

Rhode Island Tech Apps and Coding Syllabus

Middle School School (140 Contact Hours)

Course Overview and Goals

The Rhode Island Tech Apps and Coding course is a first year computer science course that is 87% aligned to the Rhode Island standards for students in grades 6-8. Students explore the basics of programming, web design, internet safety, and how information is represented digitally and sent over the Internet. Students will learn to code with Tracy the Turtle, go through the design process to create a website that addresses a community issue, and explore the impacts of internet-based innovations.

With a unique focus on creativity, problem solving and project based learning, RI Tech Apps and Coding gives students the opportunity to explore several important topics of computing using their own ideas and creativity to 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 presentations, 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.

Programming Environment

Students write and run programs in the browser using the CodeHS online editor. Students write text based programs using a modified Python library with Tracy. Students create several webpages using HTML and CSS. These webpages are hosted on the CodeHS website so that students can keep a running portfolio of their creative projects, and easily share their programs with the world. For the micro:bit module, students write and run programs in the browser using the [MakeCode](#) editor and download their programs to their micro:bit devices for further testing.

Prerequisites

This course is designed for complete beginners with no previous background in computer science.

More Information

Browse the content of this course at <https://codehs.com/course/23375/overview>

Time Frame

This course can be structured to fit the time frame of any middle school. The entire course can be taught as a full year course or can be broken into semester or quarter courses based on school needs.

The majority of the modules can be taught in any order with the following exceptions:

- Intro to Programming with Turtle Graphics must be taught *before* Intro to micro:bit.
- Project: Design for Impact must be taught *after* Web Design.

Rhode Island Tech Apps and Coding can be taught as **two semester courses**:

Recommended Semester 1 (70 hours)	Recommended Semester 2 (70 hours)
<ul style="list-style-type: none"> • Intro to Programming with Turtle Graphics • What is computing? • Intro to micro:bit* • Digital Citizenship and Cyber Hygiene • ABCs of Cryptography 	<ul style="list-style-type: none"> • Web Design • Designing for Impact* • Digital Information • The Internet • Project: Effects of the Internet • What is Cybersecurity?

* Note that Intro to micro:bit must be taught after Intro to Programming with Turtle Graphics and Designing for Impact must be taught after Web Design.

Rhode Island Tech Apps and Coding can be taught as **four quarter courses**:

Recommended Quarter 1 (40 hours)	Recommended Quarter 2 (30 hours)
<ul style="list-style-type: none"> • Intro to Programming with Turtle Graphics • Introduction to micro:bit* 	<ul style="list-style-type: none"> • What is computing? • Digital Citizenship and Cyber Hygiene • ABCs of Cryptography
Recommended Quarter 3 (35 hours)	Recommended Quarter 4 (35 hours)
<ul style="list-style-type: none"> • Web Design • Designing for Impact 	<ul style="list-style-type: none"> • Digital Information • The Internet • Project: Effects of the Internet • What is Cybersecurity?

* Note that Intro to micro:bit must be taught after Intro to Programming with Turtle Graphics and Designing for Impact must be taught after Web Design.

* To balance the number of hours in each quarter, Introduction to Physical Computing with micro:bit is taught before What is computing?

Course Breakdown

Unit 1: Intro to Programming with Turtle Graphics (30 hours)

Students learn Python commands, functions, and control structures by drawing shapes on the screen and solving puzzles with Turtle Graphics.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● What is a Command? ● Moving Tracy ● Tracy's Coordinate System ● For Loops ● Functions and Parameters ● Top Down Design ● Variables ● User Input ● If/else Statements ● While Loops ● Using Data to Refine Game Mechanics
Example Assignments / Labs	<ul style="list-style-type: none"> ● 40 exercises total ● Example exercises: <ul style="list-style-type: none"> ○ Row of Circles <ul style="list-style-type: none"> ■ In this program, Tracy should draw a row of circles across the width of the canvas using a for loop. ○ Circle Pyramid <ul style="list-style-type: none"> ■ Write a program that directs Tracy to draw a pyramid with 3 circles on the bottom row, 2 in the middle, and 1 on top. ○ Bubble Wrap 2.0 <ul style="list-style-type: none"> ■ In this program, you should have Tracy add highlights to each bubble from our Bubble Wrap example program. Use top down design to break this large problem into smaller pieces! ○ Guess a Number 3.0 <ul style="list-style-type: none"> ■ Over the course of this challenge, you will test and refine the game mechanics for your 'Guess a Number 2.0' program to make the game more challenging and fun.

Unit 2: What is Computing? (10 hours)

Students review the history of computing, learn about the various parts that make up modern computers, and explore the impact computing has had on today's world.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● History of computers ● What is a computer? ● What is software? ● What is hardware? ● Future of computing ● Troubleshooting Methodology
Example Assignments / Labs	<ul style="list-style-type: none"> ● History <ul style="list-style-type: none"> ○ Find out when the first computers were created ○ Research famous computer innovators

	<ul style="list-style-type: none"> ○ What roles do computers play in your life? ○ Example Activity: <ul style="list-style-type: none"> ■ Summarize an era of advances in computers ● What is a computer? <ul style="list-style-type: none"> ○ What parts do modern computers have? ○ What are input and output devices? ○ Example Activity: <ul style="list-style-type: none"> ■ Draw a computer and label all of its parts, including the input devices and output devices ● Software/Hardware <ul style="list-style-type: none"> ○ What's the difference between hardware and software? ○ What hardware components make up a computer? ○ What is software used for? ○ Example Activity: <ul style="list-style-type: none"> ■ Label the parts of your computer ● Future of Computing <ul style="list-style-type: none"> ○ Research uses of Artificial Intelligence in use now ○ Research new ways of storing data ○ Example Class Activity: <ul style="list-style-type: none"> ■ In what ways can we use technology that we couldn't 10 years ago. Are these technological advances helpful or harmful overall? ● Troubleshooting <ul style="list-style-type: none"> ○ How can you identify and fix an issue with a computing device? ○ Example Class Activity: <ul style="list-style-type: none"> ■ You are interning as an IT specialist for a local gym. An employee is trying to print an inspirational sign that says "I can't weight to go to the gym." Unfortunately, she is experiencing printer issues and is unable to print the sign. You have been called in to troubleshoot and fix the issue.
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Unit 3: Intro to micro:bit (10 hours)

Students learn the basics of physical computing with micro:bit, such as how to light up and change the brightness of LEDs, and how variables can be used to write more versatile programs.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Intro to physical computing ● Goal Setting ● Comments ● Pseudocode ● Analog vs. digital ● Variables ● Connecting external components
Example Assignments / Labs	<ul style="list-style-type: none"> ● 4 explorations ● 11 exercises total ● Example exercises: <ul style="list-style-type: none"> ○ Blinking Diamond <ul style="list-style-type: none"> ■ Blink LEDs between a large diamond shape and small diamond shape every half a second as long as the program is running

	<ul style="list-style-type: none"> ○ Moving Bright Box <ul style="list-style-type: none"> ■ Light the corners on the grid with the highest brightness for half a second. Light the corners of the inner box with a brightness of 150 for half a second. Light the middle LED with a brightness of 50 for half a second. Repeat until the program is manually ended. ○ Opposite Blinking External LEDs <ul style="list-style-type: none"> ■ Blink two external LEDs opposite one another. One LED should be lit while the other is off. After 1 second, the lit LED should turn off and the unlit LED should turn on. After 1 second, they should switch again. This should continue until the program is manually ended
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Unit 4: Digital Citizenship and Cyber Hygiene (10 hours)

Students learn topics on Internet etiquette, how to stay safe on the web, potential effects of digital footprints, how to protect their information, and the implications of cyberbullying.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Digital Footprint and Reputation ● Cyberbullying ● Internet Safety ● Privacy and Security
Example Assignments / Labs	<ul style="list-style-type: none"> ● Digital Footprint and Reputation <ul style="list-style-type: none"> ○ What is a digital footprint? ○ What is your digital footprint and reputation? ○ What does it mean that the internet is public and permanent? ○ Who looks at your digital footprint and reputation? ○ Example activities: <ul style="list-style-type: none"> ■ What is your digital footprint? ■ Are you going to make any changes in what you post on social media? ● Cyberbullying <ul style="list-style-type: none"> ○ What is cyberbullying? ○ What are the impacts of cyberbullying? ○ What do you do if you are being bullied or see bullying? ○ How can you be an upstander? ○ Example activities: <ul style="list-style-type: none"> ■ Explore cyberbullying scenarios: What would you do? ● Internet Safety <ul style="list-style-type: none"> ○ What are some ways to stay safe online? ○ What are some online safety guidelines? ○ Example activities: <ul style="list-style-type: none"> ■ Explore Internet safety scenarios: What would you do? ● Privacy and Security <ul style="list-style-type: none"> ○ What are data privacy and security? ○ How can you keep personal data secure and private? ○ Example activities: <ul style="list-style-type: none"> ■ Test out various passwords on a site ■ Explore Google's privacy policy: What do they know about you?

Unit 5: The ABCs of Cryptography (5-10 hours)

Students dive into the history of cryptography systems, the motivation behind using encryption systems, and basic cryptography systems.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Cryptography, Cryptology, Cryptanalysis ● History of Cryptography ● Why do we Need to Encrypt Data? ● Basic Cryptography Systems: Caesar Cipher ● Basic Cryptography Systems: Cracking the Caesar Cipher ● Basic Cryptography Systems: Vigenère Cipher
Example Assignments / Labs	<ul style="list-style-type: none"> ● Cryptography, Cryptology, Cryptanalysis <ul style="list-style-type: none"> ○ Why do we need some secrecy in our transparent information age? ○ Explain general encryption with data, keys ○ Example activities: <ul style="list-style-type: none"> ■ Video and discussion on securing the cloud ■ Passing notes in class (offline activity) ● History of Cryptography <ul style="list-style-type: none"> ○ Why do we encrypt? ○ What is the flaw in substitution ciphers? ○ What is modern cryptography and how has cryptography changed over time? ○ What is 256-bit key encryption and how does this help cryptography overall? ○ Example activities: <ul style="list-style-type: none"> ■ How did the Enigma work? ● Why do we Need to Encrypt Data? <ul style="list-style-type: none"> ○ Explore the CIA Triad and encryption ○ Example activities: <ul style="list-style-type: none"> ■ Telephone game with math (offline) ■ Modulo math activity sheet ● Basic Cryptography Systems: Caesar Cipher <ul style="list-style-type: none"> ○ Explore examples of the Caesar cipher ○ Example activities: <ul style="list-style-type: none"> ■ Practice with a Caesar Cipher JavaScript program ■ Modify the program to create the decrypting Caesar program ● Basic Cryptography Systems: Cracking the Caesar Cipher <ul style="list-style-type: none"> ○ How do we solve the Caesar Cipher with brute force and using letter frequency analysis? ○ Example activities: <ul style="list-style-type: none"> ■ Practice cracking Caesar Cipher with brute force ■ Practice cracking Caesar Cipher with letter frequency ● Basic Cryptography Systems: Vigenère Cipher <ul style="list-style-type: none"> ○ Explore examples of the Vigenère Cipher ○ Example activities: <ul style="list-style-type: none"> ■ Practice with a Vigenère Cipher JavaScript program

Unit 6: Web Design (20 hours)

Students learn the basics of HTML, CSS, and the processes involved in viewing web pages on the internet.

<p>Objectives / Topics Covered</p>	<ul style="list-style-type: none"> ● Creating webpages using HTML <ul style="list-style-type: none"> ○ Links ○ Images ○ Lists ○ Tables ○ Inline styling ● Styling webpages with CSS <ul style="list-style-type: none"> ○ Creating CSS rules ○ CSS classes ○ CSS IDs ● How webpages are requested and delivered
<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> ● Links <ul style="list-style-type: none"> ○ Learn how to link different pages together ○ Example Exercise: Create a webpage that provides links to your favorite books ● Images <ul style="list-style-type: none"> ○ Learn how to add and format images ○ Example Exercise: Create a collage of images ● Tables <ul style="list-style-type: none"> ○ Learn how to create and style tables ○ Example Exercise: Create a table describing your favorite music artists and songs ● Styling with CSS <ul style="list-style-type: none"> ○ Use CSS to add background colors, font colors, font styles, borders, and position elements on the page ○ Example Exercise: Create CSS classes and IDs to apply formatting to a BINGO board ○ Example Exercise: Create CSS classes to style a music library web page ○ Example Exercise: Create CSS Rules to put a Karel puzzle together ● Viewing websites <ul style="list-style-type: none"> ○ How are web pages served to your computer? ○ Where do web pages live? ● Final Project <ul style="list-style-type: none"> ○ Build your own homepage using everything you've learned in the module ○ This homepage will serve as your personal portfolio of creative projects as you continue through the course!

Unit 7: Designing for Impact (15 hours)

Students go through the design process to develop a website that solves a problem in their community.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● What makes an engaging interface? ● Design Process: <ul style="list-style-type: none"> ○ Empathy ○ Define ○ Ideate ○ Prototype ○ Build ● Accessibility issues ● Rapid prototyping ● User testing ● Using digital surveys to gather, clean, and analyze data
Assignments / Labs	<ul style="list-style-type: none"> ● Example exercises: <ul style="list-style-type: none"> ○ Research existing user interfaces ○ Assess the user interfaces of various web sites ○ Research a problem, and gather empathy and insights for stakeholders who are involved in the problem ○ Create a problem statement based on user research ○ Generate potential solutions for a problem ○ Prototype and test several solutions ○ Design a website using paper prototypes, test these prototypes and get feedback from your peers, and improve your design before implementing it with code ○ Build out your final prototype

Unit 8: Digital Information (10 hours)

Students learn about the various ways we represent information digitally, including number systems, encoding data, and programmatically creating pixel images.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● How digital data is represented ● Encoding data ● Converting and using different number systems <ul style="list-style-type: none"> ○ Binary ○ Hexadecimal ● Manipulating images at the pixel level
Example Assignments / Labs	<ul style="list-style-type: none"> ● Encoding data <ul style="list-style-type: none"> ○ Create your own encoding scheme ○ Encode images using binary ○ Example Activity: <ul style="list-style-type: none"> ■ Write a message by encoding the characters in binary, using the ASCII codes. ● Using different number systems <ul style="list-style-type: none"> ○ Convert numbers between decimal, binary, and hexadecimal ○ Example Activity: <ul style="list-style-type: none"> ■ Earn a high score playing the decimal to binary game or

	<p>decimal to hexadecimal game. Click on the digits to change their values and make the binary or hexadecimal number match the target decimal value.</p> <ul style="list-style-type: none"> ● Manipulating Images <ul style="list-style-type: none"> ○ Make different colors by changing the amount of red, green, and blue present ○ Create image filters ○ Create images pixel by pixel ○ Example Activity: <ul style="list-style-type: none"> ■ Create a pixel rainbow by typing out the hexadecimal color encoding for each pixel
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Unit 9: The Internet (10 hours)

Students explore the structure and design of the internet, and how this design affects the reliability of network communication, the security of data, and personal privacy.

<p>Objectives / Topics Covered</p>	<ul style="list-style-type: none"> ● Structure of the internet ● How network data is transmitted ● Hardware involved in the transmission of data ● How the internet has impacted everyday life
<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> ● Structure of the internet <ul style="list-style-type: none"> ○ Explore the differences between IPv4 and IPv6. Why are we running out of addresses? ○ Explore the different levels of the internet. ○ Example Activity <ul style="list-style-type: none"> ■ Trace a website request from the server, through the network, and to your computer ● How data is transmitted <ul style="list-style-type: none"> ○ How are internet packets able to find their way to your computer? ○ Explain in your own words how a request from your computer travels through the various levels of servers to reach and return the correct webpage and resources? ○ Example Activity: <ul style="list-style-type: none"> ■ As a class, create a protocol that will allow one classmate to send another classmate a note, without the need for talking to each other. ● Hardware involved <ul style="list-style-type: none"> ○ Explore the role of routers ○ Why are protocols so important? ○ Explore how data is able to be transmitted across the ocean by using underwater cables ● Final Project: Effects of the Internet <ul style="list-style-type: none"> ○ Create a presentation, graphic, video, or audio recording detailing a specific Internet-Based Innovation. The subject may be a product that depends on the internet for its core functionality, a cyber security innovation, or social phenomenon. What is the purpose of the innovation? What are the beneficial and harmful effects this innovation has had?

Unit 10: The Effects of the Internet (5 hours)

In this project, students choose an innovation that was enabled by the Internet and explore the effects of this innovation.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Effects of the Internet
Example Assignments / Labs	<ul style="list-style-type: none"> ● Final Project: Effects of the Internet <ul style="list-style-type: none"> ○ Create a presentation, graphic, video, or audio recording detailing a specific Internet-Based Innovation. The subject may be a product that depends on the internet for its core functionality, a cyber security innovation, or social phenomenon. What is the purpose of the innovation? What are the beneficial and harmful effects this innovation has had?

Unit 11: What is Cybersecurity? (10 hours)

This module gives an introduction to cybersecurity. It focuses on why cybersecurity is important, recent threats to cybersecurity, and different careers in the field.

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Common Cybersecurity Attacks ● Impact of Cybersecurity ● CIA Triad
Example Assignments / Labs	<ul style="list-style-type: none"> ● Internet of Things <ul style="list-style-type: none"> ○ Students watch a series of videos that introduce the concept of the IoT as well as the cybersecurity risks it creates. ● Phishing for Your Info <ul style="list-style-type: none"> ○ Students learn about an instance where a couple is tricked by a phishing attack.