GCSE Subject Level Conditions and Requirements for Computer Science

May 2015

Contents

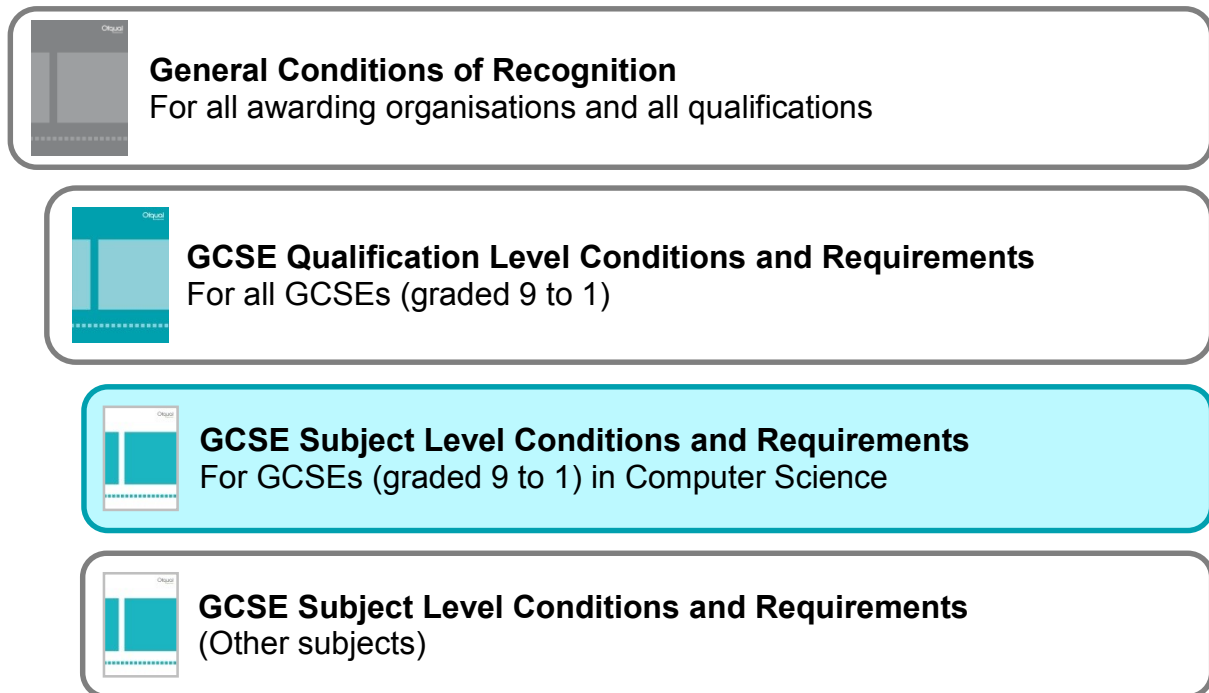# Introduction

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).

General Conditions of Recognition
For all awarding organisations and all qualifications

GCSE Qualification Level Conditions and Requirements
For all GCSEs (graded 9 to 1)

GCSE Subject Level Conditions and Requirements
For GCSEs (graded 9 to 1) in Computer Science

GCSE Subject Level Conditions and Requirements
(Other subjects)

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 the GCSE Subject Level Conditions for Computer Science. These conditions will come into effect at 12.01am on Thursday 14 May 2015 for all GCSE qualifications (graded from 9 to 1) in Computer Science.

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; and

- assessment – awarding organisations must comply with these requirements under Condition GCSE (Computer Science)2.3.

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]

With respect to GCSE qualifications graded from A* to G, awarding organisations must continue to comply with the General Conditions of Recognition, and the relevant Regulatory Documents.

Summary of requirements

Subject Level Conditions	
GCSE(Computer Science)1	Compliance with content requirements
GCSE(Computer Science)2	Assessment

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[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

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](#)

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',[5] 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.

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[5] www.gov.uk/government/publications/gcse-computer-science

Condition GCSE(Computer Science)2	Assessment
GCSE(Computer Science)2.1	Condition GCSE4.1 does not apply to any GCSE Qualification in Computer Science which an awarding organisation makes available or proposes to make available.
GCSE(Computer Science)2.2	In respect of the total marks available for a GCSE Qualification in Computer Science which it makes available, an awarding organisation must ensure that – (a) 80 per cent of those marks are made available through Assessments by Examination, and (b) 20 per cent of those marks are made available through assessments that are not Assessments by Examination.
GCSE(Computer Science)2.3	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.

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: ■ to make reasoned judgements ■ to design, program, evaluate and refine solutions.	*30%*

Assessment requirements

Requirements in relation to assessments for GCSE Qualifications in Computer Science

Condition GCSE(Computer Science)2.3 allows us to specify requirements and guidance in relation to assessments for GCSE Qualifications in Computer Science.

We set out our requirements for the purposes of Condition GCSE(Computer Science)2.3 below.

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 in assessments which are not Assessments by Examination,

(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.

Non-examination assessment

Condition GCSE(Computer Science)2.2(b) states that an awarding organisation must ensure that, of the total marks available for a GCSE Qualification in Computer Science, 20 per cent of those marks shall be made available through assessments which are not Assessments by Examination.

An awarding organisation must ensure that each such assessment which is not an Assessment by Examination –

(a) is designed and set on the basis that it should be completed by each Learner during periods of assessment totalling 20 hours,

(b) is designed and set to be taken under conditions specified by the awarding organisation, including, in particular, conditions which ensure that the evidence generated by each Learner can be Authenticated, and

(c) requires each Learner to undertake a single project which leads to the generation of the following evidence –

(i) a program designed, written, tested and refined by the Learner, either to a specification or to solve a problem, using one or more of the programming languages specified by the awarding organisation, and

(ii) a written report.

An assessment for a GCSE Qualification in Computer Science which is not an Assessment by Examination may be set –

(a) by the awarding organisation, or

(b) by a Centre.

In any event, the 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 setting the assessment, 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.

Marking of assessments

Evidence generated by a Learner in an assessment for a GCSE Qualification in Computer Science which is not an Assessment by Examination may be marked –

(a) by the awarding organisation or a person connected to the awarding organisation,

(b) by a Centre, or

(c) through a combination of (a) and (b).

In any event, the 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 marking the assessments (and to Moderation where appropriate), 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)

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Computer science

GCSE subject content

January 2015

Contents

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 data[1]

- 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

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[1] Formal comparisons of algorithmic efficiency are not required

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