Indiana Principles of Computing Syllabus

High School (145-150 Contact Hours)

Course Overview and Goals

The CodeHS Principles of Computing curriculum teaches the foundations of computer science and basic programming, with an emphasis on helping students develop logical thinking and problem-solving skills. Once students complete the CodeHS Principles of Computing course, they will have learned material equivalent to a semester college introductory course in Computer Science and be able to program in JavaScript.

Learning Environment

The course utilizes a blended classroom approach. The content is fully web-based, with students writing and running code in the browser. 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, example programs to explore, and written programming exercises, adding up to over 100 hours of hands-on programming practice. Each unit ends with a comprehensive unit test that assesses students' mastery of that unit's material and challenge problems where students can display their understanding of the material.

Programming Environment

Students write and run JavaScript programs in the browser using the CodeHS editor.

More Information

Browse the content of this course at https://codehs.com/course/17769/explore

Prerequisites

The Indiana Principles of Computing 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 new coders.

Course Breakdown

Module 1: Introduction to Programming in JavaScript with Karel the Dog (3 weeks/15 hours)

The first module is programming with Karel. Karel is a dog that only knows how to move, turn left, and place tennis balls in his world. Students can give Karel these commands to instruct him to do certain things. We use Karel to show students what it means to program, and allow them to focus on problem-solving.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24366

Objectives / Topics Covered	- Commands - Defining vs. Calling Methods - Designing methods - Program entry points - Control flow - Looping

	- Conditionals - Classes - Commenting code - Preconditions and Postconditions - Top-Down Design
Assignments / Labs	26 Karel Programming Exercises and Challenges in total - 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 in the first row, two in the second row, and one in the third row. - Teach Karel new commands like `turnRight()` or `makePancakes()` - Example Exercise: Pancakes Karel is the waiter. He needs to deliver a stack of pancakes to the guests on the 2nd, 4th, and 6th avenue. Each stack of pancakes should have three pancakes. Create a method called `makePancakes()` to help Karel solve this problem. - Solve large Karel problems by breaking them down into smaller, more manageable problems using Top-Down Design - Example Exercise: The Two Towers In this program, Karel should build two towers of tennis balls. Each tower should be 3 tennis balls high. In the end, Karel should end up on top of the second tower, facing East. - Using control structures and conditionals to solve general problems - Example Exercise: Random Hurdles Write a program that has Karel run to the other side of the first street, jumping over all of the hurdles. However, the hurdles can be in random locations. The world is fourteen avenues long.

Module 2: Karel Challenges (1.5 weeks/7 hours)

In this module you'll take all of the foundational concepts from Karel to solve some programming challenges. Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24367

Objectives / Topics Covered	- Variables - User Input - Arithmetic Expressions - Graphics - Image Representation
Assignments / Labs	5 JavaScript & graphics programming exercises in total - Using variables and getting user input using JavaScript - Example Exercise: Dinner Plans Prompt the user for their name, then ask them what time you should meet for dinner. Greet them by name and tell them you will meet them at the time they specified! - Create basic graphics in JavaScript - Example Exercise: Flag of the Netherlands This program should draw the flag of the Netherlands. The top third of the canvas is red, the middle third is white, and the bottom third is blue, as shown below. You will need to use Rectangle objects in this program.

Module 3: Cybersecurity (7 weeks/35 hours)

This module includes topics on Internet etiquette and how to stay safe on the world wide web. We will also look at the potential effects of our digital footprints, how to protect information from online risks, and the implications of hacking. Finally, the module includes how to find and cite quality resources online.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24368

Objectives / Topics Covered	- Intro to Cybersecurity - Digital Footprint and Reputation - Privacy and Security - Information Literacy - Creative Credit & Copyright - Hacking Ethics - Identifying Risks - Assessing Risk
Assignments / Labs	- Intro to Cybersecurity - Example activities: - Why should we discuss Cybersecurity? - Cyberattacks Reflection - Digital Footprint and Reputation - Example activities: - What is your digital footprint? - Are you going to make any changes in what you post on social media? - Keeping data private and secure - Example activities: - Test out various passwords on a site - Explore Google's privacy policy: What do they know about you? - Information Literacy - Example activities: - Create and test search queries - Explore the evidence for using sources - Different types of copyright licenses - Example activities: - Create citations for sources - Explore image search tools - Hacking Ethics - Example activities: - Explore what penetration testing is - Sign ethical hacker agreement - Identifying Risks - Example activities: - What is a Honeypot? - Why might a security professional set up and use a honeypot? - Assessing Risk - Example activities: - Poor password assessment - What are the four possible options in responding to risk?

Module 4: What is Computing? (6 weeks/30 hours)

Students dive into the history of computing, consider how computing impacts today's world, and learn about the various parts that make up modern computers.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24473

Objectives / Topics Covered	- History of Computers - Computer Organization - Software - Hardware - Future of Computing - Cloud Computing - Different Types of Cloud Computing - Lab: Chat Bot - Intro to Cloud Storage
Assignments / Labs	- History - Research famous computer innovators - What roles do computers play in your life? - Summarize an era of advances in computers - What is a computer? - What parts do modern computers have? - What are input/output devices? - Draw a computer and label all of its parts - Software/Hardware - What's the difference? What hardware components make up a computer? - Label the parts of your computer - Future of Computing - Research uses of Artificial Intelligence in use now - Research new ways of storing data - In what ways can we use technology that we couldn't 10 years ago. Are these technological advances helpful or harmful overall? - Cloud Computing - What are the advantages of cloud computing? - Summarize the benefits of using cloud computing in different industries - Different Types of Cloud Computing - What are the three common divisions of cloud computing? - Pecha Kucha style presentation on the different types of cloud computing - Lab: Chat Bot - Build a restaurant chatbot with Amazon Lex - Intro to Cloud Storage - Complete the AWS Cloud Computing Course

Module 5: Digital Information (5 weeks/25 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 module at https://codehs.com/course/17769/explore/module/24480

Objectives / Topics Covered	- How digital data is represented - Encoding data - Converting and using different number systems - Binary - Hexadecimal - Manipulating images at the pixel level
Assignments / Labs	- Encoding data - Create your own encoding scheme - Encode images using binary - Write a message by encoding the characters in binary, using ASCII codes. - Using different number systems - Convert numbers between decimal, binary, and hexadecimal - 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 - Create a pixel by typing out the hexadecimal color encoding for each pixel

Module 6: The Internet (5 days/25 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.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24479

Objectives / Topics Covered	- Structure of the internet - How a network's data is transmitted - Hardware involved in the transmission of data - How the internet has impacted everyday life
Assignments / Labs	- Structure of the internet - Explore the differences between IPv4 and IPv6 - Explore the different levels of the internet - 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 you your own words how a request from your computer travels through the various levels of servers to reach and return the correct web pages and information.

	○ 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 important?
	  ○ Explore how data is able to be transmitted across the ocean by using underwater cables

Module 7: Project: The Effects of the Internet (3 days/3 hours)

In this project, students will choose an innovation that was enabled by the Internet and explore the positive and negative impacts of their innovation on society, economy, and culture. Students will develop a computational artifact that illustrates, represents, or explains the innovation's purpose, function, or effect, and embed this artifact in their personal portfolio website.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24587

Assignments / Labs	● *The Effects of the Internet:* Students provide evidence of the extensive knowledge they have developed about a chosen Internet-based innovation and its impact(s). Students include citations, as applicable, within their written responses. Within their computational artifact, students explain at least one beneficial effect and at least one harmful effect the Internet-based innovation has had or has the potential to have, on society, economy, or culture. They also identify data privacy, security, or storage concerns for the computing innovation.

Module 8: JavaScript and Graphics (1.5 weeks/7 hours)

This module introduces students to basic data structures that make storing and accessing data easier.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24369

Objectives / Topics Covered	● Intro to Integrated Development Environments ● Variables ● User Input ● Arithmetic Expressions ● Graphics ● Image Representation

Assignments / Labs	● An introduction to general IDEs and the CodeHS IDE
	● 7 JavaScript & graphics programming exercises in total
	● Using variables and getting user input using JavaScript
	  ○ Example Exercise: Dinner Plans
	    Prompt the user for their name, then ask them what time you should meet for dinner.
	    Greet them by name and tell them you will meet them at the time they specified!
	● Create basic graphics in JavaScript
	  ○ Example Exercise: Flag of the Netherlands
	    This program should draw the flag for the Netherlands. The top third of

	the canvas is red, the middle third is white, and the bottom third is blue, as shown below. You will need to use Rectangle objects in this program.

Module 9: Graphics Challenges (1 week/5 hours)

In this module you'll learn how to pair-program! You'll also take all the foundational concepts from JavaScript Graphics to solve some programming challenges.

Browse the full content of this module at https://codehs.com/course/17769/explore/module/24370

Objectives / Topics Covered	- Pair programming - Solving large and more complex problems that incorporate graphics and user input
Assignments / Labs	3 graphics challenges to tie everything learned in the JavaScript & Graphics module together - Example Exercise: Ghost Write a program to draw a ghost on the screen. You must do this by using the constant values given (this will allow us to easily alter the size or color of the ghost.)

Module 10: JavaScript Control Structures (3 weeks/15 hours)

Learn how to use control structures such as if/else statements and loops to make more advanced programs in JavaScript.

Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24371

Objectives / Topics Covered	- Booleans - For Loops - Conditionals - Nested Control Structures - While Loops
Assignments / Labs	22 control structures programming exercises in total - Using comparison and logical operators to control the flow of the program - Example Exercise: Inventory Write a program that keeps track of a simple inventory for a store. While there are still items left in the inventory, ask the user how many items they would like to buy. Then print out how many are left in inventory after the purchase. You should use a while loop for this problem. Make sure you catch the case where the user tries to buy more items than there are in the inventory. In that case, you should print a message to the user saying that their request isn't possible. - Using for loops - Example Exercise: All Dice Values Write a program that prints all possible dice rolls with 2 dice To do so, you should use a double for loop. - Drawing basic graphics using control structures - Example Exercise: Caterpillar This graphics program should draw a caterpillar. A caterpillar has NUM_CIRCLES circles. Every other circle is a different color, the even circles are red, and the odd circles are green (by even we mean when i is an even number). Use a for loop to draw the caterpillar, centered vertically in the screen. Also, be sure that the caterpillar is still drawn

| | across the whole canvas even if the value of NUM_CIRCLES is changed. |

Module 11: Control Structures Challenges (1 week/5 hours)

In this module you'll take all the foundational concepts from the Control Structures unit to solve some programming challenges.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24372

Objectives / Topics Covered	● Solving large and more complex problems that incorporate control structures
Assignments / Labs	● 4 challenges using control structures to tie everything learned in the JavaScript Control Structures module together 　○ Example Exercise: Circles in Squares 　　Repeatedly draw a circle inside of a square and then a square inside that circle and so on. You should repeat this while the size is greater than MIN_SIZE. Each time you draw a shape, it should be centered on the screen and a new random color. You'll need to update the size based on the size of the previous one.

Module 12: Functions and Parameters (2 weeks/10 hours)

Learn to write reusable code with functions and parameters.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24373

Objectives / Topics Covered	● Functions with and without parameters ● Functions with and without return values ● Nested Control Structures ● Local variables and scope
Assignments / Labs	● 14 functions programming exercises in total 　○ Example Exercise: Vertical Lines 　　Write a function that draws vertical lines on the graphics canvas. If a line is vertical, then the x-values for the endpoints are the same. 　　The parameters to your function should be the x location, and the length, and all of your lines should start at y position 0. 　○ Example Exercise: Is it even? 　　Write a function called isEven that returns a boolean of whether or not a value is even or odd. The isEven function should not print anything out or return a number. It should only take in a number and return a boolean. Once you've written this function, write a program that asks the user for integers and prints whether the number they entered is even or odd using your isEven function. You should let the user keep entering numbers until they enter the SENTINEL given.

Module 13: Functions Challenges (1 week/5 hours)

Use what you have learned in the Functions unit to solve challenges.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24374

Objectives / Topics Covered	● Solving large and more complex problems that incorporate functions, parameters, and return values

Assignments / Labs	● 4 challenges using functions to tie everything learned in the Functions and Parameters module together
	    ○ Example Exercise: Grades
	        Write a function that takes a number score from 0 to 100 and prints the grade.
	        You should print the letter grade A-F and the +/- sign if needed

Module 14: Operating Systems and Software (2 week/10 hours)

Students will compare and contrast common operating systems and explain the importance of compatibility. Students will also explore software apps while discussing software licenses and running through the software development life cycle.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24485

Objectives / Topics Covered	● Programming Fundamentals ● Operating Systems ● Software Applications

Assignments / Labs	● Programming Fundamentals
	    ○ Programming Concepts
	    ○ Compilers vs. Interpreters
	● Understanding Operating Systems
	● Comparing Operating Systems
	    ○ Installing an OS
	● File Management
	    ○ What Processor are you Running?
	● Software Licenses
	● Software Development
	    ○ Development Life Cycle
	    ○ Agile/SCRUM

Module 15: IT Infrastructure (1 week/5 hours)

In this module students learn about the physical elements of computers and networking, such as motherboards, RAM, routers, and the use of port numbers, ethernet, and wireless devices.
Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24482

Objectives / Topics Covered	● Internal Components ● Peripheral Devices ● Network Devices ● IT Infrastructure Quiz
Assignments / Labs	● Different Types of CPU ● RAM vs. Hard Drive ● Wireless Internet Connections ○ Speed Test ● Security of Cloud Storage ● Ethernet Standards

	● Setting Up a Firewall
	    ○ Establishing firewall rules
	● SSH Logs
	    ○ Reading logs

Module 16: Data (1 week/5 hours)

In this module, students will explore using computational tools to store massive amounts of data, manipulate and visualize data, find patterns in data, and draw conclusions from data. Students will consider how the modern wealth of data collection has impacted society in positive and negative ways. Students will work in teams to investigate a question of personal interest and use public data to present a data-driven insight to their peers. They will develop visualizations to communicate their findings, and embed their visualizations in their portfolio websites.

Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24489

Objectives / Topics Covered	● Visualizing and Interpreting Data ● Data Collection and Limitations ● Project: Present a Data-Driven Insight

Assignments / Labs	● Visualizing and Interpreting Data
	    ○ Students examine a series of visualizations to determine the strength of the visualization in communicating data.
	● Data Collection and Limitations
	    ○ Students explore how visualizations can misrepresent data. Students determine the validity of visualizations based on data context.
	● *Present a Data-driven Insight:* Students consider how the amount of collected data impacts our lives in ways that require considerable study and reflection for us to fully understand them. Students explore a question that can be answered by analyzing a dataset. They form a question and use visualization techniques to analyze the data to answer the question.

Module 17: Final Project (2-4 weeks/10-20 hours)

In this module students will take all the skills they've learned throughout the course to create a final program with a partner!

Browse the full content of this unit at https://codehs.com/course/17769/explore/module/24378

Objectives / Topics Covered	● Project Planning ● Final Project Creation

Assignments / Labs	● Collaborative open-ended final project which encourages creativity
	● Program Requirements:
	Your program:
	    ○ must use JavaScript Graphics
	    ○ must allow the user to interact with your project with either their mouse or keyboard
	    ○ must use at least one timer
	    ○ must break down the program into multiple functions
	    ○ must utilize control structures where applicable

Optional Supplemental Materials

Objectives / Topics Covered	- Extra practice with: - Karel - Basic JavaScript - JavaScript functions - Graphics - Animation - Animation and Games - Project: Breakout - Basic Data Structures in JavaScript - Game Design - Music Visualization
Assignments / Labs	Several additional exercises and large projects covering the topics listed above