

CodeHS

WV Discovering Computer Science Course Syllabus
One Semester (60-70 contact hours)

Course Overview and Goals

The West Virginia Discovering Computer Science course is a beginner-level computer science course that is fully aligned to the WV state course of the same name. The course is designed for students in grades 6-8 and will provide them with opportunities to explore the many facets of Computer Science. This may be taught in a single class in one grade level or divided into sections and taught over a three-year period. See timing notes below.

Students explore the basics of programming, computing ideas, online safety, and how information is represented digitally and sent over the Internet. Students will learn to code with Karel the Dog, go through the design process to create a public service announcement that addresses a current issue, and explore the impacts of internet-based innovations.

With a unique focus on creativity, problem solving and project based learning, this 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 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 JavaScript library with Karel.

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

Time Frame: This course can be structured to fit the time frame of any middle school. The entire course can be taught in a semester or can be broken into modules based on the school needs.

The majority of the 10-hour modules can be taught in any order with one exception:

- We recommend teaching *Exploring Code with Karel* before *Exploring Simulations* and *Exploring Art with Code* in order to provide a strong programming foundation.

More information: Browse the content of this course at https://codehs.com/course/20502

Course Breakdown

Module 1: Exploring Code with Karel (2 weeks/10-12 hours)
In this module, students learn the basics of programming by giving Karel the Dog commands in a grid world.

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/28392

Objectives / Topics Covered	• Commands • Functions • Conditionals • Looping • Control Flow

Example Assignments	• Program-specific tasks for Karel the Dog
	  ○ Example Exercise: Tennis Ball Game Setup
	  Karel's getting ready to play a tennis ball game with friends at the dog park. Karel wants to hide 4 tennis balls around the dog park. Help Karel get the game setup by programming Karel to put one tennis ball on each of the purple squares around the dog park.
	• Teach Karel new commands like `turnRight()` or `makeStack()`
	  ○ Example Exercise: Tennis Ball Stacks
	  Karel is setting up stacks of tennis balls for a game with friends. The stacks of tennis balls need to be placed on the cement squares in the 2nd, 4th, and 6th columns. Each stack should have three tennis balls. Create a function called `makeStack()` to help Karel create the tennis ball stacks.
	• Using control structures and conditionals to solve general problems
	  ○ Example Exercise: Karel's Race
	  Your task is to get Karel to move around the racetrack eight times, and end up back in the starting position. Every time Karel hits a corner, Karel should put a ball down. Then at the end of the race there should be 8 balls on each corner.

Module 2: Exploring Computing (2 weeks/10-12 hours)
In this module, students explore different technologies and the impact they have on our world.

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/42365

Topics Covered	• History of Computing • Software • Hardware • Operating Systems • Cloud Computing • Ethics and Legal Considerations • The Future of Computing
Example Assignments	• History of Computing ○ *Jigsaw: Computer Interaction Over the Decades:* In this activity, students are going to work in small groups to research what it was like to interact with computers over the various decades. For each

	section, students will want to consider what was typical for most computers. For example, GUI interfaces were first used in the 1970s, but they were not typical until the 1980s. ● Cloud Computing ○ *Case Study: Cloud Computing vs. Physical Computing:* Is cloud computing more efficient? Is physical computing the way to go? Students will read through a case study for a middle school that needs to decide between implementing a cloud computing solution or a physical computing solution. What are the pros and cons of each? Which way would you ultimately choose to implement?

Module 3: Exploring Simulations (1 week/1-3 hours)

In this module, students learn about the Universal Law of Gravity as they develop and use their own gravity simulation to explore its various effects.

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/28528

Objectives / Topics Covered	● What are simulations? ● How can simulations play a role in scientific inquiry? ● Simulation exploration ● Gravity simulation in JavaScript
Example Assignments	● Exploring Simulations ○ In this exercise, try out a handful of the simulations below and answer the questions in the editor about the advantages and disadvantages of using them. ● Solar System ○ Now it's time to create your very own solar system! Here are the program's requirements: ■ There must be a large sun near the center of the system. ■ There must be at least three planets around the sun. ■ Each object (sun and planets) must have a different position, radius, and color, and be stored in its own variable. ■ There must be a colored background for your outerspace (can be any color).

Module 4: Exploring the Internet (2 week/10-12 hours)

In this module, students learn network protocols and different strategies used to protect online information.

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/28394

Objectives / Topics Covered	● What is the Internet ● The Need for Protocols ● Impact of the Internet ● Cybersecurity ● The CIA Triad ● Encryption

Example Assignments	● Encrypt and Decrypt ○ Explore the following simulation to practice encrypting and decrypting a message using a key. Create a message to encrypt and decide on a key. The key can be a word or a number (or a combination). Do you think you'd be able to decode and crack this message without the key? ● Final Project: Steganography ○ In the following activity, you will see a picture and the corresponding color codes associated with the pixels. There is a message hidden in the first 12 pixels! Your mission will be to reverse the process and find the secret message!

Module 5: Exploring Art with Code (2 week/10-12 hours)

In this module, students explore the intersection of art and technology by creating sketches using p5.js.

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/28397

Objectives / Topics Covered	● Color Theory ● Color Transitions ● Color Transformations ● Shape Transformations ● Direction ● Animation ● Interactivity
Example Assignments	● Final Project: Animate an Emoji ○ Create an animated sketch of an emoji. An emoji is a small icon used to represent an emotion, symbol, or object. Complete the project proposal to plan your sketch and then use drawing and color functions we have learned so far to create it using p5.js.

Module 6: Exploring Digital Citizenship (2 weeks/10-12 hours)

In this module, students learn about Internet etiquette and how to stay safe on the world wide web.

Browse the full content of this module at https://codehs.com/course/20502/explore/module/28395

Objectives / Topics Covered	● Digital Footprint and Reputation ● Cyberbullying ● Internet Safety ● Privacy & Security ● Information Literacy ● Creative Credit & Copyright ● Hacking Ethics
Example Assignments	● Build a Positive Digital Footprint ○ Reflect on your social media activity. Give an example of a social media post that builds a positive digital footprint. Give an example of a social media post that builds a negative digital footprint. ● Final Project: Create a Public Service Announcement

	○ Create a Public Service Announcement (PSA) to teach your peers about your selected topic in digital citizenship and cyber hygiene. You could make a video, song, poster, or slideshow.

Unit 7: Digital Information (2-3 weeks/10-15 hours)

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

Browse the full content of this unit at https://codehs.com/course/20502/explore/module/28396

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	● 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