CodeHS

Intro to Programming with Tracy the Turtle and micro:bit Syllabus
1 semester for Middle School (70-90 contact hours)

Course Overview and Goals

The Intro to Programming with Tracy the Turtle and micro:bit course merges the Physical Computing with micro:bit and the Introduction to Python with Tracy the Turtle courses. The Tracy course will provide the prerequisite information needed before students apply programming concepts to their physical micro:bit device.

Note that the Tracy lessons are in Python and the micro:bit lessons are in JavaScript. While the languages are different, the programming concepts are the same. The micro:bit lessons have videos and examples that provide a bridge between the differences in syntax.

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 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, pseudocode exercises, physical explorations, example programs, and written programming exercises, adding up to over 60 hours of hands-on programming practice in total.

Programming Environment: Students write and run Tracy the Turtle programs in Python in the browser using the CodeHS online editor. For micro:bit, students write and run programs in JavaScript in the browser using the MakeCode editor and will download their programs to their micro:bit devices for further testing.

Prerequisites: The Intro to Programming with Tracy the Turtle and micro:bit course is designed for complete beginners with no previous background in computer science. The course is highly visual, dynamic, and interactive, making it engaging for those new to computer science.

More information: Browse the content of this course at https://codehs.com/course/9648

Course Breakdown

Unit 1: Tracy's World (.5 week/2 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14523

Objectives / Topics Covered	● What is a command? ● How do we communicate with computers? ● Moving Tracy ● Drawing circles ● Tracy's coordinate system
Example Assignments / Labs	● 3 exercises total ● Commands ○ Drawing simple graphics ○ Example Exercise: Caterpillar Combine multiple commands to write a program that has Tracy draw 5 circles in a row

Unit 2: Moving Tracy Efficiently (1 week/4 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14524

Objectives / Topics Covered	● Turning Tracy at right angles ● For Loops ● Using coordinates and angles to move Tracy’s position
Example Assignments / Labs	● 7 exercises total ● Turning Tracy at right angles ○ Learn how to use the left and right commands to let Tracy explore more of her world ○ Example Exercise: 4 Columns Write a program that will have Tracy split her world into 4 columns by drawing 3 vertical lines 100 pixels apart ● For Loops ○ For loops execute the code inside the loop a set number of times. ○ Example Exercise: Row of Circles In this program, Tracy should draw a row of circles across the width of the canvas using a for loop. ● Using coordinates and angles to move Tracy’s position ○ Any angle can be used to have Tracy draw shapes with diagonal lines. ○ Example Exercise: Hexagon Write a program, using for loops, that has Tracy draw a hexagon on the canvas. ○ Tracy can be moved directly to a position on the canvas using coordinate points. ○ Example Exercise: 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.

Unit 3: Designing and Communicating Solutions (1 week/6 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14525

Objectives / Topics Covered	● Commenting your code ● Naming rules in Python ● Functions ● Artistic commands ● Top Down Design
Example Assignments / Labs	● 8 exercises total ● Commenting Your Code ○ Commenting is important to make sure your code is understandable to yourself and others. ■ Example Exercise: Circle Pyramid with Comments Take your Circle Pyramid program from earlier and add comments to explain what your program is doing. ● Functions ○ Teach Tracy new commands by grouping a set of commands that can be called with one line of code. ○ Example Exercise: Shape Stack Give Tracy instructions to draw a tower of squares and circles from the bottom to the top of the canvas.

	● Artistic Commands ○ There are many ways to get creative with the graphics Tracy draws, such as using color, filling in shapes, and leaving trails with varying thicknesses. ○ Example Exercise: Kid's Shapes Toy Write a program to have Tracy draw a representation of a popular toy used to teach children shapes and colors. There should be 4 different shapes with 4 different colors. ● Top Down Design ○ Solve large Tracy problems by breaking them down into smaller, more manageable problems. ○ Example Exercise: 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!

Unit 4: Controlling Tracy with Variables (1.5 week/7 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14526

Objectives / Topics Covered	● Variables ● User input ● Parameters ● The value of i in for loops
Example Assignments / Labs	● 10 exercises total ● Variables ○ Variables are used to store and manipulate values in our programs. ○ Example Exercise: Dart Board Write a program that uses variables to draw a dart board which consists of 4 concentric circles that each increase in radius by 25 pixels. ● User Input ○ We can use input from a user to control certain commands in our code and make our programs more personalized. ○ Example Exercise: Four Corners User input will dictate the length of the sides of a square. Squares of the indicated size will be drawn in each corner of the canvas. ● Parameters ○ Parameters can be used to customize functions to make them more reusable. ○ Example Exercise: Colorful Caterpillar Use parameters to draw a caterpillar with 8 body circles of 4 different colors. ● The Value of i in For Loops ○ The value of i in a for loop is actually a variable! It can be altered and used to control commands in our code. ○ Example Exercise: Dart Board Using i Alter your previous Dart Board program to use the value of i to control the circle's radius instead of a separate variable.

Unit 5: Intro to Physical Computing with micro:bit (1-2 weeks/5-10 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14520

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: ○ 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

Unit 6: Making Decisions (1 week/5 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14527

Objectives / Topics Covered	● If statements ● If/else statements ● While loops
Example Assignments / Labs	● 6 exercises total ● If statements ○ If statements will execute code only if certain conditions are met ○ Example Exercise: Happy Face Write a program that will draw a happy face on the screen if the user answers that they are happy. ● If/Else statements ○ The if/else statement executes a block of code if a specified condition is true. If the condition is false, another block of code can be executed. ○ Example Exercise: Rating Write a program that shows a graphical representation of a user's rating value. If the value is between 1 and 4, draw a red X. If it is between 5 and 7, draw a yellow horizontal line. If it is an 8 or above, draw a green checkmark.

	● While Loops ○ A while loop allows code to be executed repeatedly based on a given Boolean condition. ○ Example Exercise: Increasing Squares Write a program that has Tracy draw concentric squares form the center of the canvas until the length variable reaches 400 pixels.

Unit 7: Program Control with micro:bit (2-3 weeks/10-15 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14521

Objectives / Topics Covered	● For loops ● While loops ● Variables ● Making sound ● If statements ● If/else statements ● Using buttons ● Using servo motors ● Operators (arithmetic, comparison, and logical) ● Using sensors (light, temperature, acceleration, distance) ● Functions and parameters
Example Assignments / Labs	● 4 explorations ● 17 exercises in total ● Example exercises: ○ Twinkle Twinkle ■ Control your micro:bit to play Twinkle Twinkle Little Star! Use loops (maybe more than one!) to play the song until the program is manually stopped. ○ Servo Position by Button Press ■ Increase the servo position by 90 degrees each time Button A is pressed. Decrease the servo position by 90 degrees each time Button B is pressed. Repeat this motion until the program is manually ended. ○ Temperature Monitor ■ Create a temperature monitor. If the temperature is between 60 and 70 degrees fahrenheit, the middle LED should stay on. If the temperature is below 60 or above 70 degrees fahrenheit, the middle LED should blink on and off at a speed of a quarter second. Repeat this motion until the program is manually ended. ○ LED Arrow Following Servo ■ When button A is pressed, increase the servo position by 90 degrees. When button B is pressed, decrease the servo position by 90 degrees. Use functions to light an LED arrow on the screen that points in the direction of the servo (up, down, left, or right).

Unit 8: Tracy Challenges (1 week/6 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14528

Objectives / Topics Covered	● Control Structures ● Commands ● Defining versus Calling Functions ● Control flow ● Looping ● Conditionals ● Commenting code ● Top Down Design
Example Assignments / Labs	● Challenges ○ Students use all of the skills learned in the course to solve complex puzzles and challenges. ○ Example Exercise: Guess a Number 2.0 Write a program that allows the user to guess a secret number. If their number is too high, draw a down arrow. If their number is too low, draw an up arrow. If they guess the number, draw a checkmark and end the program.

Unit 9: Advanced micro:bit (4-7 weeks/20-35 hours)

Browse the full content of this unit at https://codehs.com/library/course/9648/module/14522

Objectives / Topics Covered	● Challenges ● Explore a new sensor ● Build a step-by-step project ● Final project
Example Assignments / Labs	● Example exercises: ○ Explore a new sensor ■ Research a sensor we have not studied in this course and explore how it is used. In a group, develop and present a lesson to teach your peers about your chosen sensor, including exercises where they can practice using the sensor for themselves. ○ Build a step-by-step project ■ Find a ready-made project online. Follow the steps to recreate the project using your micro:bit and any needed materials. ■ Create an updated set of directions complete with pictures and tips from your experience. ○ Final project ■ Use your micro:bit to bring an idea to life using sensors and external components. ■ Present your project to peers, administration, and family!

Supplemental Material

Supplementary Units	**Prerequisite/Recommended Unit(s)**	**# of activities**
Advanced Tracy Challenges	All modules in course are complete	4
Abstraction	Preferably placed following ‘Top Down Design’ in the ‘Designing and Communicating Solutions’ module.	6
Categorizing Triangles	All modules in course are complete; students should have some basic knowledge of geometry	13