

International Baccalaureate Computer Science for the Diploma Programme

Higher Level (105 Contact Hours)

Course Overview and Goals

The International Baccalaureate (IB) Diploma Programme for Computer Science is designed to facilitate the learning and exam taking processes for students who are enrolled in the Higher Level (HL) section of their IB Diploma Programme. This course covers programming components and critical skills, which align with each of the 10 characteristics of the [IB Learner Profile](#). Students will learn how programming and cybersecurity are applicable to nearly all fields of study and how to implement these skills in real-life.

Learning Environment

This course adapts the blended learning approach, giving teachers more autonomy in their pedagogical approach. The course content is a combination of web-based and offline activities. However, students will access lessons through the CodeHS platform.

Programming Environment

Students will demonstrate their programming skills by learning Advanced Placement Computer Science Principles in Javascript, which aligns with the standards established by the College Board and the International Baccalaureate Organization. Certain concepts such as Databases, Web Science, and Modelling and Simulation will be covered through the Cybersecurity portion of the course. Students will also be able to practice exam problems throughout the course.

Quizzes

Each lesson includes at least one multiple choice assessment. At the end of each module, students will take a summative multiple choice assessment to test their understanding of the concepts covered throughout the course.

Prerequisites

The International Baccalaureate Computer Science for Diploma Programme course uses the Javascript programming language and is designed for complete beginners with no previous background in computer science. However, students should be comfortable with algebraic functions and notations.

More Information

Browse the content of this course at: [Insert course link]

Course Breakdown

Module 1: Introduction to Programming (3 weeks/15 hours)

In this module, students will be able to use their programming skills to explore future topics within this course by starting with Intro to Programming with Karel.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none">• Welcome to AP CSP• Intro to Programming With Karel• More Basic Karel• Karel Can't Turn Right• Functions in Karel• The Start Function• Top Down Design and Decomposition in Karel• Commenting Your Code• Abstraction• Super Karel• For Loops• If Statements• If/Else Statements• While Loops in Karel• Control Structures Example• Debugging Strategies• Karel Algorithms• Code Indentation• Ultra Karel
Assignments / Labs	<ul style="list-style-type: none">• Your First Karel Program• Short Stack• Make a Tower• Pyramid of Karel• Fireman Karel• Slide Karel• Pancakes• Backflip• Digging Karel• Pancakes with Start• Digging Karel with Start• The Two Towers• The Two Towers with Comments• The Two Towers with SuperKarel• Take 'em All• Dizzy Karel• For Loop Square• Lots of Hurdles• Is there a ball?• Make a Tower• Right Side Up• Follow the Yellow Ball Road• Lay Row of Tennis Balls

	<ul style="list-style-type: none"> ● Big Tower ● Random Hurdles ● Diagonal ● Staircase ● Invert Colors ● Checkerboard Karel
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Module 2: Programming with JavaScript (2 weeks/10 hours)

In this module, students learn the basics of JavaScript, including variables, user input, control structures, functions with parameters and return values, and basic graphics, how to send messages to objects.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● What is a Code? ● Uses of Programs ● Hello World ● Variables ● User Input ● Basic Math in JavaScript ● Using Graphics in JavaScript ● Mouse Events: Mouse Clicked
Assignments / Labs	<ul style="list-style-type: none"> ● Your Name and Hobby ● Apples and Oranges ● Obi-Wan Says ● Sporting Goods Shop ● Running Speed ● 24 vs. "24" ● French Flag ● Snowman ● Click for Rectangles

Module 3: JavaScript Control Structures (2 weeks/10 hours)

In this module, students will learn how to use booleans and logical operators with control structures to make more advanced programs in JavaScript.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Booleans ● Logical Operators ● Comparison Operators ● If Statements ● Key Events ● For Loops in JavaScripts ● General For Loops ● For Loop Practice ● Random Numbers ● While Loops
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	<ul style="list-style-type: none"> ● Loop and a Half
Assignments / Labs	<ul style="list-style-type: none"> ● Do you have a cat? ● Can you graduate? ● School's Out ● Rolling Dice ● All Star ● Teenagers ● Meal Planner ● Growing Circle ● Meme Text Generator ● The Worm ● Caterpillar ● Count By Sevens ● Power of Two ● Better Sum ● Factorial ● All Dice Values ● Lots of Dice ● Random Color Square ● Inventory ● Fibonacci ● Snake Eyes ● Better Password Prompt

Module 4: Functions and Parameters (2 weeks/10 hours)

In this module, students learn to write reusable code with functions and parameters.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Functions and Parameters 1 ● Functions and Parameters 2 ● Functions and Parameters 3 ● Functions and Return Values 1 ● Functions and Return Values 2 ● Local Variables and Scope ● JavaScript vs Karel ● Basic JavaScript and Graphics Challenges
Assignments / Labs	<ul style="list-style-type: none"> ● Square ● Triple ● Area of Triangle ● Height in Meters ● Horizontal Lines ● Graphics Stop Light ● Pool Table ● Square with Return Values ● Quadruple with Return Values ● Is it Even?

	<ul style="list-style-type: none"> ● Min ● Local Variables ● Making Karel Turn Right ● Making Karel Move
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Module 5: Basic Data Structures (2 weeks/10 hours)

In this module, students will be introduced to lists/arrays. These are the essential basic data structures that any program will use.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Into to List/Arrays ● Indexing Into an Array ● Adding/Removing From an Array ● Array Length and Looping Through Arrays ● Iterating Over an Array ● Finding an Element in a List ● Removing an Element From an Array ● Simulation
Assignments / Labs	<ul style="list-style-type: none"> ● List of Places to Travel ● List of Prime Numbers ● Top Movies ● Empty Array (Push/Pop) ● Product of List ● Print Flight Itinerary ● Double List ● Evens Only List ● In a World Without Arrays! ● Reverse List ● Coin Flip Fun: Number of Heads and Tails ● Coin Flip Fun: Longest Streak of Heads ● Changing Circles ● Draw a Barcode ● Who is in Line? ● Remove From Line ● Simulating a Coin Flip

Module 6: The Internet (2 weeks/10 hours)

In this module, students will 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: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Welcome to the Internet ● Internet Hardware ● Internet Addresses ● Viewing Websites
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	<ul style="list-style-type: none"> ● DNS
Assignments / Labs	<ul style="list-style-type: none"> ● Functions ● Exceptions ● Putting it All Together

Module 7: Digital Information (3 weeks/15 hours)

In this unit, students will learn about the various ways we represent information digitally. Topics covered include number systems, encoding data, programmatically creating pixel images, comparing data encodings, compressing and encrypting data.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none"> ● Intro to Digital Information ● Number Systems ● Encoding Text with Binary ● Pixel Images ● Hexadecimal ● Pixel Colors! ● Image Manipulation ● Data Compression ● Lossy Compression ● Cryptography
Assignments / Labs	<ul style="list-style-type: none"> ● Binary Game ● Overflow Error ● Hello Karel in Bits ● Create Your Own Encoding ● Text to Binary ● Checkerboard ● Ladder ● Create an Image! ● Binary to Hex Game ● Exploring RGB ● Making Yellow ● Rainbow ● Create a Color Image! ● Invert Filter ● Blue Filter ● Darken Filter ● Decreasing Resolution ● Guess the Passcode

Module 8: Software Security (4weeks/20 hours)

In this module, students will learn what happens when running a web application and how to look inside web apps using developer tools, code source, and more. They will learn basic SQL and common attacks like SQLi.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none">● Inside Web Applications● Developer Tools● The Value of Data● SQL Overview● Clients, Servers, Databases● Common Security Problems● SQL Injection
Assignments / Labs	<ul style="list-style-type: none">● Scavenger Hunt● Getting Started with OWASP● Chrome Developer Tools● SELECT statement to query a database● Discuss Equifax SQL injection attack● Practice basic SQLi on a safe site● Research SQLi prevention

Module 9: Exam Practice (1 week/5 hours)

In this module, students will have the opportunity to apply their programming and cybersecurity knowledge and complete IB-related exam practice questions.

Browse the full content of this module at: [Insert course link]

Objectives / Topics Covered	<ul style="list-style-type: none">● Exam Overview● Testing Mindset
Assignments / Labs	<ul style="list-style-type: none">● Review: Exam Guidelines● Exercise: Key Terms● Quiz: Practice Exam