Rhode Island Computer Science Principles in Python

High School (140 Contact Hours)

Course Overview and Goals

The Rhode Island Computer Science Principles in Python course introduces students to the foundational concepts of computer science and explores the impact computing and technology have on our society.

With a unique focus on creative problem solving and real-world applications, the CodeHS RI Computer Science Principles course gives students the opportunity to explore several important topics of computing using their own ideas and creativity, use the power of computing to create artifacts of personal value, and develop an interest in computer science that will foster further endeavors in the field.

Learning Environment

The course utilizes a blended classroom approach. The content is a mix of web-based and physical activities. Students will write and run code in the browser, create websites and digital artifacts, and engage in in-person collaborative exercises with classmates. Teachers utilize tools and resources provided by CodeHS to leverage time in the classroom and give focused 1-on-1 attention to students. Each unit of the course is broken down into lessons. Lessons consist of video tutorials, short quizzes, example programs to explore, written programming exercises, free response exercises, collaborative creation projects, and research projects.

Programming Environment

Students write and run programs in the browser using the CodeHS editor. Students will be able to write text-based Python programs, and students will use a graphics library to create Python graphical programs. Students gain programming experience early on in the course that will enable them to explore the rest of the course topics through computational thinking practices.

More Information

Browse the content of this course at https://codehs.com/course/23323/overview

Prerequisites

There are no official prerequisites for the CodeHS RI Computer Science Principles in Python course. This course is meant to be a first-time introduction to computer science and does not require students to come in with any computer programming experience. We also recommend that students complete a first-year high school algebra course prior to taking this course. Students should be comfortable with functions and function notation such as f(x) = x + 2 as well as using a Cartesian (x, y) coordinate system to represent points in a plane.

Course Breakdown

Unit 1: Introduction to Programming (3 weeks/15 hours)

This course begins with a strong focus on programming in order to allow students to create computational artifacts early on in the course. Students will be able to use their knowledge of programming to explore future topics in the course.

We use Karel, a dog that only knows how to move, turn left, and place tennis balls in his world, to show students what it means to program, and allow students to focus on computational problem-solving. Students will learn about the need for programming languages, the uses of programs, how to write programs to solve computational problems, how to design algorithms, how to analyze and compare potential solutions to programming problems, and learn the value and challenges involved in collaborating with others to solve programming problems.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/32108

Objectives / Topics	● Commands ● Defining vs. Calling Methods ● Designing methods ● Program entry points ● Control flow ● Looping ● Conditionals ● Classes ● Commenting code ● Preconditions and Postconditions ● Top-Down Design
Example Assignments	● 26 Karel Programming Exercises and Challenges in total ● Program-specific tasks for Karel the Dog ○ Example Exercise: Pyramid of Karel Write a program to have Karel build a pyramid. There should be three balls in the first row, two in the second row, and one in the third row. ● Teach Karel new commands like `turnRight()` or `makePancakes()` ○ Example Exercise: Pancakes Karel is the waiter. He needs to deliver a stack of pancakes to the guests on the 2nd, 4th, and 6th avenue. Each stack of pancakes should have three pancakes. Create a method called `makePancakes()` to help Karel solve this problem. ● Solve large Karel problems by breaking them down into smaller, more manageable problems using Top-Down Design ○ Example Exercise: The Two Towers In this program, Karel should build two towers of tennis balls. Each tower should be 3 tennis balls high. In the end, Karel should end up on top of the second tower, facing East. ● Using control structures and conditionals to solve general problems ○ Example Exercise: Random Hurdles Write a program that has Karel run to the other side of the first street, jumping over all of the hurdles. However, the hurdles can be in random locations. The world is fourteen avenues long.

Unit 2: Programming with Python (2 weeks/10 hours)

Students learn the basics of Python, including variables, user input, control structures, functions with parameters and return values, and basic graphics, and how to send messages to objects.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/11695

Objectives / Topics	● Pseudocode ● Programming Languages ● Variable Names ● Data Types ● Program Behavior ● Order of Operations ● Modulus ● Strings ● User Input
Example Assignments	● Hello World ○ In this lesson, students will learn how to print messages out onto the console using the Python command `print`. ● Variables ○ In this lesson, students learn how to assign values to variables, manipulate those variable values, and use them in program statements. This is the introductory lesson into how data can be stored in variables. ● User Input ○ In this lesson, students learn how they can allow users to input information into their programs, and use that input accordingly. ● Basic Math in Python ○ In this lesson, students learn about the different mathematical operators they can use to perform mathematical computations and create useful programs that compute information for the user. ● Using Graphics in Python ○ In this lesson, students will learn the basics of creating graphics objects. Graphic creation relies on setting the type, shape, size, position, and color on the artist's canvas before adding to the screen. Using geometric concepts, multiple graphic objects can be created in Python. ● Mouse Events ○ In this lesson, students are introduced to a way input can be taken from the user's mouse using the mouse clicked method.

Unit 3: Python Control Structures (2 weeks/10 hours)

Students learn how to use booleans and logical operators with control structures to make more advanced programs in Python.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/11696

Objectives / Topics	● Booleans ● Logical Operators ● Comparison Operators ● If Statements ● For Loops in Python

	● Random Numbers ● While Loops ● Loop and a Half
Example Assignments	● Booleans ○ In this lesson, students will learn more about boolean values. Booleans refer to a value that is either true or false, and are used to test whether a specific condition is true or false. ● Logical Operators ○ In this lesson, students will learn about logical operators. Logical operators allow students to connect or modify Boolean expressions. Three logical operators are `and`, `or`, and `not`. ● Comparison Operators ○ In this lesson, students learn how to use comparison operators. Comparison operators let students compare two values. ● If Statements ○ In this lesson, students learn about if statements as a way to make decisions and execute specific code depending on the validity of a condition. ● For Loops in Python ○ In this lesson, students will learn in greater detail about for loops. For loops in Python are written and executed in the same manner as Karel exercises, except now students will explore modifying the initialization statement, test statement, and increment statements of the loops. ● Random Numbers ○ In this lesson, students will learn how random numbers can enhance a program and be used in combination with various control structures. ● While Loops ○ In this lesson, students will explore while loops and Python variables. This combines the ideas of creating variables, updating variables throughout a loop, and determining the correct ending condition. ● Loop and a Half ○ In this lesson, students will learn how to create a Loop and Half. A Loop and a Half is a specific way to write a while loop with the condition being `True`. Inside the loop, students create a `SENTINEL` value to break out of the loop whenever that condition is met, causing the loop to end.

Unit 4: Functions and Parameters (2 weeks/10 hours)

Students learn how to write reusable code with functions and parameters.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/11697

Objectives / Topics	● Functions and Parameters ● Functions and Return Values ● Local Variables and Scope
Example Assignments	● Functions and Parameters ○ Students learn about functions and parameters in the context of Python which builds on their prior knowledge of working with

	functions in Karel. This lesson focuses specifically on defining and calling functions, and passing simple, single parameters to functions. ● Functions and Return Values ○ In this lesson, students learn about return values so they can write functions that do some work and send the result back or use later in the program. ● Python vs Karel ○ In this lesson, students will take a look behind the scenes of Karel. While they are familiar with the basic commands, this lesson explores details about how Karel's API is created. Students will gain a better understanding of APIs while at the same time, applying graphics and function concepts. ● Basic Python and Graphics Challenges ○ Use your knowledge of basic Python to create some fun programs! Students will create their own Ghost drawings from Pacman, a Guessing Game, and a drawing of their own choosing. This will allow students to get creative with their code to show what they have learned.

Unit 5: Cybersecurity and You (3 weeks/15 hours)

In this module, students delve into key areas such as personal data collection, the reliability of online information, cyber ethics and laws, personal data security, cybersecurity essentials, and strategies to combat common cyber threats and their prevention, equipping individuals with the knowledge to navigate the digital landscape responsibly and securely.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/30145

Objectives / Topics	● Digital Footprint and Responsibility ● Personal Data Collection and Security ● Cyber Ethics and Laws ● Cybersecurity Essentials ● Common Cyber Attacks and Prevention
Example Assignments	● Digital Footprint and Responsibility ○ Students explore the impact of social media and technology on teenagers, covering topics like digital footprints, the rise of social media screenings, cyberbullying, and the importance of updating privacy settings. ● Personal Data Collection and Security ○ This lesson delves into the use and security of personal data, discussing how companies like Google utilize user information, the implications of location tracking, legal aspects of privacy, and encourages critical thinking through reflections, checks for understanding, and explorations of browser security settings and the trade-offs of security measures. ● Cyber Ethics and Laws ○ This lesson navigates through cyber ethics, differentiating between ethics and laws, exploring legal consequences, copyright in education, the process of obtaining permissions, and the pros and cons of intellectual property laws. ● Cybersecurity Essentials

	○ This lesson covers cybersecurity, featuring activities on the AAA Security Framework and the CIA Triad, along with exploring the impact of the Internet of Things on data security.

Unit 6: Basic Data Structures (2 weeks/10 hours)

Students will learn the basics of lists in Python while exploring tuples and lists. Students will explore how to create each of these and the various methods to access or alter them.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/12478

Objectives / Topics	● Tuples ● Lists ● Simulations
Example Assignments	● Tuples ○ Students learn about tuples, a heterogenous, immutable data type that stores an ordered sequence of things. Students find the length of tuples with `len`. ● Lists ○ Students create lists, iterate through them, and convert data between strings and lists. ● List Methods ○ Students learn to call methods on lists. ● Simulation ○ Students learn what simulations are, how they are used, and we simulate gravity and Conway's Game of Life.

Unit 7: Data (1 week/5 hours)

Students explore using computational tools to store massive amounts of data, manipulate and visualize data, find patterns in data, and pull conclusions from data.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/11706

Objectives / Topics	● Interpreting Data ● Collecting Data ● Visualizing Data
Example Assignments	● Visualizing and Interpreting Data ○ In this lesson, students will learn about the impact of visually representing data to make information easier to analyze and use. ● Data Collection & Limitations ○ In this lesson, students learn how computers can be used to collect and store data. They learn best practices for interpreting data that is presented. Data visualizations can be very helpful in recognizing patterns and answering questions, but can also be used to mislead if skewed or full of bias.

Unit 8: Creative Development (2-4 weeks/10-20 hours)

Students learn the theory and practice of user interface design. Students learn about what makes an engaging and accessible user interface and will employ an iterative design process including rapid prototyping and user testing to design and develop their own engaging programs.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/11711

Objectives / Topics	● Design Thinking ● Prototyping ● Testing
Example Assignments	● Intro to Design Thinking ○ In this lesson, students are introduced to the concept of design thinking and learn the steps in the design cycle. ● Prototype ○ In this lesson, students will be introduced to prototyping. They will be given guidelines for this step and shown examples in order to successfully create prototypes of their own final project ideas. ● Test ○ In this lesson, students will explore the testing step of the design process. They will see good and bad examples of testing practices and will be able to get feedback on their own prototypes before moving into the building process. ● Project Prep and Development ○ In this final programming module, students will put together all of the concepts learned throughout the course to create a website. They will work with partners or in groups to creatively develop a website that includes aspects from each part of the course.

Unit 9: Project: Mastermind (2 weeks/10 hours)

Students use their knowledge of lists, functions, variables, and control structures to create a basic Mastermind game where players must guess a generated sequence of numbers.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/14545

Objectives / Topics	● Project
Example Assignments	● Let’s Build Mastermind ○ Students use tuples, lists, control structures, conditionals, and other Python programming concepts learned earlier in the course to develop a Mastermind game where players guess a sequence of numbers. This is a guided project.

Unit 10: System Administration (3 weeks/15 hours)

In this unit, students will compare and contrast common operating systems (Windows, Linux, OS) and explain the importance of application security. They will investigate security options and implement user accounts to enforce authentication and authorization. Students will also demonstrate how to work with basic and advanced command prompts.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/30125

Objectives / Topics	● Operating Systems ● Software and Applications ● Application Security ● Browser Configuration ● System Administration ● Command Line Interface
Example Assignments	● Understanding Operating Systems ● Comparing Operating Systems ○ Installing an OS ● File Management ○ What Processor are you Running? ● Software Licenses ● Antivirus Software ○ Data Backups ● Using Cache ● Popup Blockers ● User Accounts ○ Admin vs. Standard ● Host Security ○ Using a Log ● System Commands ○ cd, ls, mk etc ● Network Commands ○ ipconfig, netstat, etc.

Unit 11: IT Concepts (3 weeks/15 hours)

In this unit, students explore the structure and design of the internet and networks, and how this design affects the reliability of network communication, the security of data, and personal privacy. Students will learn how the Internet connects computers all over the world by use of networking protocols.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/30146

Objectives / Topics	● Binary ● Encoding Text and Images in Binary ● IP Addresses ● Routing and Packets ● Protocols: TCP, UDP, HTTP/HTTPS ● How do Websites Work? ● OSI Model ● Impact of the Internet
Example Assignments	● Write a Message in Binary ● Create a Color Pixel Image ● Routing with ARPANET ● Journey of a Web Page ● Troubleshooting with the OSI Model ● Compass Points: The Internet ○ In this activity, students use the Compass Points thinking routine to examine your feelings about the internet and its impact on society.

Unit 12: IT Infrastructure (2 weeks/10 hours)

In this unit, students will learn about the physical elements of computers and networking such as motherboards, RAM, routers, and the use of port numbers, ethernet, and wireless devices.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/30129

Objectives / Topics	● Internal Components of a Computer ● Peripheral Devices ● Network Devices ● Storage and Network Options ● Network Communication ● Network Management
Example Assignments	● Different Types of CPU ● RAM vs. Hard Drive ● Wireless Internet Connections ○ Speed Test ● Security of Cloud Storage ● Ethernet Standards ● Setting Up a Firewall ○ Establish Firewall Rules ● SSH Logs ○ Reading Logs

Unit 13: Final (1 day/1 hour)

Students complete a final exam for the course.

Browse the full contents of this unit at https://codehs.com/course/23323/explore/module/32021

Objectives / Topics	● Final Exam
Example Assignments	● Final ○ Students complete a multiple choice final exam covering many of the concepts and skills learned in the course.

Optional Supplemental Materials

Objectives / Topics	● Karel Extra Practice ● Python Strings ● Basics in HTML/CSS
Example Assignments	● Extra Karel Practice ● Extra Karel Puzzles ● Karel Challenges ● Strings ● Web Development