	1.B, 2.C, 2.D	Sharing and Responding: Provide students with the pseudocode to multiple recursive algorithms and have students write the base case of

<p>CON-2.P Apply recursive search algorithms to information in String, 1D array, or ArrayList objects.</p> <p>CON-2.Q Apply recursive algorithms to sort elements of array or ArrayList objects.</p>	<ul style="list-style-type: none"> Write recursive methods and determine the purpose or output by tracing. 		<p>the recursive methods and share with their partner.</p> <p>Look for a Pattern: Provide students with a recursive method and several different inputs. Have students run the recursive method, record the various outputs, and look for a pattern between the input and related output. Ask students to write one or two sentences as a broad description of what the recursive method is doing.</p> <p>Code Tracing: When looking at a recursive method to determine how many times it executes, have students create a call tree or stack trace to show the method being called and the values of any parameters of each call. Students can then count up the number of times a statement executes or a method is being called.</p>
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Unit 10 Assessment Plan	
Formative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Summative Assessment <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> Formative Assessment with polling Quizzes codelt! Nows Unit 10 Homework Practice Problems College Board Progress Checks College Board Activities 1-3 	<ul style="list-style-type: none"> Unit 10 Test/Retest Unit 10 Labs

Unit 10 Suggested Modifications/Accommodations/Extension Activities

English Language Learners (ELL) <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Special Education / 504 <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>	Gifted and Talented <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i>
<ul style="list-style-type: none"> ● Teacher Modeling ● Gestures ● Pictures/Photos ● Word Wall ● Native language Supports ● Partner Work 	<ul style="list-style-type: none"> ● Change in pace ● Alternative assessments ● Accommodations as per IEP ● Modifications as per IEP ● Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties ● Use self-regulations strategies for student to monitor and assess their thinking and performance for difficulty attending to task ● Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence ● Use technology and/or hands on devices ● Simplify and reduce strategies/ goal structure to enhance motivation, foster independence and self-direction ● Word Wall ● Native language Supports 	<ul style="list-style-type: none"> ● “Medium” and “Hard” Exercises in AP Review Online Textbook: https://runestone.academy/runestone/books/published/apcsareview/index.html

Unit 10 Connections

NJSLS - Technology <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Technology Standards	Career Readiness Practices <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the NJ Career Readiness Practices
<ul style="list-style-type: none"> ● 8.1 and 8.2 ● Khan Academy ● code.org ● https://runestone.academy/runestone/books/published/apcsareview/index.html ● Live Codelt! Problems 	<ul style="list-style-type: none"> ● CRP1, CRP2, CRP4, CRP5, CRP6, CRP8, CRP11, CRP12 ● In discussion groups, or using online tools for collaboration, have students read about and examine possible sources of data in various fields, such as medicine, business, criminal justice, marketing, civil engineering, and municipal planning. ● Have students generate and pose questions about a set of data and use sharing and responding to refine those questions. ● Use pair programming to have students develop a program to process information from a large, real world data set.

<p style="text-align: center;">21st Century Skills <i>When possible, provide links to specific samples/ documents/ assignments/etc.</i> Refer to the 21st Century Life and Skills</p>	<p style="text-align: center;">Interdisciplinary Connections <i>When possible, provide links to specific ELA/Math/Sci/SS standards as well as samples/ documents/ assignments/etc.</i> Refer to the NJ Student Learning Standards</p>
<p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.</p> <p>9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.</p> <p>9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p>	<ul style="list-style-type: none"> • Several of the labs for AP Computer Science A include the opportunity to bring in real-world data, and the more that data can be used as part of everyday practice, the more comfortable students will become. By showing students how to solve problems and answer questions using real-world data sets, we are reinforcing the power of computer science and its applications to other disciplines.