

Proposed GCE AS and A Level Subject Content for Computer Science

The criteria

Introduction

AS and A level subject criteria set out the knowledge, understanding, skills and assessment objectives common to all AS and A level specifications in a given subject.

They provide the framework within which the awarding organisation creates the detail of the specification.

Aims and objectives

1. All specifications in Computer Science must build on knowledge, understanding and skills established at Key Stage 4 and encourage learners to develop a broad range of skills and knowledge of computing, as a basis for progression into further learning and/or employment in computing-related fields.
2. A level specifications in Computer Science must encourage learners to develop:
 - the capacity for thinking creatively, innovatively, analytically, logically and critically;
 - an understanding of computer systems;
 - Computational thinking skills (as set out in the attached annex);
 - the ability to apply skills, knowledge and understanding to solve problems;
 - the capacity to see relationships between different aspects of Computer Science;
 - an understanding of the consequences of uses of computing, including social, legal, ethical and other issues; and
 - an awareness of technologies and an appreciation of their impact on society.

Subject content

Knowledge and understanding

3. AS and A level specifications must require learners to develop a knowledge and understanding of the fundamentals of computer science and programming. AS

specifications must address each of the bullets below in a balanced way but need not make explicit requirements for every item.

- The characteristics of contemporary processors, input, output and storage devices.
- The need for and means of connection between hardware components of a computer system.
- The characteristics of networks and the importance of networking protocols and standards.
- Possible future developments.
- The systematic approach to problem-solving using computers.
- The need for and functions of systems software.
- The need for and attributes of different types of software.
- The methods of capturing, selecting, exchanging and managing data to produce information for a particular purpose.
- The fundamentals of programming techniques.
- Data types, data structures and algorithms.
- The need for and characteristics of a variety of programming paradigms.
- The purpose and characteristics of a range of uses of computing.
- The data, processing, and communication requirements of computer systems.
- Software engineering (the methodology, software development, including systems life cycle and testing).
- The consequences of current uses of computing including economic, social, legal and ethical issues.

Skills

7. AS and A level specifications must require learners to develop skills in the following topics. AS specifications must address each of the sections in a balanced way but need not make explicit requirements for every item.

Analysis

- Evaluate the possible need for development of a computer-based solution to a problem.

- Judge the feasibility of a computer-based solution to a problem.
- Derive the user, data and processing requirements of a system, including a consideration of the human aspects and physical environment.
- Specify and document the data and processing requirements for a computer-based solution to a problem.

Design

- Specify and document, using appropriate systematic methods:
 - the functions of the parts of a system;
 - the interrelationships between the various parts of a system;
 - the selection of an appropriate hardware and software configuration;
 - the method of solving the problem including, where appropriate, evaluation of alternative proposals;
 - the algorithms, data types, data structures and other requirements of the solution;
 - the method of testing the solution and the selection of test data; and
 - the effectiveness of the proposed solution in meeting the requirements of the problem.

Implementation

- Select appropriate software and hardware, and techniques for their use.
- Implement the design.
- Carry out testing.
- Develop documentation.

Evaluation

- Evaluate the methods used to obtain a solution.
- Evaluate solutions against the specification and on the basis of effectiveness, usability and maintainability.

Annex: Computational Thinking Skills

Maths content in AS and A Level Computer Science specifications

Computer Science uses mathematics to express its computational laws and process.

Any accredited specification in Computer Science must contain a minimum of 10% mathematics. Awarding Organisations are free to include and assess a greater percentage of mathematics. Students may be asked to demonstrate their Knowledge & Understanding and Skills of computational processes and problem-solving in both theoretical and practical ways. The following table shows the key concepts that will be common to all specifications in Computer Science.

For each topic below, while the concepts are Level 2 (though not all appear in GCSE Mathematics specifications), students will, however, be expected to apply the skills they acquire in a Level 3 context.

Topic	Level	Clarification
Boolean algebra	3	The concept is Level 2 but the application is Level 3
Algorithms	3	The concept is Level 2 but the application is Level 3
Data types and data structures	3	The concept is Level 2 but the application is Level 3
Number representations and bases	3	The concept is Level 2 but the application is Level 3