

FEBRUARY 2019

GCSE Subject Level Conditions and Requirements for Computer Science

For qualifications examined from 2022 onwards

ofqual

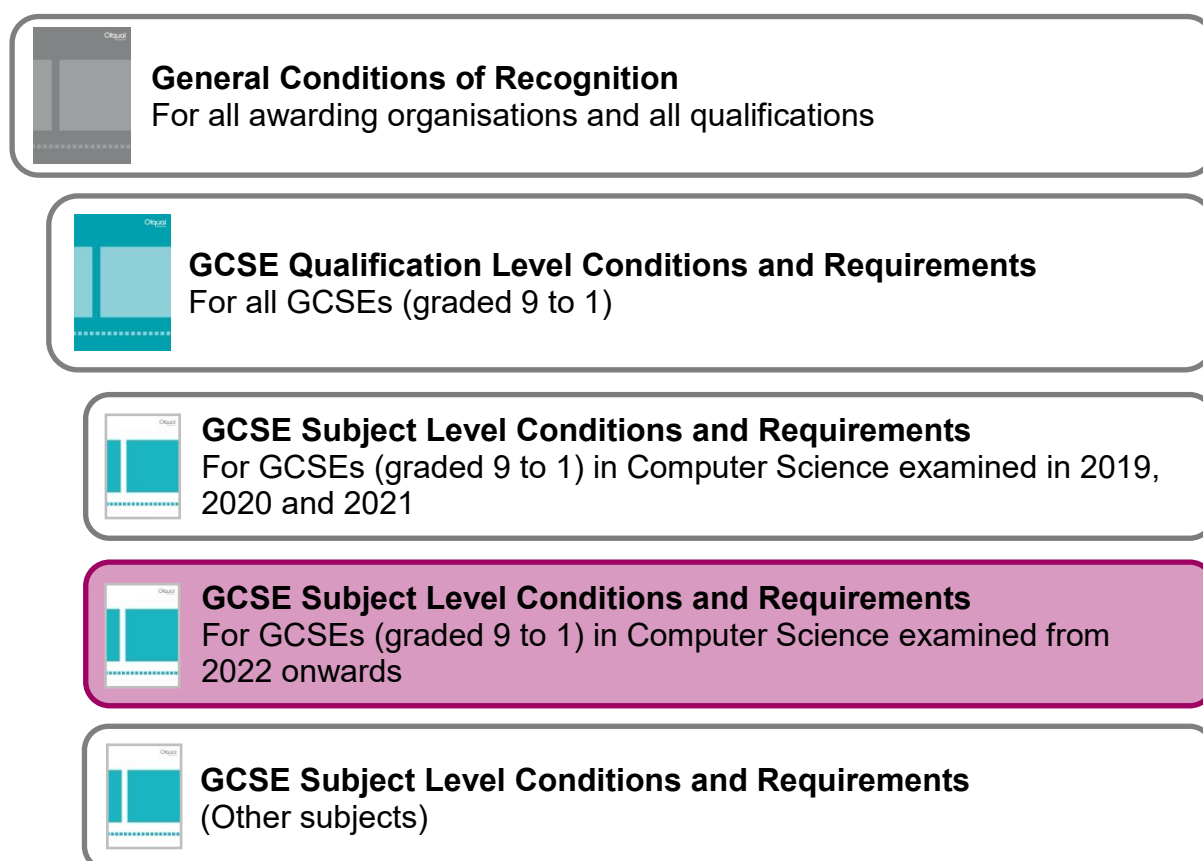
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Introduction

About this document

This document (highlighted in the figure below) is part of a suite of documents which sets out the regulatory requirements for awarding organisations offering GCSE qualifications (graded from 9 to 1).



We have developed these requirements with the intention that GCSE qualifications (graded from 9 to 1) should fulfil the following purposes:

- To provide evidence of students' achievements against demanding and fulfilling content;
- To provide a strong foundation for further academic and vocational study and for employment; and
- To provide (if required) a basis for schools and colleges to be held accountable for the performance of all of their students.

Requirements set out in this document

This document sets out GCSE Subject Level Conditions for Computer Science. These Conditions come into effect at 5.01pm on Monday 18 February 2019 and apply to all GCSE qualifications (graded from 9 to 1) in Computer Science examined in or after 2022.

It also sets out our requirements in relation to:

- assessment objectives – awarding organisations must comply with these requirements under Condition GCSE(Computer Science)1.2;
- assessments – awarding organisations must comply with these requirements under Condition GCSE(Computer Science)2.1.

Appendix 1 reproduces the requirements in relation to subject content for GCSE Computer Science,¹ as published by the Department for Education. Awarding organisations must comply with these requirements under Condition GCSE(Computer Science)1.1.

With respect to all GCSE Qualifications (graded from 9 to 1) in Computer Science, awarding organisations must also comply with:

- our *General Conditions of Recognition*,² which apply to all awarding organisations and qualifications;
- our *GCSE Qualification Level Conditions*;³ and
- all relevant Regulatory Documents.⁴

Application of this document

We have revised our *GCSE Subject Level Conditions and Requirements for Computer Science* since they were originally published (see Appendix 2 for details), most recently in February 2019.

This (February 2019) version applies only to GCSE qualifications (graded from 9 to 1) in Computer Science examined in or after 2022. For those qualifications, it replaces all previous versions of *GCSE Subject Level Conditions and Requirements for Computer Science* with effect from 5.01 pm on Monday 18 February 2019.

¹ www.gov.uk/government/publications/gcse-computer-science

² www.gov.uk/government/publications/general-conditions-of-recognition

³ www.gov.uk/government/publications/gcse-9-to-1-qualification-level-conditions

⁴ www.gov.uk/government/publications/regulatory-documents-list

The previous (January 2018) version of *GCSE Subject Level Conditions and Requirements for Computer Science*⁵ remains in force for all GCSE qualifications (graded from 9 to 1) in Computer Science examined in 2019, 2020 and 2021.

Summary of requirements

| Subject Level Conditions | |
|--|--|
| GCSE(Computer Science)1 | Compliance with content requirements |
| GCSE(Computer Science)2 | Assessment |
| GCSE (Computer Science)3 | Practical Programming Statement |

| Assessment objectives |
|---|
| Assessment objectives – GCSE Qualifications in Computer Science |

| Assessment requirements |
|---|
| Requirements in relation to assessments for GCSE Qualifications in Computer Science |

| Appendix 1 – Subject content (published by Department for Education) |
|--|
| Computer Science: GCSE subject content |

⁵ www.gov.uk/government/publications/gcse-9-to-1-subject-level-conditions-and-requirements-for-computer-science

Subject Level Conditions

GCSE Subject Level Conditions for Computer Science

Condition GCSE(Computer Science)1

Compliance with content requirements

- GCSE(Computer Science)1.1 In respect of each GCSE Qualification in Computer Science which it makes available, or proposes to make available, an awarding organisation must –
- (a) comply with the requirements relating to that qualification set out in the document published by the Secretary of State entitled ‘Computer science GCSE subject content’,⁶ document reference DFE-00701-2014,
 - (b) have regard to any recommendations or guidelines relating to that qualification set out in that document, and
 - (c) interpret that document in accordance with any requirements, and having regard to any guidance, which may be published by Ofqual and revised from time to time.
- GCSE(Computer Science)1.2 In respect of each GCSE Qualification in Computer Science which it makes available, or proposes to make available, an awarding organisation must comply with any requirements, and have regard to any guidance, relating to the objectives to be met by any assessment for that qualification which may be published by Ofqual and revised from time to time.

⁶ www.gov.uk/government/publications/gcse-computer-science

Condition
GCSE(Computer
Science)2

Assessment

GCSE (Computer
Science)2.1

An awarding organisation must ensure that in respect of each assessment for a GCSE Qualification in Computer Science which it makes available it complies with any requirements, and has regard to any guidance, which may be published by Ofqual and revised from time to time.

*Condition
GCSE(Computer
Science)3*

Practical programming statement

- GCSE(Computer Science)3.1 In respect of each assessment cycle for a GCSE qualification in Computer Science which it makes available, an awarding organisation must –
- (a) require each centre to provide a practical programming statement to the awarding organisation, and
 - (b) treat any failure by a Centre to provide a practical programming statement to awarding organisation in a timely manner as malpractice and/or maladministration (under General Condition A8 (*Malpractice and maladministration*)).
- GCSE(Computer Science)3.2 For the purpose of this condition, a ‘practical programming statement’ is a true and accurate written statement made by a Centre to an awarding organisation which confirms that it has taken reasonable steps to ensure that each Learner to which that Centre has delivered the assessments to be taken in a particular assessment cycle for a GCSE Qualification in Computer Science which the awarding organisation makes available has had the opportunity to undertake a programming task or tasks during their course of study which allow(s) them to develop the skills to:
- design,
 - write,
 - test, and
 - refine programs
- using one or more high-level programming language with a textual program definition, either to a specification or to solve a problem (or problems).
-

Assessment objectives

Assessment objectives – GCSE Qualifications in Computer Science

Condition GCSE(Computer Science)1.2 allows us to specify requirements relating to the objectives to be met by any assessment for all GCSE Qualifications in Computer Science.

The assessment objectives set out below constitute requirements for the purposes of Condition GCSE(Computer Science)1.2. Awarding organisations must comply with these requirements in relation to all GCSE Qualifications in Computer Science they make available or propose to make available.

| | Objective | Weighting |
|------------|--|-----------|
| AO1 | Demonstrate knowledge and understanding of the key concepts and principles of computer science. | 30% |
| AO2 | Apply knowledge and understanding of key concepts and principles of computer science. | 40% |
| AO3 | Analyse problems in computational terms: <ul style="list-style-type: none"> ■ to make reasoned judgements ■ to design, program, evaluate and refine solutions. | 30% |

Requirements for assessments

Requirements in relation to assessments for GCSE Qualifications in Computer Science

Condition GCSE(Computer Science)2.1 allows us to specify requirements and guidance in relation to assessments for GCSE Qualification in Computer Science.

We set out below our requirements for the purposes of Condition GCSE(Computer Science)2.1. Awarding organisations must comply with these requirements in relation to all GCSE Qualifications in Computer Science they make available.

Programming languages

For each GCSE Qualification in Computer Science which it makes available, or proposes to make available, an awarding organisation must ensure that –

- (a) it sets out in the specification for that qualification the programming language(s) which Learners are permitted to use for the purposes of the assessments,
- (b) each such programming language is a high-level programming language that has a textual program definition, and
- (c) it justifies its choice of permitted programming language(s) in its assessment strategy for the qualification.

Assessment of Programming Skills

The subject content for GCSE Qualifications in Computer Science is set out in the document published by the Secretary of State entitled ‘Computer Science GCSE subject content’, document reference DFE-00701-2104 (the ‘Content Document’).

Paragraph 5 of the Content Document states that GCSE Qualification in Computer Science must –

... require students to develop the following skills:

[...]

- design, write, test and refine programs, using one or more high-level programming language with a textual program definition, either to a specification or to solve a problem

In designing and setting the assessments for a GCSE Qualification in Computer Science which it makes available, or proposes to make available, an awarding organisation must ensure that – taking those assessments together – Learners are required to –

- (a) design,
- (b) write,
- (c) test, and
- (d) refine

a program to a set task/brief (or to solve a problem), using one or more high-level programming language with a textual program definition (together, the 'Programming Skills').

For clarity, assessments may require Learners to demonstrate each of the Programming Skills –

- (a) separately, or in any combination, and
- (b) in relation to one or more separate tasks, briefs or problems.

An awarding organisation must demonstrate to Ofqual's satisfaction in its assessment strategy that –

- (a) it has taken all reasonable steps to identify the risk of any Adverse Effect which may result from its approach to assessing Programming Skills, and
- (b) where such a risk is identified, it has taken all reasonable steps to prevent that Adverse Effect or, where it cannot be prevented, to mitigate that Adverse Effect.

Subject content (published by Department for Education)



Department
for Education

Computer science

GCSE subject content

January 2015

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The content for computer science GCSEs

Introduction

1. The GCSE subject content sets out the knowledge, understanding and skills common to all GCSE specifications in a given subject. Together with the assessment objectives it provides the framework within which the awarding organisations create the detail of their specifications, so ensuring progression from key stage 3 national curriculum requirements and the possibilities for development into A level.

Subject aims and learning outcomes

2. All specifications in computer science must build on the knowledge, understanding and skills established through the computer science elements of the programme of study for computing at key stage 3, satisfy the computer science elements of computing at key stage 4 and enable students to progress into further learning and/or employment.

3. GCSE specifications in computer science should enable students to:

- understand and apply the fundamental principles and concepts of computer science, including abstraction, decomposition, logic, algorithms, and data representation
- analyse problems in computational terms through practical experience of solving such problems, including designing, writing and debugging programs
- think creatively, innovatively, analytically, logically and critically
- understand the components that make up digital systems, and how they communicate with one another and with other systems
- understand the impacts of digital technology to the individual and to wider society
- apply mathematical skills relevant to computer science

Subject content

Knowledge and understanding

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

- standard algorithms, including binary search and merge sort
- following and writing algorithms to solve problems including
 - sequence, selection and iteration
 - input, processing and output
- how particular programs and algorithms work
- the concept of data type, including integer, Boolean, real, character and string, and data structures, including records and one- and two-dimensional arrays
- representation of numbers in binary and hexadecimal; conversion between these and decimal; binary addition and shifts
- representation of text, sound, and graphics inside computers
- Boolean logic using AND, OR and NOT, combinations of these, and the application of logical operators in appropriate truth tables to solve problems
- the purpose and functionality of systems software, including the operating system and utility software
- characteristics of systems architectures, including
 - CPU architecture, including Von Neumann and the role of the components of the CPU in the fetch-execute cycle
 - main and contemporary secondary storage and ways of storing data on devices including magnetic, optical and solid state
 - data capacity and calculation of data capacity requirements
 - hardware components and embedded systems
- networks and the importance of:
 - connectivity, both wired and wireless
 - types of network
 - common network topologies
 - network security
 - the concept of networking protocols, including Ethernet, Wi-Fi, TCP/IP, HTTP, HTTPS, FTP and email protocols
 - layers

- cyber security: forms of attack (based on technical weaknesses and behaviour), methods of identifying vulnerabilities, and ways to protect software systems (during design, creation, testing, and use)
- the ethical, legal and environmental impacts of digital technology on wider society, including issues of privacy and cyber security
- characteristics and purpose of different levels of programming language, including low-level language

Skills

5. GCSE specifications must require students to develop the following skills:
- take a systematic approach to problem solving including the use of decomposition and abstraction, and make use of conventions including pseudo code and flowcharts
 - design, write, test and refine programs, using one or more high-level programming language with a textual program definition, either to a specification or to solve a problem
 - use appropriate security techniques, including validation and authentication
 - evaluate the fitness for purpose of algorithms in meeting requirements efficiently using logical reasoning and test data¹
 - use abstraction effectively
 - to model selected aspects of the external world in a program
 - to appropriately structure programs into modular parts with clear, well-documented interfaces
 - apply computing-related mathematics

¹ Formal comparisons of algorithmic efficiency are not required



Department
for Education

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Appendix 2 – Revisions to this document

The table below sets out all revisions to this document since it was first published, and the dates on which those revisions came into force.

| Revision | Date in force |
|--|----------------------|
| <p>Published revised Conditions and requirements for qualifications examined in or after 2022:</p> <ul style="list-style-type: none"> ■ Condition GCSE(Computer Science)2 (new) ■ Condition GCSE(Computer Science)3 (replaced) ■ Assessment objectives (amended) ■ Assessment requirements (new) ■ Requirements for the programming project (removed) | <p>February 2019</p> |
| <ul style="list-style-type: none"> ■ Condition GCSE(Computer Science)2 (removed) ■ Condition GCSE(Computer Science) ■ Assessment objectives (amended) ■ Assessment requirements (removed) ■ Requirements for the programming project (new) | <p>January 2018</p> |
| <p>First published</p> | <p>May 2015</p> |



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