CodeHS

New Jersey MS Computer Science Syllabus
One Semester (75 contact hours)

Course Overview and Goals

The New Jersey MS Computer Science course is a first year computer science course that is fully aligned to the NJ 6-8 computer science standards. Students explore the basics of programming, how information is represented digitally and sent over the Internet, and physical computing with micro:bit devices.

With a unique focus on creativity, problem solving and project based learning, the New Jersey MS Computer Science course 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 physical machines, 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. 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/18816

Course Breakdown

Unit 1: Intro to Programming with Turtle Graphics (6 weeks/30 hours)
Browse the full content of this unit at https://codehs.com/course/18816/explore/module/25818

Objectives / Topics Covered	- 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	40 exercises total - Example exercises:

	○ Row of Circles
	  ■ In this program, Tracy should draw a row of circles across the width of the canvas using a for loop.
	○ Circle Pyramid
	  ■ 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
	  ■ 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
	  ■ 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: Digital Information (2 weeks/10 hours)

Browse the full content of this unit at https://codehs.com/course/18816/explore/module/25825

Objectives / Topics Covered	● How digital data is represented
	● Encoding data
	● Converting and using different number systems
	  ○ Binary
	  ○ Hexadecimal
	● Manipulating images at the pixel level

Example Assignments / Labs	● Encoding data
	  ○ Create your own encoding scheme
	  ○ Encode images using binary
	  ○ Example Activity:
	    ■ Write a message by encoding the characters in binary, using the ASCII codes.
	● Using different number systems
	  ○ Convert numbers between decimal, binary, and hexadecimal
	  ○ Example Activity:
	    ■ Earn a high score playing the decimal to binary game or decimal to hexadecimal game. Click on the digits to change their values and make the binary or hexadecimal number match the target decimal value.
	● Manipulating Images
	  ○ Make different colors by changing the amount of red, green, and blue present
	  ○ Create image filters
	  ○ Create images pixel by pixel
	  ○ Example Activity:
	    ■ Create a pixel rainbow by typing out the hexadecimal color encoding for each pixel

Unit 3: The Internet (3 weeks/15 hours)

Browse the full content of this unit at https://codehs.com/course/18816/explore/module/25826

Objectives / Topics Covered	- Structure of the internet - How network data is transmitted - Hardware involved in the transmission of data - How the internet has impacted everyday life
Example Assignments / Labs	- Structure of the internet - Explore the differences between IPv4 and IPv6. Why are we running out of addresses? - Explore the different levels of the internet. - Example Activity - Trace a website request from the server, through the network, and to your computer - How data is transmitted - 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: - 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 - 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 - 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 4: Intro to micro:bit (2 weeks/10 hours)

Browse the full content of this unit at https://codehs.com/course/18816/explore/module/25820

Objectives / Topics Covered	- Intro to physical computing - Goal Setting - Comments - Pseudocode - Analog vs. digital - Variables - Connecting external components
Example Assignments / Labs	4 explorations 11 exercises total - Example exercises:

<table>
<tr><td></td><td>

- ○ Blinking Diamond
  - ■ Blink LEDs between a large diamond shape and small diamond shape every half a second as long as the program is running
- ○ Moving Bright Box
  - ■ 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
  - ■ 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

</td></tr>
</table>

Unit 5: Project: Using Data to Answer a Question (2 weeks/10 hours)
Browse the full content of this unit at https://codehs.com/course/18816/explore/module/25837

Objectives / Topics Covered	● Sample Data Project on Climate Change ● How to Find a Question ● Bias & Accessibility ● Sensors ● Analyzing and Visualizing Data ● Presenting Findings

Example Assignments / Labs	● Sample Project: Climate Change
	  ○ Students will explore why we use models to explain future scenarios and dive into both simple and complex climate models to reflect and synthesize findings
	● Using Data to Answer a Question
	  ○ Students will choose their own question to explore and will use a physical device to collect data to find an answer. They will use data analysis and visualization to present their findings.