

Course Overview and Goals

The Computing Ideas course is a first year computer science course introducing the basics of programming with Karel the Dog, the basics of designing a web page, and how information is represented digitally and sent over the Internet. Students will learn to code using blocks to drag and drop, but they can switch between blocks and text as desired. Students will create a personal portfolio website showing projects they build throughout the course.

With a unique focus on creativity, problem solving and project based learning, Computing Ideas 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 websites and digital presentations, and engage in in-person collaborative exercises with classmates. Teachers utilize tools and resources provided by Nexitto 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 Nexitonline editor. Students will be able to write both text based and block based programs in Karel. Students will also create several webpages using HTML and CSS. These webpages will be hosted on the Nexitwebsite so that they can keep a running portfolio of their creative projects, and easily share their programs with the world. Students gain programming experience early on in the course that will enable them to explore the rest of the course topics through computational thinking practices.

Quizzes: Each lesson includes at least one formative short multiple choice quiz. At the end of each unit, students take a summative multiple choice unit quiz that assesses their knowledge of the concepts covered in the unit.

Prerequisites: The Computing Ideas 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.

Course Breakdown

Unit 1: Introduction to Programming with Karel the Dog (10 weeks/50 hours)

Objectives / Topics Covered	<ul style="list-style-type: none"> • Commands • Defining versus Calling Methods • Designing methods • Control flow • Looping • Conditionals • Commenting code • Preconditions and Postconditions • Top Down Design
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 new commands like <code>turnRight()</code> or <code>makePancakes()</code> ◦ 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 <code>makePancakes()</code> to help Karel solve this problem. • 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. • Loops and Conditionals <ul style="list-style-type: none"> ◦ Example Exercise: Random Hurdles Write a program that has Karel run to the other side of first street, jumping over all of the hurdles. However, the hurdles can be in random locations. The world is fourteen avenues long. ◦ Example Exercise: Super Cleanup Karel Karel's world is a complete mess. There are tennis balls

	<p>all over the place, and you need to clean them up. Karel will start in the bottom left corner of the world facing east, and should clean up all of the tennis balls in the world. This program should be general enough to work on any size world with tennis balls in any locations.</p>
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Unit 2: What is Computing? (5 weeks/25 hours)

Objectives / Topics Covered	<ul style="list-style-type: none"> • History of computers • What is a computer? • What is software? • What is hardware? • Future of computing
Example Assignments / Labs	<ul style="list-style-type: none"> • History <ul style="list-style-type: none"> ○ Find out when the first computers were created ○ Research famous computer innovators ○ What roles do computers play in your life? ○ Example Activity: <ul style="list-style-type: none"> ■ Summarize an era of advances in computers • What is a computer? <ul style="list-style-type: none"> ○ What parts do modern computers have? ○ What are input devices? ○ What are output devices? ○ Example Activity: <ul style="list-style-type: none"> ■ Draw a computer and label all of its parts, including the input devices and output devices • Software/Hardware <ul style="list-style-type: none"> ○ What's the difference? ○ What hardware components make up a computer? ○ What is software used for? ○ Example Activity: <ul style="list-style-type: none"> ■ Label the parts of your computer • Future of Computing <ul style="list-style-type: none"> ○ Research uses of Artificial Intelligence in use now ○ Research new ways of storing data ○ Example Class Activity: <ul style="list-style-type: none"> ■ In what ways can we use technology that we couldn't 10 years ago. Are these technological advances helpful or harmful overall? • Final Project <ul style="list-style-type: none"> ○ Create a presentation about a computer. Choose any computer -- a phone, an early computer model, drones, etc. Who built it and why? How does it interact with people? How do people interact with the computer?

Unit 3: Web Design (6 weeks/30 hours)

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Creating webpages using HTML <ul style="list-style-type: none"> ○ Links ○ Images ○ Lists ○ Tables ○ Inline styling ● Styling webpages with CSS <ul style="list-style-type: none"> ○ Creating CSS rules ○ CSS classes ○ CSS IDs ● How webpages are requested and delivered
Example Assignments / Labs	<ul style="list-style-type: none"> ● Links <ul style="list-style-type: none"> ○ Learn how to link different pages together ○ Example Exercise: Create a webpage that provides links to your favorite books ● Images <ul style="list-style-type: none"> ○ Learn how to add and format images ○ Example Exercise: Create a collage of images ● Tables <ul style="list-style-type: none"> ○ Learn how to create and style tables ○ Example Exercise: Create a table describing your favorite music artists and songs ● Styling with CSS <ul style="list-style-type: none"> ○ Use CSS to add background colors, font colors, font styles, borders, and position elements on the page ○ Example Exercise: Create CSS classes and IDs to apply formatting to a BINGO board ○ Example Exercise: Create CSS classes to style a music library web page ○ Example Exercise: Create CSS Rules to put a Karel puzzle together ● Viewing websites <ul style="list-style-type: none"> ○ How are web pages served to your computer? ○ Where do web pages live? ● Final Project <ul style="list-style-type: none"> ○ Build your own homepage using everything you've learned in the module ○ This homepage will serve as your personal portfolio of creative projects as you continue through the course!

Unit 4: Digital Information (5 weeks/25 hours)

Objectives / Topics Covered	<ul style="list-style-type: none"> • How digital data is represented • Encoding data • Converting and using different number systems <ul style="list-style-type: none"> ◦ Binary ◦ Hexadecimal • Manipulating images at the pixel level
Example Assignments / Labs	<ul style="list-style-type: none"> • Encoding data <ul style="list-style-type: none"> ◦ Create your own encoding scheme ◦ Encode images using binary ◦ Example Activity: <ul style="list-style-type: none"> ■ Write a message by encoding the characters in binary, using the ASCII codes. • Using different number systems <ul style="list-style-type: none"> ◦ Convert numbers between decimal, binary, and hexadecimal ◦ Example Activity: <ul style="list-style-type: none"> ■ 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 <ul style="list-style-type: none"> ◦ Make different colors by changing the amount of red, green, and blue present ◦ Create image filters ◦ Create images pixel by pixel ◦ Example Activity: <ul style="list-style-type: none"> ■ Create a pixel rainbow by typing out the hexadecimal color encoding for each pixel

Unit 5: The Internet (5 weeks/25 hours)

Objectives / Topics Covered	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Structure of the internet <ul style="list-style-type: none"> ◦ Explore the differences between IPv4 and IPv6. Why are we running out of addresses? ◦ Explore the different levels of the internet. ◦ Example Activity <ul style="list-style-type: none"> ■ Trace a website request from the server,

	<p>through the network, and to your computer</p> <ul style="list-style-type: none">● How data is transmitted<ul style="list-style-type: none">○ 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:<ul style="list-style-type: none">■ 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<ul style="list-style-type: none">○ 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<ul style="list-style-type: none">○ 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?
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