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Diploma Programme

Computer science subject outline

First examinations 2014

This document explains the major features of the course, and outlines the syllabus and assessment requirements.

More detailed information about the course can be obtained by referring to the guide for this subject, which is available on the subject page of the IB online curriculum centre (OCC) website (http://occ.ibo.org) and can also be purchased from the IB store (http://store.ibo.org).

Nature of the subject

Computer science requires an understanding of the fundamental concepts of computational thinking as well as knowledge of how computers and other digital devices operate.

The Diploma Programme computer science course is engaging, accessible, inspiring and rigorous. It has the following characteristics.

- draws on a wide spectrum of knowledge
- enables and empowers innovation, exploration and the acquisition of further knowledge
- interacts with and influences cultures, society and how individuals and societies behave
- raises ethical issues
- is underpinned by computational thinking.

Computational thinking involves the ability to:

- think procedurally, logically, concurrently, abstractly, recursively and think ahead
- utilize an experimental and inquiry-based approach to problem-solving
- develop algorithms and express them clearly
- appreciate how theoretical and practical limitations affect the extent to which problems can be solved computationally.

During the course the student will develop computational solutions. This will involve the ability to:

- identify a problem or unanswered question
- design, prototype and test a proposed solution
- liaise with clients to evaluate the success of the proposed solution and make recommendations for future developments.

Computer science has links with subjects outside of group 4, notably information technology in a global society (ITGS), but it should be noted that there are clear differences between the subjects.

Prior learning

Past experience shows that students will be able to study computer science at SL successfully with no background in, or previous knowledge of, computer science. Their approach to study, characterized by specific IB learner profile attributes—inquirers, thinkers and communicators—will be significant here. Students who have undertaken the IB Middle Years Programme (MYP) or studied a similar course prior to commencing the IB Diploma Programme would also be well prepared.

The study of computer science at HL demands a higher level of problem-solving skills and the ability to understand and manipulate abstract concepts. Although no previous knowledge of computer science is required, some exposure to programming is desirable.

Links to the Middle Years Programme

Students who have undertaken the MYP sciences, technology and mathematics courses will be well prepared for group 4 subjects. The MYP science objectives and assessment criteria A–F are aligned with the group 4 objectives and internal assessment criteria, and allow for a smooth transition from the MYP to the Diploma Programme. In particular, the "One world" objective in MYP sciences is further developed in group 4 computer science with the increased emphasis on aim 8—that is, to "raise awareness of the moral, ethical, social, economic and environmental implications of using science and technology". There are specific references to aim 8 implications in assessment statements and teacher's notes in the syllabus details sections in all group 4 guides.

Aims

Subject aims

Diploma Programme computer science students should become aware of how computer scientists work and communicate with each other and with other stakeholders in the successful development and implementation of IT solutions. While the methodology used to solve problems in computer science may take a wide variety of forms, the group 4 computer science course emphasizes the need for both a theoretical and practical approach.

It is in this context that the Diploma Programme computer science course should aim to:

1. provide opportunities for study and creativity within a global context that will stimulate and challenge students developing the skills necessary for independent and lifelong learning
2. provide a body of knowledge, methods and techniques that characterize computer science
3. enable students to apply and use a body of knowledge, methods and techniques that characterize computer science
4. demonstrate initiative in applying thinking skills critically to identify and resolve complex problems
5. engender an awareness of the need for, and the value of, effective collaboration and communication in resolving complex problems
6. develop logical and critical thinking as well as experimental, investigative and problem-solving skills
7. develop and apply the students' information and communication technology skills in the study of computer science to communicate information confidently and effectively
8. raise awareness of the moral, ethical, social, economic and environmental implications of using science and technology
9. develop an appreciation of the possibilities and limitations associated with continued developments in IT systems and computer science
10. encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method.

Assessment objectives

The objectives for all group 4 subjects reflect those parts of the aims that will be assessed. Wherever appropriate, the assessment will draw upon a range of contexts and identify the social, moral and economic effects of science and technology.

It is the intention of the Diploma Programme computer science course that students achieve the following objectives.

1. Know and understand:
   - relevant facts and concepts
   - appropriate methods and techniques
   - computer science terminology
   - methods of presenting information.
2. Apply and use:
   - relevant facts and concepts
   - relevant design methods and techniques
   - terminology to communicate effectively
   - appropriate communication methods to present information.
3. Construct, analyse, evaluate and formulate:
   - success criteria, solution specifications including task outlines, designs and test plans
   - appropriate techniques within a specified solution.
4. Demonstrate the personal skills of cooperation and perseverance as well as appropriate technical skills for effective problem-solving in developing a specified product.

Syllabus outline

Syllabus component	Teaching hours	
	SL	HL
Core syllabus content		
SL/HL core The topics that must be studied, including some practical work, are: • Topic 1: System fundamentals (20 hours) • Topic 2: Computer organization (6 hours) • Topic 3: Networks (9 hours) • Topic 4: Computational thinking, problem-solving and programming (45 hours)	80	80
HL extension The topics that must be studied, including some practical work, are: • Topic 5: Abstract data structures (23 hours) • Topic 6: Resource management (8 hours) • Topic 7: Control (14 hours)	---	45
Case study Additional subject content introduced by the annually issued case study	---	30
Option		
SL/HL core	30	30
HL extension Students study one of the following options: Option A: Databases Option B: Modelling and simulation Option C: Web science Option D: Object-oriented programming (OOP)	---	15
Internal assessment		
Solution Practical application of skills through the development of a product and associated documentation	30	30
Group 4 project	10	10
Total teaching hours	**150**	**240**

Assessment outline—SL

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Assessment component	Weighting
External assessment (2 hours 30 minutes) **Paper 1 (1 hour 30 minutes)** Paper 1 is an examination paper consisting of **two compulsory sections**. • Section A (30 minutes approximately) consists of several **compulsory** short answer questions. The maximum mark for this section is 25. • Section B (60 minutes approximately) consists of three **compulsory** structured questions. The maximum mark for this section is 45. (70 marks) **Paper 2 (1 hour)** Paper 2 is an examination paper linked to the option studied. The paper consists of between two and five **compulsory** questions. (45 marks) **Calculators:** The use of calculators is **not** permitted in any computer science examination.	**70%** **45%** **25%**
Internal assessment (40 hours) This component is internally assessed by the teacher and externally moderated by the IB at the end of the course. **Solution (30 hours)** The development of a computational solution. Students must produce: • a cover page that follows the prescribed format • a product • supporting documentation (word limit 2,000 words). (34 marks) **Group 4 project (10 hours)** To be assessed using the criterion Personal skills. (6 marks) (total 40 marks)	**30%**

Assessment outline—HL

First examinations 2014

Assessment component	Weighting
External assessment (4 hours 30 minutes) **Paper 1 (2 hours 10 minutes)** Paper 1 is an examination paper consisting of **two compulsory sections**. • Section A (30 minutes approximately) consists of several **compulsory** short answer questions. The maximum mark for this section is 25. • Section B (100 minutes approximately) consists of five **compulsory** structured questions. The maximum mark for this section is 75.	**80%** **40%**
Paper 2 (1 hour 20 minutes) Paper 2 is an examination paper linked to the option studied. The paper consists of between three and seven **compulsory** questions. The SL/HL core questions are common and worth 45 marks, HL extension is worth 20 marks. (65 marks)	**20%**
Paper 3 (1 hour) Paper 3 is an examination paper of **1 hour** consisting of **four compulsory** questions based on a pre-seen case study. (30 marks) **Calculators:** The use of calculators is **not** permitted in any computer science examination.	**20%**
Internal assessment (40 hours) This component is internally assessed by the teacher and externally moderated by the IB at the end of the course. **Solution (30 hours)** The development of a computational solution. Students must produce: • a cover page that follows the prescribed format • a product • supporting documentation (word limit 2,000 words). (34 marks) **Group 4 project (10 hours)** To be assessed using the criterion Personal skills. (6 marks) (total 40 marks)	**20%**