



CodeHS

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

Course Overview and Goals

The Intro to Programming with Karel and micro:bit course merges the Physical Computing with micro:bit and the Introduction to Programming with Karel courses. The Karel course will provide the prerequisite information needed before students apply programming concepts to their physical micro:bit device. **Note:** Supplemental material on variables and parameters will need to be added to the course before students use these concepts with their micro:bit devices.

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 Karel programs in the browser using the CodeHS online editor. For micro:bit, students write and run programs 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 Karel 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/9647>

Course Breakdown

Unit 1: Introduction to Programming (1 week/5 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14510>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● What is Programming ● Commands ● Introduction to functions ● History of Computers ● Computers' Role in Your Life ● Software explained
Example Assignments / Labs	<ul style="list-style-type: none"> ● Commands <ul style="list-style-type: none"> ○ 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 on the first row, two in the second row, and one in the third row. ● Functions <ul style="list-style-type: none"> ○ Teach Karel <code>turnRight()</code>

	<ul style="list-style-type: none"> ○ Example Exercise: Fireman Karel There is a fire, and Karel needs to slide down a fireman's pole. Define and use the <code>turnRight()</code> function to help Karel get to the ground. ● Computers' Role in Your Life <ul style="list-style-type: none"> ○ List three to five ways that computers are involved in your day to day life. ○ What do you think you will be able to do with computers 10 years from now that you cannot do now?
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Unit 2: Intro to micro:bit (1-2 weeks/5-10 hours)

Note: Supplemental material must be added to introduce students to variables before beginning this module

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14507>

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 ○ 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

Unit 3: Functions (1 week/4 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14511>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Functions ● The Start function ● Top Down Design and Decomposition
Example Assignments / Labs	<ul style="list-style-type: none"> ● Functions <ul style="list-style-type: none"> ○ Teach Karel new commands like <code>turnRight()</code> or <code>makePancakes()</code> ○ Example Exercise: Pancakes

	<p>Commands</p> <ul style="list-style-type: none"> ■ 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 on the first row, two in the second row, and one in the third row. <ul style="list-style-type: none"> ● Top Down Design <ul style="list-style-type: none"> ○ Solve large Karel problems by breaking them down into smaller, more manageable problems ○ Example Exercise: The Two Towers In this program, Karel should build two towers of tennis balls. Each tower should be 3 tennis balls high. At the end, Karel should end up on top of the second tower, facing East.
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Unit 4: Super Karel and For Loops (1 week/4 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14512>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Commenting Your Code ● Super Karel ● For Loops
Example Assignments / Labs	<ul style="list-style-type: none"> ● Commenting Your Code <ul style="list-style-type: none"> ○ Commenting is important to make sure your code is understandable to yourself and others. <ul style="list-style-type: none"> ■ Example Exercise: The Two Towers + Comments Take your Two Towers program from earlier, and comment each of the functions to explain what your program is doing. ● Super Karel <ul style="list-style-type: none"> ○ Super Karel knows how to <code>turnRight()</code> and <code>turnAround()</code>, so you don't need to define these functions before you call them ○ Example Exercise: The Two Towers + SuperKarel Take your Two Towers program from earlier, and make it work with SuperKarel. This means you can get rid of your definition for <code>turnRight</code>, because SuperKarel already knows <code>turnRight</code>! ● For Loops <ul style="list-style-type: none"> ○ For loops execute the code inside the loop a set number of times. ○ Example Exercise: Dizzy Karel Write a program to have Karel spin in place 8 times. This means Karel is going to need to turn left 32 times. You must use a for loop in this program.

Unit 5: If Statements (.5 week/2 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14513>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● If Statements ● If/Else Statements
Example Assignments / Labs	<ul style="list-style-type: none"> ● If statements <ul style="list-style-type: none"> ○ If statements will execute code only if certain conditions are met <ul style="list-style-type: none"> ■ Example Exercise: Is there a ball?

	<p>If there is a ball in the first spot, move once. Otherwise, put a ball down and then move once. Karel should end up on the second column in the first row, and there should be a ball at 1, 1.</p> <ul style="list-style-type: none"> ● If/Else statements <ul style="list-style-type: none"> ○ 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: Right Side Up Karel got spun around and is facing the wrong direction. Karel could either be facing south or west, and you need to get Karel back to facing east. You must use an if/else statement here.
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Unit 6: While Loops (.5 week/2 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14514>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● While Loops
Example Assignments / Labs	<ul style="list-style-type: none"> ● While Loops <ul style="list-style-type: none"> ○ A while loop allows code to be executed repeatedly based on a given Boolean condition <ul style="list-style-type: none"> ■ Example Exercise: Big Tower You need to make a tall tower (all the way to the top) of tennis balls in the column Karel is standing in at the start. Karel could be in any column, and the world's height could be any size. Your solution should include more than one helper function. Karel can start facing any direction, so you need to make sure to orient Karel to the North.

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/9647/module/14508>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● 4 explorations ● 17 exercises in total ● Example exercises: <ul style="list-style-type: none"> ○ Twinkle Twinkle <ul style="list-style-type: none"> ■ 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

	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ■ 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 <ul style="list-style-type: none"> ■ 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 <ul style="list-style-type: none"> ■ 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).
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Unit 8: Control Structures (1 week/4 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14515>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Control Structures ● Indenting Code
Example Assignments / Labs	<ul style="list-style-type: none"> ● Control Structures <ul style="list-style-type: none"> ○ Students learn how to determine which control structure is appropriate for a given task <ul style="list-style-type: none"> ■ Example Exercise: Decorate the Fence Karel is getting ready for Halloween by putting up jack-o-lantern lights. Help Karel by finding the wall to string lights on and putting down lights along the wall. However, Karel doesn't want lights blocking the doors and windows! Make sure that you only put lights where there is a wall. Karel starts in the bottom left corner facing East. Karel should end at the top of the wall, facing North. ● Indenting Code <ul style="list-style-type: none"> ○ Indenting Code makes programs more readable and helps you avoid error. <ul style="list-style-type: none"> ■ Example exercise: Staircase This program builds a staircase in any sized square world, but the indenting is all wrong. Your job is to fix it, so the indentation is correct. Remember, push tab to indent once to the right and delete/backspace to remove a tab.

Unit 9: Karel Challenges (1 week/5 hours)

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14516>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Commands ● Defining versus Calling Methods ● Designing methods ● Control flow
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	<ul style="list-style-type: none"> ● Looping ● Conditionals ● Commenting code ● Preconditions and Postconditions ● Top Down Design
Example Assignments / Labs	<ul style="list-style-type: none"> ● Challenges <ul style="list-style-type: none"> ○ Students use all of the skills learned in the course to solve complex puzzles and challenges. <ul style="list-style-type: none"> ■ Example exercise: Go Through the Fence Karel is stuck in the backyard, but really, really wants to get out to play in the neighbor's backyard. Karel knows there is a hole somewhere in the fence, but the pesky humans keep fixing the hole. Luckily, a new hole opens up almost every day! Help Karel by finding the hole in the fence, and going through it. Remember that the hole moves day to day. Karel starts in the bottom left corner facing East. Karel should end in the top right corner facing East.

Unit 10: Advanced micro:bit (4-7 weeks/20-35 hours)

Note: The final project lesson in this module can be combined with the next final project module

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14509>

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Challenges ● Explore a new sensor ● Build a step-by-step project ● Final project
Example Assignments / Labs	<ul style="list-style-type: none"> ● Example exercises: <ul style="list-style-type: none"> ○ Explore a new sensor <ul style="list-style-type: none"> ■ 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 <ul style="list-style-type: none"> ■ 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 <ul style="list-style-type: none"> ■ Use your micro:bit to bring an idea to life using sensors and external components. ■ Present your project to peers, administration, and family!

Unit 11: Final Project (.5 weeks/2 hour)

Note: This module can be combined with the project completed in the previous micro:bit module

Browse the full content of this unit at <https://codehs.com/library/course/9647/module/14517>

Objectives / Topics	Final Project
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Covered	
Assignments / Labs	<ul style="list-style-type: none">• Students brainstorm, discuss, and pseudocode to create a fully functional Karel program that solves a puzzle, creates a picture, or completes some other challenge of their choosing