



# GCE AS and A level subject content for computer science

## Introduction

1. AS and A level subject content sets out the knowledge, understanding and skills common to all AS and A level specifications in computer science.

## Aims and objectives

2. All specifications in computer science must build on the knowledge, understanding and skills established at key stage 4 and encourage students to develop a broad range of the knowledge, understanding and skills of computing, as a basis for progression into further learning and/or employment.

3. AS and A level specifications in computer science must encourage students to develop:

- an understanding of, and the ability to apply, the fundamental principles and concepts of computer science, including abstraction, decomposition, logic, algorithms and data representation
- the ability to analyse problems in computational terms through practical experience of solving such problems, including writing programs to do so
- the capacity for thinking creatively, innovatively, analytically, logically and critically
- the capacity to see relationships between different aspects of computer science
- mathematical skills (as set out in the attached annex)
- the ability to articulate the individual (moral), social (ethical), legal and cultural opportunities and risks of digital technology

## Subject content

### Knowledge and understanding

4. AS and A level specifications must require students to develop a knowledge and understanding of the fundamentals of computer science and programming including:

- fundamentals of programming
- the concept of data type, including primitive data types and complex data structures
- data representation

- following and writing algorithms
  - methods of capturing, selecting, exchanging and managing data to produce information for a particular purpose
  - the need for and functions of systems software
  - characteristics of contemporary systems architectures, including processors, storage, input, output and their connectivity
  - characteristics of networks and the importance of networking protocols and standards
  - the individual (moral), social (ethical), legal and cultural opportunities and risks of digital technology
5. In addition, A level specifications must require students to develop a knowledge and understanding of:
- the importance of the efficiency of an algorithm; that this can be measured in terms of execution time and space requirements, and that the efficiency of algorithms that perform the same task can be compared
  - standard algorithms
  - the use of databases to store, retrieve and manipulate data, including database programming and producing a data model
  - the need for and characteristics of a variety of programming paradigms

## Skills

6. AS and A level specifications must require students to develop the following skills:
- take a systematic approach to problem solving
  - design, write and test programs to either a specification or to solve a problem
  - articulate how a program works, arguing for its correctness and efficiency using logical reasoning, test data, and user feedback
  - use abstraction effectively:
    - to appropriately structure programs into modular parts with clear, well-documented interfaces
    - to model selected aspects of the external world in a program
  - apply computing-related mathematics
7. In addition, A level specifications must require students to:
- know and understand how to write specifications for a programming solution

## Annex: mathematical skills

Computer science uses mathematics to express its computational laws and processes.

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 and understanding and skills of computational processes and problem-solving in both theoretical and practical ways. The following list shows the key topics 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.

Topics:

- Boolean algebra
- Comparison of complexity of algorithms\*
- Number representations and bases

\*applicable to A level only due to its advanced nature.

