

**CURRICULUM**

**FOR**

**COMPUTER**

**SCIENCE - I**

**GRADES 9-12**

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

### **ACKNOWLEDGMENTS**

**Dr. Susan Dube, Program Supervisor of Math, Science, and Technology Education**

The Board acknowledges the following who contributed to the preparation of this curriculum.

**Ambika Bhosale**

**Dr. Tiffany A. Beer, Director of Curriculum and Instruction**

Subject/Course Title:  
**Computer Science I**  
**Grades - 9-12**

Date of Board Adoption:  
**September 19, 2023**

# RAHWAY PUBLIC SCHOOLS CURRICULUM

Computer Science I : Grades 9 - 12

## *PACING GUIDE*

<b>Unit</b>	<b>Title</b>	<b>Pacing</b>
1	Intro to Python with Tracy the Turtle	6 weeks
2	Basic Python and Console interaction	4 weeks
3	Conditional Statements	4 weeks
4	Control Statements	6 weeks
5	Functions and Exceptions	4 weeks
6	Strings	4 weeks
7	Creating and Altering Data Structures	4 weeks
8	Extending Data Structures	4 weeks
9	Computer Science and its effects on environment	4 weeks

## **ACCOMMODATIONS**

<p><b>504 Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide scaffolded vocabulary and vocabulary lists.</li> <li>● Provide extra visual and verbal cues and prompts.</li> <li>● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.</li> <li>● Provide links to audio files and utilize video clips.</li> <li>● Provide graphic organizers and/or checklists.</li> <li>● Provide modified rubrics.</li> <li>● Provide a copy of teaching notes, especially any key terms, in advance.</li> <li>● Allow additional time to complete assignments and/or assessments.</li> <li>● Provide shorter writing assignments.</li> <li>● Provide sentence starters.</li> <li>● Utilize small group instruction.</li> <li>● Utilize Think-Pair-Share structure.</li> <li>● Check for understanding frequently.</li> <li>● Have student restate information.</li> <li>● Support auditory presentations with visuals.</li> <li>● Weekly home-school communication tools (notebook, daily log, phone calls or email messages).</li> <li>● Provide study sheets and teacher outlines prior to assessments.</li> <li>● Quiet corner or room to calm down and relax when anxious.</li> <li>● Reduction of distractions.</li> <li>● Permit answers to be dictated.</li> <li>● Hands-on activities.</li> <li>● Use of manipulatives.</li> <li>● Assign preferential seating.</li> <li>● No penalty for spelling errors or sloppy handwriting.</li> <li>● Follow a routine/schedule.</li> <li>● Provide student with rest breaks.</li> <li>● Use verbal and visual cues regarding directions and staying on task.</li> <li>● Assist in maintaining agenda book.</li> </ul>	<p><b>IEP Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide scaffolded vocabulary and vocabulary lists.</li> <li>● Differentiate reading levels of texts (e.g., Newsela).</li> <li>● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.</li> <li>● Provide extra visual and verbal cues and prompts.</li> <li>● Provide links to audio files and utilize video clips.</li> <li>● Provide graphic organizers and/or checklists.</li> <li>● Provide modified rubrics.</li> <li>● Provide a copy of teaching notes, especially any key terms, in advance.</li> <li>● Provide students with additional information to supplement notes.</li> <li>● Modify questioning techniques and provide a reduced number of questions or items on tests.</li> <li>● Allow additional time to complete assignments and/or assessments.</li> <li>● Provide shorter writing assignments.</li> <li>● Provide sentence starters.</li> <li>● Utilize small group instruction.</li> <li>● Utilize Think-Pair-Share structure.</li> <li>● Check for understanding frequently.</li> <li>● Have student restate information.</li> <li>● Support auditory presentations with visuals.</li> <li>● Provide study sheets and teacher outlines prior to assessments.</li> <li>● Use of manipulatives.</li> <li>● Have students work with partners or in groups for reading, presentations, assignments, and analyses.</li> <li>● Assign appropriate roles in collaborative work.</li> <li>● Assign preferential seating.</li> <li>● Follow a routine/schedule.</li> </ul>
<p><b>Gifted and Talented Accommodations:</b></p>	<p><b>ML Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide extended time.</li> </ul>

- Differentiate reading levels of texts (e.g., Newsela).
- Offer students additional texts with higher lexile levels.
- Provide more challenging and/or more supplemental readings and/or activities to deepen understanding.
- Allow for independent reading, research, and projects.
- Accelerate or compact the curriculum.
- Offer higher-level thinking questions for deeper analysis.
- Offer more rigorous materials/tasks/prompts.
- Increase number and complexity of sources.
- Assign group research and presentations to teach the class.
- Assign/allow for leadership roles during collaborative work and in other learning activities.

- Assign preferential seating.
- Assign peer buddy who the student can work with.
- Check for understanding frequently.
- Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc...).
- Have student repeat directions.
- Make vocabulary words available during classwork and exams.
- Use study guides/checklists to organize information.
- Repeat directions.
- Increase one-on-one conferencing.
- Allow student to listen to an audio version of the text.
- Give directions in small, distinct steps.
- Allow copying from paper/book.
- Give student a copy of the class notes.
- Provide written and oral instructions.
- Differentiate reading levels of texts (e.g., Newsela).
- Shorten assignments.
- Read directions aloud to student.
- Give oral clues or prompts.
- Record or type assignments.
- Adapt worksheets/packets.
- Create alternate assignments.
- Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted.
- Allow student to resubmit assignments.
- Use small group instruction.
- Simplify language.
- Provide scaffolded vocabulary and vocabulary lists.
- Demonstrate concepts possibly through the use of visuals.
- Use manipulatives.
- Emphasize critical information by highlighting it for the student.
- Use graphic organizers.
- Pre-teach or pre-view vocabulary.
- Provide student with a list of prompts or sentence starters that they can use when completing a written assignment.

- |  |  |
|--|--|
|  | <ul style="list-style-type: none"><li>• Provide audio versions of the textbooks.</li><li>• Highlight textbooks/study guides.</li><li>• Use supplementary materials.</li><li>• Give assistance in note taking</li><li>• Use adapted/modified textbooks.</li><li>• Allow use of computer/word processor.</li><li>• Allow student to answer orally, give extended time (time-and-a-half).</li><li>• Allow tests to be given in a separate location (with the ESL teacher).</li><li>• Allow additional time to complete assignments and/or assessments.</li><li>• Read question to student to clarify.</li><li>• Provide a definition or synonym for words on a test that do not impact the validity of the exam.</li><li>• Modify the format of assessments.</li><li>• Shorten test length or require only selected test items.</li><li>• Create alternative assessments.</li><li>• On an exam other than a spelling test, don't take points off for spelling errors.</li></ul> |
|--|--|

## *UNIT 1 OVERVIEW*

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Intro to Python with Tracy the turtle

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students are introduced to computer programming through Tracy the Turtle. Students will give commands to the turtle and instruct it to perform simple drawing tasks. In doing so, students will discover what it means to program and improvise their problem solving skills.

**Approximate Length of Unit:** 6 weeks

## *LEARNING TARGETS*

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.
- 9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and

propose a resolution to a real-world problem.

**9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

**HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

**RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Computer programming is a sequence of commands that are read by a computer in a language it can understand
- Commands are functions that can be created by the user, and then used by the user as they see fit
- Control structures help programmers create efficient, organized programs

### **Unit Essential Questions:**

- What is programming and how does it work?
- What is a computer command?
- How can computers “get stuck” while trying to execute commands?
- What is a control structure?
- How are complex problems broken down into smaller problems through programming?

### **Knowledge and Skills:**

*Students will know...*

- The four basic Karel commands: move, turnLeft, putBall, and takeBall
- The difference between defining a function versus calling a function
- How to create a function
- Where the “beginning” of a program is



- What an if/if-else statement does
- The difference between a for loop and a while loop
- How to comment code
- The importance of “top-down” design when it comes to programming

*Students will be able to...*

- Complete various programming tasks on CodeHS
- Use functions, loops and conditionals to solve complex programming tasks
- Explain how their code works using comments

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
  
- **End of Unit Assessment:** Students will identify terminology, as well as the key concepts of the unit. Students will also be given a program to solve using programming and explain their thought process for the solution code.

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## ***RESOURCES***

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and videos

**Equipment Needed:**

- Classroom Computers/Chromebooks
- Access to high speed internet
- CodeHS.org

## *UNIT 2 OVERVIEW*

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Basic Python and Console interaction

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students will learn how to make a basic Python program. Students will apply many concepts and ideas learned from programming with Turtle to help them create their first Python programs, while at the same time, learning about some distinct differences. Key new concepts such as variables, data types, user input, mathematical operators, logical operators and code comments provide students with an entirely new dynamic when designing and solving programming tasks.

**Approximate Length of Unit:** 4 weeks

## *LEARNING TARGETS*

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for

accomplishing a specific task.

**9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

**9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

**HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

**RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Python is a real-world programming language that is used today in creating software applications
- Variables are used to store information inside our programs, and help us solve complicated tasks that would otherwise be very difficult without their use
- User input allows for interaction between the program and the person running the computer program. It allows the application to be interactive.
- Arithmetic expressions and logical operators are an integral part of computer programming and its functionality

### **Unit Essential Questions:**

- What is similar in how programs are created in Python versus Turtle, and what is distinctly different?
- How do variables change our approach to solving programming tasks?
- How does user input affect our ability to create complex, engaging programs?
- Why is it useful for a program to be able to output messages to the user?
- How can we store data in Python?
- How can we debug Python programs?
- What are some rules and guidelines for writing Python variable names?

- How are math operators used in Python?
- How can data be compared in Python?
- How can conditions be combined in Python?
- How can variables be used to perform computations?

**Knowledge and Skills:**

*Students will know...*

- How to print text on a screen
- How to prompt a user to enter data (text data, numerical data, etc.)
- How to create a variable, assign it a value, modify its value, and use it within a program
- How to use mathematical operators and logical operators, and why it is used in Python programming

*Students will be able to...*

- Print text in Python
- Define Python variables and types
- Incorporate user input into their programs
- Create programs that take in user input, do simple computations with the input, and produce useful output
- Use mathematical operators with strings
- Incorporate comments into their programs in order to make them more readable

<b><i>EVIDENCE OF LEARNING</i></b>
------------------------------------

**Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- End of Unit Assessment :
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code

**Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects

- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## *RESOURCES*

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

### **Equipment Needed:**

- Classroom computers
- CodeHS.org
- High Speed Internet

## ***UNIT 3 OVERVIEW***

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Conditional Statements

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students will learn how to create the various conditional statements in Python that they first learned in Tracy the Turtle. With the introduction to variables from Unit 2, there are now several new concepts that students will need to master, including Booleans, Logical Operators, and Comparison Operators and conditional IF-ELSE statements. These new topics and concepts play an integral role in the functionality of many of the conditional statements students will use to create complex applications.

**Approximate Length of Unit:** 4 weeks

## ***LEARNING TARGETS***

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for

accomplishing a specific task.

**9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

**9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

**HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

**RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Booleans are a primitive form of data that can be read directly by a computer
- Comparison and Logical operators are an integral part of the control structures of programming
- Algorithms can be created from an idea, by combining existing algorithms, or by modifying existing algorithms
- Conditional statements, or “if-statements,” affect the sequential flow of control by executing different statements based on the value of a Boolean expression
- Nested conditional statements consist of conditional statements within conditional statements

### **Unit Essential Questions:**

- What is a Boolean, and how is it used in Python?
- How do Comparison and Logical Operators make the various control structures work?
- How do you apply a control structure to write a program that functions as intended?

### **Knowledge and Skills:**

*Students will know...*

- Booleans can take on either a true or false value
- Logical operators are used to combine Boolean expressions and are used in if/if-else statements and while loops



- Comparison operators are used for mathematical expressions and are used in loop structures
- Conditional structures help solve large and complex problems in programming

*Students will be able to...*

- Create and use Boolean variables and expressions
- Explain the meaning of each of the comparison operators (<, <=, >, >=, ==, !=)
- Determine whether a combination of Boolean expressions is true or false based on the truth tables for the Logical Operators AND or OR
- Use Comparison Operators to solve programming tasks
- Create and use If/If-Else Statements in Python
- Use conditional statements to solve complex problems in programming

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## ***RESOURCES***

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

**Equipment Needed:**

- CodeHS.org
- Classroom computers
- High Speed Internet

## ***UNIT 4 OVERVIEW***

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Control Statements

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students will learn how to create the various looping statements in Python that they first learned in Tracy the Turtle. With the introduction to Booleans, Logical Operators, Comparison Operators and conditional IF-ELSE statements, students can design complex algorithms to solve problems. These new topics and concepts play an integral role in the functionality of many of the looping statements students that will use to create complex applications.

**Approximate Length of Unit:** 6 weeks

## ***LEARNING TARGETS***

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

**9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

**9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.

**9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

**9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

**HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

**RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Comparison and Logical operators are an integral part of the control structures of programming
- Nested control structures add an even greater level of complexity to programming

### **Unit Essential Questions:**

- How can we use a control structure to continuously check whether a condition is true and execute based on the result?
- How do you combine control structures to achieve a desired output?
- How do Comparison and Logical Operators make the various control structures work?
- How do we use control structures to order programming statements in Python?

### **Knowledge and Skills:**

*Students will know...*

- While loops allow code to be executed repeatedly based on a condition
- While loop might create an infinite loop if not used correctly

- How to use i as a variable in the for loop as well as how to control the values of i
- A break statement is used to immediately terminate a loop
- A continue statement is used to skip out of future commands inside a loop
- To use control structures within control structures, which are referred to as nested control structures.

*Students will be able to...*

- Effectively use while loops in their programs
- Detect and resolve infinite loops
- Implement for loops
- Use the variable i as a counter
- Control the values of “i” in a for loop
- Explain the critical difference between break and continue
- Describe why a break or continue statement would be needed in a coding scenario
- Identify the different control structures that can be used to modify the flow of control through a program
- Combine control structures to solve complicated problems
- Choose the proper control structure for a given problem

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges

- Individualized student to teacher code demonstrations

**Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com

***RESOURCES***

- Teacher designed worksheets
- CodeHS.com lesson exercises and video

**Equipment Needed:**

- Classroom computers
- High Speed Internet

***UNIT 5 OVERVIEW***

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Functions and Parameters

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students learn about Functions. Functions let us break our program into different parts that we can organize and reuse however we like. Functions are the main building block of complex Python programs. We dive deeper into the concept of functions by exploring how to use parameters and understand the difference between a local and global variable. Students will learn what parameters are, and how to send them along while calling a function. Students explore functions with return values and deepen their understanding of and ability to use functions. Students explore Python’s way of handling errors with exceptions.

**Approximate Length of Unit:** 4 weeks

***LEARNING TARGETS***

**NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.

- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

**Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.
- 9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
- 9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice
- 9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

**Interdisciplinary Connections and Standards:**

- HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

**NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

- RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
- NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

**Unit Understandings:**

*Students will understand that...*

- Functions are essential in higher level programming
- Parameters are values sent to a function when called in order to allow the function to perform some action or computation based on the value of those parameters
- Functions with return values are useful in certain scenarios, and are sometimes preferred to functions without return values

**Unit Essential Questions:**

- How do functions modularize code?
- How do you efficiently write functions into a program?
- How do you write a program using a function?
- How do you provide information to a function?

**Knowledge and Skills:**

*Students will know...*

- How to define and call a function in Python
- What a parameter is
- What a return value is, and how it is used
- Why functions are essential to programming

*Students will be able to...*

- Modularize their programs with functions
- Effectively use parameters to customize functions in their programs
- Describe the different namespaces with regards to variables and functions
- Remove complexity from their programs by abstracting with functions
- Generalize their functions with parameters
- Chain functions together using return values
- Create programs that can gracefully handle exceptions
- Continue to function when an error is raised

***EVIDENCE OF LEARNING***

**Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion



- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

**Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

**RESOURCES**

**Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

**Equipment Needed:**

- Classroom computers
- High Speed Internet

**UNIT 6 OVERVIEW**

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Strings

**Target Course/Grade Level:** 9-12

**Unit Summary:** Students will learn how indexing can be used to specify a specific character in a string based on location. Students will learn how slicing allows them to select multiple string values at once from a given string. In Python, strings have the property of “immutability” which means they cannot be mutated or changed. students will look at the use of for loops with strings. Since both string indices and for loops index at zero, the len value can be used to go through strings in a for loop.

**Approximate Length of Unit:** 4 weeks

## *LEARNING TARGETS*

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.
- 9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
- 9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice
- 9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

- HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

- RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Searching for specific characters in string can be done using Indexing and loops
- Strings are the most common data types used in Python
- Strings are immutable

### **Unit Essential Questions:**

- What are the various inbuilt python functions to manipulate strings?
- How can you search for a string using indexing and loops?
- How to use the IN keyword to check if a character is in a string

### **Knowledge and Skills:**

*Students will know...*

- How to concatenate strings to make a new string.
- A substring is part of an existing string.
- How to use indexing and for loops to search through a string
- How to define immutable strings
- How to slice a string to select specific values from the string

*Students will be able to...*

- Use indexing in order to find a specific character in a string
- Use slicing to select a set of values from a string
- Explain what immutability is and how this applies to strings in Python
- Iterate over characters in a string using for loops
- Use the in keyword to check if a character is in a string
- Use various string methods to alter string values

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## ***RESOURCES***

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

### **Equipment Needed:**

- Classroom computers
- High Speed Internet

## *UNIT 7 OVERVIEW*

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Creating and Altering Data Structures

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this unit, students will learn that tuples are a heterogenous, immutable data type that stores an ordered sequence of things that can be accessed using indices. In addition, students will learn that a list is a mutable, heterogeneous data type that stores an ordered sequence of things. Students will be able to edit lists and iterate through them. Various list methods will be implemented to solve complex problems.

**Approximate Length of Unit:** 4 weeks

## *LEARNING TARGETS*

### **NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

### **Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal

design solutions.

**9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.

**9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

**9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

### **Interdisciplinary Connections and Standards:**

**HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

### **NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

**RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

### **Unit Understandings:**

*Students will understand that...*

- Lists and Tuples allow multiple related items to be treated as a single value
- Control statements can be used to traverse a list or tuple
- Sequential search algorithms check each element of a list, in order, until the desired value is found or until the list ends

### **Unit Essential Questions:**

- How are collections of data stored in Python?
- How can programs search and move over a collection of data?
- How can we manipulate lists and the data within?
- How can we manipulate tuples and the data within?

### **Knowledge and Skills:**

*Students will know...*

- How to store information in a list or tuple
- How to search for specific data through a list or tuple

*Students will be able to...*

- Create and store information in tuples
- Understand and explain the characteristics of a tuple
- Use lists to store and recall information
- Understand and explain the characteristics of a list
- Use for loops to go through items in a list
- Apply useful list methods to alter and access information about a list

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## ***RESOURCES***

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

**Equipment Needed:**

- Classroom computers
- High Speed Internet

***UNIT 8 OVERVIEW***

**Content Area:** Computer Science I ( Python Programming)

**Unit Title:** Extending Data Structures

**Target Course/Grade Level:** 9-12

**Unit Summary:** In this lesson, students will learn how 2d lists are stored and how to use indexing and slicing to extract specific items from a list of lists. Students will implement list comprehensions to alter the items in a list with one line of code. Students will also learn how packing and unpacking makes assigning variables to list items very easy and the concepts of implementing dictionaries differ from other data structures and why they are useful. Students will learn the difference between equivalence and identity of values.

**Approximate Length of Unit:** 4 weeks

***LEARNING TARGETS*****NJ Student Learning Standards:**

- 8.2.12.ED.1:** Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2:** Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3:** Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.



- 8.2.12.ED.4:** Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 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.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.
- 8.1.12.AP.9:** Collaboratively document and present design decisions in the development of complex programs

**Career Readiness, Life Literacies, and Key Skills:**

- 9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.1:** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task.
- 9.4.12.TL.4:** Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
- 9.4.12.CT.1:** Identify problem-solving strategies used in the development of an innovative product or practice
- 9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving

**Interdisciplinary Connections and Standards:**

- HS-ETS1-4:** Use a computer simulation to model the impact of proposed solutions to a complex real world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

**NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:**

- RST.9-10.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.9-10.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- RST.9-10.9.** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
- NJSLSA.W1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

**Unit Understandings:**

*Students will understand that...*

- A dictionary is a collection which is ordered, changeable and does not allow duplicates

- Dictionary items are presented in key:value pairs, and can be referred to by using the key name
- 2 Dimensional lists are used to store and organize complex data

**Unit Essential Questions:**

- What is the purpose of creating a 2D List?
- How is a dictionary different from a 2D List?
- How is data organized in a 2D List?
- How is data organized in a Python Dictionary?

**Knowledge and Skills:**

*Students will know...*

- How to create 2 dimensional lists
- How to add items to a list and update lists
- How to create dictionaries in Python
- How to access items in a dictionary

*Students will be able to...*

- Use 2d lists to store information in rows and columns
- Perform list comprehensions in order to alter all items in a list at once
- Pack and unpack lists in order to quickly and efficiently assign variables to list items
- Use dictionaries to structure data
- Predict if two values are identical and/or equivalent

<b><i>EVIDENCE OF LEARNING</i></b>
------------------------------------

**Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- CodeHS.com lesson exercises
- Class participation
- Class discussion
- **End of Unit Assessment:**
  - Students will identify terminology, as well as the key concepts of the unit.
  - Students will also be given a program to solve using programming and explain their thought process for the solution code.

**Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Group programming projects
- Teacher demonstrations over Screen Share software
- Reinforcement worksheets and extra practice
- Paired-programming challenges
- Individualized student to teacher code demonstrations

## *RESOURCES*

### **Teacher Resources:**

- Demonstrations of worked out solutions from CodeHS.com
- Teacher designed worksheets
- CodeHS.com lesson exercises and video

### **Equipment Needed:**

- Classroom computers
- High Speed Internet