



# Computer Science

## Nature of the Subject

Computer science is the study of computational systems, programming, and algorithmic problem-solving. The subject emphasizes computational thinking, allowing students to analyze and develop solutions to complex problems using programming, data structures, and networking. It integrates theoretical foundations with practical applications, preparing students to understand emerging technologies, artificial intelligence, databases, and ethical considerations in computing. The course fosters logical reasoning, innovation, and a critical understanding of the role of computing in society.

## Distinction between Higher and Standard Level:

Both Higher Level (HL) and Standard Level (SL) students study fundamental concepts such as computational thinking, programming, databases, networks, and machine learning. However, HL students explore additional topics such as abstract data types, advanced algorithms, and broader applications of object-oriented programming. HL students are also required to engage in more depth with regards to the case study, which includes extra challenge questions, and they have additional requirements (exercises) in the external assessments.

## Syllabus outline

The syllabus is divided into two main themes:

- Theme A: Concepts of Computer Science
  - Computer fundamentals
  - Networks
  - Databases
  - Machine learning
- Theme B: Computational Thinking and Problem-Solving
  - Computational thinking
  - Programming (Python or Java)
  - Object-oriented programming
  - Abstract data types (HL only)

Additionally, students will complete a collaborative sciences project and an internal assessment in the form of a computational solution.

## Prior Learning

Experience demonstrates that students can study computer science at SL successfully with no background in the subject. For students considering computer science at HL, some previous exposure to programming is recommended, although there is no intention of restricting access. HL demands a higher level of problem-solving skills and a greater ability to understand and manipulate abstract concepts. Students who enjoy mathematical problem-solving are well suited to studying HL computer science.

## **Assessment Objectives**

Having followed the Diploma Programme course in Computer Science, students will be expected to:

- Demonstrate knowledge and understanding of computer science concepts, techniques, and methodologies.
- Apply computational thinking to solve real-world problems using programming and structured problem-solving approaches.
- Analyze, evaluate, and synthesize information to construct effective computational solutions.
- Demonstrate ethical awareness and evaluate the social impact of computing technologies.

## **Teaching Approach**

Teaching computer science in the IB follows an inquiry-based, conceptual learning approach, encouraging students to explore computational concepts through problem-solving and programming exercises. Practical applications, case studies, and real-world projects support deeper understanding, with an emphasis on hands-on experimentation. Collaboration and interdisciplinary connections with mathematics and the sciences are also encouraged.

## **Why students might choose this subject**

Students interested in technology, software development, data science, artificial intelligence, cybersecurity, or engineering will benefit from the analytical and practical skills gained in this course. The subject provides a strong foundation for university studies in computer science and related fields. It also develops problem-solving, algorithmic thinking, and computational literacy, which are valuable in a wide range of careers.

## Course Assessment

In addition to formal IB assessments, students will complete in-school assessments such as practice programming exercises, algorithm development tasks, research-based assignments, and mock examinations.

The **final Diploma grade** in the subject is determined by three assessment components:

### 1. Internal assessment: The Computational Solution

Students develop a computational solution to a real-world problem of their choice. This involves defining a problem, designing an algorithm, developing a program, and evaluating the effectiveness of their solution. The IA is worth 30% of the final grade for the SL and 20% for the HL.

### 2. External assessment: Written examinations

Assessment component	Weighting
External assessment (4 hours for HL, 2 hours 30 minutes for SL)	80% (HL) 70% (SL)
Paper 1 (2 hours for HL, 1 hour 15 minutes for SL) Section A—extended-response questions linked to theme A: Concepts of computer science Section B—short- and extended-response questions linked to the pre-seen case study (80 marks for HL, 50 marks for SL)	40% (HL) 35% (SL)
Paper 2 (2 hours for HL, 1 hour 15 minutes for SL) Extended-response questions linked to theme B: Computational thinking and problem-solving (80 marks for HL, 50 marks for SL)	40% (HL) 35% (SL)