AQA

# GCSE
Specification

# Computer Science

For exams June 2014 onwards
For certification June 2014 onwards

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Specification

# Computer Science
# 4512

**For GCSE exams June 2014 onwards**
**For certification June 2014 onwards**

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AQA Logistics Centre (Manchester)
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# Contents

# 1 Introduction



## 1a Why choose AQA?

We are the United Kingdom's favourite exam board and more students get their academic qualifications from us than from any other. But why are we so popular?

**We understand the different requirements of each subject by working with teachers. Our GCSEs:**

- help students achieve their full potential
- are relevant for today's challenges
- are manageable for schools and colleges
- are easy to understand by students of all levels of ability
- lead to accurate results, delivered on time
- are affordable and value for money.

**We provide a wide range of support services for teachers, including:**

- access to subject departments
- training for teachers, including practical teaching strategies and methods that work, presented by senior examiners
- individual support for Controlled Assessment
- 24-hour support through our website and online with **Ask AQA**
- past question papers and mark schemes
- a wide range of printed and electronic resources for teachers and students
- free online results analysis, with Enhanced Results Analysis.

We are an educational charity focused on the needs of the learner. All our income is spent on improving the quality of our specifications, examinations and support services. We don't aim to profit from education, we want you to.

If you are already a customer we thank you for your support. If you are thinking of joining us we look forward to welcoming you.

# 1b Why choose GCSE in Computer Science?

Computing is of enormous importance to the economy, and the role of Computer Science as a discipline itself and as an 'underpinning' subject across science and engineering is growing rapidly.

Computer technology continues to advance rapidly and the way that technology is consumed has also been changing at a fast pace over recent years. The growth in the use of mobile devices and web-related technologies has exploded, resulting in new challenges for employers and employees. For example, businesses today require an ever-increasing number of technologically-aware individuals. This is even more so in the gaming, mobile and web related industries and this specification has been designed with this in mind. Students studying this specification will learn how to create applications that:

- run on mobile devices
- operate in a web enabled environment.

In addition they will:

- learn how to create simple computer games
- gain an understanding of the fundamental concepts around creating software applications
- have opportunities to work collaboratively.

Having studied this specification, candidates will be able to create their own mobile applications to gain additional functionality from their mobile devices, such as mobile phones or tablets, rather than being restricted to the applications available from other sources. They will also be able to create interactive web-based applications as opposed to just being end users of these. In the context of gaming, candidates will be able to create their own simple games instead of being restricted to those produced for them by others. In essence, studying this specification will free the candidate from dependency on other people creating applications for them to use. They will have developed the skills and understanding which underpin the creation of their own applications.

The specification does not specify the particular computer languages that students must use or learn. Instead that choice is left to schools/colleges and students to take account of teacher expertise, resources and student needs and interests.

AQA will provide controlled assessment tasks that will allow students to select areas of broad interest to them from gaming, mobile, web and more traditional systems. Within each broad area they will be given a scenario-based task to create an appropriate software solution that meets the needs of the user.

The specification provides progression from key stage 3 studies by building on the knowledge and skills taught and will provide excellent progression to 'A' level Computer Science, vocational courses and on to degree level courses in the areas of computing, engineering and science. Whilst this specification is not specifically mapped to any particular industry standard IT qualifications it will provide a sound preparatory basis of study for them. In addition the course provides the knowledge, skills and understanding that a growing number of employers are demanding.

## 1c How do I start using this specification?

- You need to register at **www.aqa.org.uk/askaqa.php** to ensure that you receive regular updates and have access to mark schemes, past question papers, a whole range of teacher support materials and receive details of teacher support meetings.

- **Already using existing AQA specifications?**

  Tell us that you intend to enter students. Then we can make sure that you receive all the material you need for the examinations. You can let us know by completing the appropriate Intention to Enter and Estimated Entry forms. We will send copies to your Exams Officer and they are also available on our website at **www.aqa.org.uk/entries**

- **Not using an AQA specification currently?**

  Almost all schools/colleges in England and Wales use AQA or have used AQA in the past and are approved AQA centres. A small minority are not. If your school/college is new to AQA, please contact our centre approval team at **centreapproval@aqa.org.uk**

## 1d How can I find out more?

You can choose to find out more about this specification or the services that AQA offer in a number of ways.

### Ask AQA

You have 24-hour access to useful information and answers to the most commonly asked questions at **www.aqa.org.uk/askaqa.php**.

If the answer to your question is not available, you can submit a query through **Ask AQA** for our team. We will respond within two working days.

### Speak to your subject team

You can talk directly to the ICT subject team about this specification either by emailing **ict-subjects@aqa.org.uk** or by calling 0161 958 3860.

### Teacher Support

Details of the full range of current Teacher Support and CPD courses are available on our website at **http://web.aqa.org.uk/qual/cpd/index.php**

There is also a link to our fast and convenient online booking system for all of our courses at **http://coursesandevents.aqa.org.uk/**

### Latest information online

You can find out more including the latest news, how to register to use Enhanced Results Analysis, support and downloadable resources on our website at **www.aqa.org.uk**

# 2 Specification at a glance

This specification has one tier of assessment, with a single paper that covers all of the grades A*–G.

For assessments and subject awards for this specification there is a requirement that 100% of the assessment is terminal.

## Computer Science (4512)

**Component 1 – Practical programming**

Approximately 50 hours of controlled assessment (2 tasks of 25 hours each)

60% of the marks

126 marks (63 marks for each task)

180 UMS

Internally assessed, externally moderated.

Different tasks will be provided by AQA each year.

Each student should complete two tasks from a choice of four. Working independently students demonstrate their ability to code a solution to a given problem. The tasks will be set in engaging and relevant contexts, eg gaming, web, mobile phone applications.

Tasks may be completed and submitted on paper or electronically (saved to CD and posted to the moderator).

**PLUS**

**Component 2 – Computing fundamentals**

1 hour 30 minutes

40% of the marks

84 marks

120 UMS

Externally assessed. Schools/colleges can choose to enter students for either a paper-based or on-screen version.

All questions will be compulsory and will be taken from across the subject content.

This component will include a range of types of questions from very short to extended answer.

# 3 Subject content

This subject content should be taught within a range of realistic contexts based around the major themes within the specification of web, mobile, gaming and more traditional coding systems. A number of the sections will benefit from being taught holistically to gain the most from the specification. For example, algorithms could be taught alongside programming techniques as there is a close relationship between them.

Throughout the subject content the learning outcomes are specified. These will not change during the lifespan of the specification. There is no intention for the assessment to go beyond the items listed other than in exceptional circumstances, for example where the speed of the introduction of a ubiquitous new technology outstrips the speed at which the specification can be updated.

## Content overview

The subject content of this specification has been divided into sections for ease of reference.



### Overview of the subject content:

## Detailed content and learning outcomes

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.1 Constants, variables and data types**<br>■ data and information<br>■ constants<br>■ variables<br>■ data types<br>■ purpose of data types | Students should:<br>■ understand what is meant by the terms data and information<br>■ be able to describe the difference between a constant and a variable<br>■ understand when to use constants and variables in problem solving scenarios<br>■ understand the different data types available to them. As a minimum, students should know about integer, Boolean, real, character and string data types and how these are represented in the programming language(s) they are using<br>■ be able to explain the purpose of data types within code<br>■ understand and be able to program with 1 and 2 dimensional arrays<br>■ be able to use NOT, AND and OR when creating Boolean expressions and have experience in using these operators within coded solutions. |
| **3.1.2 Structures**<br>■ how data types can be combined to make data structures<br>■ how data structures can make coding a solution to a problem simpler | Students should:<br>■ be able to explain what a data structure is<br>■ be able to produce their own data types that go beyond the built in structures of the language(s) they are using, such as arrays or lists. These could include, for example, records in Delphi, structs in C or classes in Python and Java. The actual structures would depend on the language(s) being used by the students<br>■ understand and be able to explain why data structures can make coding a solution simpler. |
| **3.1.3 Program flow control**<br>■ sequencing<br>■ selection<br>■ iteration | Students should:<br>■ understand the need for structure when designing coded solutions to problems<br>■ understand how problems can be broken down into smaller problems and how these steps can be represented by the use of devices such as flowcharts and structure diagrams<br>■ understand and be able to describe the basic building blocks of coded solutions (ie sequencing, selection and iteration)<br>■ know when to use the different flow control blocks (ie sequencing, selection and iteration) to solve a problem. |

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.4 Procedures and functions**<br>■ what procedures and functions are<br>■ when to use procedures and functions<br>■ writing your own procedures and functions<br>■ built-in functions<br>■ parameters<br>■ return values | Students should:<br>■ understand what procedures and functions are in programming terms<br>■ know when the use of a procedure or function would make sense and would simplify the coded solution<br>■ know how to write and use their own simple procedures and functions<br>■ know about and be able to describe common built in functions in their chosen language(s)<br>■ use common built-in functions in their chosen language(s) when coding solutions to problems<br>■ understand what a parameter is when working with procedures and functions<br>■ know how to use parameters when creating efficient solutions to problems<br>■ understand the concepts of parameters and return values when working with procedures and functions. |
| **3.1.5 Scope of variables, constants, functions and procedures** | Students should:<br>■ know what is meant by the scope of a variable, constant, function or procedure<br>■ be able to identify what value a particular variable will hold at a given point in the code. |
| **3.1.6 Error handling**<br>■ different types of error that can occur<br>■ how to test your code for errors<br>■ how to detect errors from within code<br>■ how to recover from errors within the code | Students should:<br>■ be able to discuss and identify the different types of errors that can occur within code (ie syntax, run-time and logical)<br>■ understand that some errors can be detected and corrected during the coding stage<br>■ understand that some errors will occur during the execution of the code<br>■ know how to detect errors at execution time and how to handle those errors to prevent the program from crashing where desirable<br>■ be able to use trace tables to check their code for errors<br>■ understand that computer programs can be developed with tools to help the programmer detect and deal with errors (eg Watch, Breakpoint, Step). |

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.7 Handling external data**<br>■ using text files to read/write data<br>■ using databases to read/write data | Students should:<br>■ know how to use an external text file to read and write data in a way that is appropriate for the programming language(s) used and the problem being solved<br>■ know how to read and write data from an external database in a way that is appropriate for the programming language(s) used and the problem being solved. |
| **3.1.8 Computer structure:**<br>**3.1.8.1 Systems** | Students should:<br>■ be able to define a computer system (ie hardware and software working together to create a working solution)<br>■ understand and be able to discuss the importance of computer systems to the modern world<br>■ understand that computer systems must be reliable and robust and be able to discuss the reasons why this is important. |
| **3.1.8.2 Hardware** | Students should:<br>■ be able to describe and explain the fundamental pieces of hardware required to make a functioning computer system<br>■ be able to discuss how developments in different hardware technologies (including memory and processor) are leading to exciting innovative products being created, eg in the mobile and gaming industries<br>■ be able to categorise devices as input or output depending on their function. |
| **3.1.8.3 CPU (Central Processing Unit)** | Students should:<br>■ be able to describe the purpose of the processor (CPU)<br>■ understand how different components link to a processor (ROM, RAM, I/O, storage, etc)<br>■ be able to explain the effect of common CPU characteristics on the performance of the processor. These should include clock speed, number of cores and cache size/types. |

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.8.4 Memory** | Students should:<br>■ know the differences between non-volatile and volatile memory<br>■ understand the purpose of both types of memory and when each should be used<br>■ be able to explain the purpose of virtual memory and cache memory<br>■ be able to explain the concept that data and instructions are stored in memory and processed by the CPU. |
| **3.1.8.5 Secondary storage** | Students should:<br>■ understand what secondary storage is and be able to explain why it is required<br>■ be able to describe the most common types of secondary storage<br>■ understand how optical media, magnetic media and solid state work. |
| **3.1.9 Algorithms** | Students should:<br>■ understand that algorithms are computational solutions that always finish and return an answer<br>■ be able to interpret simple algorithms to deduce their function<br>■ be able to create algorithms to solve simple problems<br>■ be able to detect and correct errors in simple algorithms. |
| **3.1.10 Data representation** | Students should:<br>■ understand that computers use the binary alphabet to represent all data and instructions<br>■ understand the terms bit, nibble, byte, kilobyte, megabyte, gigabyte and terabyte<br>■ understand that a binary code could represent different types of data such as text, image, sound, integer, date, real number<br>■ understand how binary can be used to represent positive whole numbers (up to 255)<br>■ understand how sound and bitmap images can be represented in binary<br>■ understand how characters are represented in binary and be familiar with ASCII and its limitations<br>■ understand why hexadecimal number representation is often used and know how to convert between binary, denary and hexadecimal. |

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.11 Software development life cycle** | Students should:<br>■ understand the software development life cycle<br>■ be able to explain what commonly occurs at each stage of the software development life cycle<br>■ be able to identify at which stage of the software development life cycle a given step would occur<br>■ understand that there are several lifecycle models that can be used (eg cyclical, waterfall, spiral)<br>■ be able to discuss the advantages and disadvantages of these lifecycle models. |
| **3.1.11.1 Prototyping** | Students should:<br>■ understand what prototyping is<br>■ be able to discuss the advantages and disadvantages of using prototyping when developing solutions<br>■ have experience of using prototyping to create solutions to simple problems. |
| **3.1.12 Application testing** | Students should:<br>■ understand the need for rigorous testing of coded solutions<br>■ understand the different types of tests that can be used, including unit/modular testing<br>■ be able to create suitable test plans and carry out suitable testing to demonstrate their solutions work as intended<br>■ be able to hand test simple code designs/algorithms using trace tables. |
| **3.1.13 Networking** | Students should:<br>■ understand what a computer network is<br>■ be able to discuss the advantages and disadvantages of using a computer network<br>■ be able to describe and explain the bus, ring and star networking topologies<br>■ be able to discuss the advantages and disadvantages of each of these topologies. |
| **3.1.13.1 Client server** | Students should:<br>■ understand the client-server model<br>■ be able to explain, in simple terms, the handshake process used in most modern networking protocols<br>■ be able to explain how coding for a client-server model is different from coding for a stand-alone application. |

| Subject Content | Learning Outcomes |
|---|---|
| **3.1.13.2 Web application concepts** | Students should:<br>■ understand the concept of coding at the server and client end<br>■ know what can be coded at the server end<br>■ know what can be coded at the client end<br>■ have experience of coding solutions to simple web application problems. |
| **3.1.14 Use of external code sources** | Students should:<br>■ know of the existence of external code sources<br>■ know how to integrate code from these sources into their own code<br>■ be able to explain the advantages and disadvantages of using such sources. |
| **3.1.15 Database concepts** | Students should:<br>■ understand the basic concepts of a relational database as a data store<br>■ be able to explain the terms record, field, table, query, primary key, relationship, index and search criteria. |
| **3.1.15.1 Query methods (SQL)** | Students should:<br>■ be able to create simple SQL statements to extract, add and edit data stored in databases<br>■ have experience of using these SQL statements from within their own coded systems. |
| **3.1.15.2 Connecting to databases from applications and web based apps** | Students should:<br>■ be able to use databases from within their own web based applications. |
| **3.1.16 The use of computer technology in society** | Students should:<br>■ be able to evaluate the effectiveness of computer programs/solutions<br>■ be able to evaluate the impact of and issues related to the use of computer technology in society. |

# 3a Controlled assessment of Component 1 – Practical programming

Controlled assessment (CA) is a form of internal assessment where the control levels for each stage of the assessment process (task setting, task taking and task marking) have been defined by Ofqual. These control levels must be applied by all GCSE Awarding Bodies. The control levels which must be applied are as follows:

- Task Setting: High
- Task Taking: Medium
- Task Marking: Medium.

## Contextualisation

A high level of control for task setting is required by the Ofqual controlled assessment criteria. This means that AQA must set the tasks for Component 1. However, schools and colleges are permitted to contextualise one or more tasks if an element of a task needs to be changed to meet the availability of, and access to, an individual school or college's resources.

## Controlled assessment and marking criteria

### Task setting

The tasks are set by AQA. Each student will complete two tasks from a choice of four. Working independently the students demonstrate their ability to code a solution to a given problem. The tasks will be set in engaging and relevant contexts, eg gaming, web, mobile phone applications.

The tasks will be available for examination once a year in June beginning in 2014 and will change each year thereafter. It is therefore the responsibility of the school or college to ensure that the correct tasks are used when preparing students.

### Task taking

Important information about task taking in Controlled Assessment is available on the AQA Website. Teachers must read this before beginning Component 1.

When completing the controlled assessment it is expected that candidates must work to produce an individual portfolio of work, in either hard copy or electronic form (saved to CD), for each of the two scenarios completed.

The portfolio for each scenario should be divided into four sections:

1. **Design of the Solution**
2. **Solution Development**
3. **Programming Techniques Used**
4. **Testing and Evaluation**

It is expected that the majority of the portfolio will be produced using a word processor. Certain aspects such as flowcharts, diagrams and plans may need to be created using other types of software or drawn by hand.

Each of the two controlled assessment tasks should take around 25 hours to complete.

### Task marking

The marking criteria for Component 1 are given below. Further important information about controlled assessment task marking is available on the AQA website. Teachers' standardising will be available each year to give support on the tasks, the conduct and the marking. If you have queries about the tasks, you are encouraged to contact us using *Ask AQA for Teachers* on the AQA Website. Each school or college will also be assigned a Controlled Assessment Adviser who will be available to assist teachers with any specific matters relating to Component 1. Contact details of advisers will be provided when you inform us that you are to use the specification.

### Marking criteria

| **Overview** | |
|---|---|
| Design of solution | 9 marks |
| Solution development | 9 marks |
| Programming techniques used | 36 marks |
| Testing and evaluation | 9 marks |
| **Total** | **63 marks** |

## Detailed breakdown

**Design of solution** (0–9 marks available)

The design of solution should include:

1. an explanation of what the problem is and what the solution should be capable of in terms of the needs of the user and their stated objectives
2. a plan showing the high level overview of how the solution will be constructed (using any suitable method)
3. explained/annotated pseudocode (or suitable alternative) showing the main blocks within the proposed solution.

0 marks awarded for no response or for responses not worthy of credit.

| | 1–3 marks | 4–6 marks | 7–9 marks |
|---|---|---|---|
| **Design of solution** | Produced a minimal outline of what the problem involves with minimal or no reference to the user's needs. | Produced evidence showing a good understanding of what the problem involves with reference to most of the user's needs. | There is evidence showing a thorough understanding of what the problem involves with reference to all or almost all of the user's needs. |
| | Produced a minimal high level overview plan that may contain a minimal attempt to show how the problem is to be solved. | Produced a good high level overview plan that contains a reasonable attempt to show how the problem is to be solved. | Produced a thorough high level overview plan that clearly shows how the problem is to be solved. |
| | Produced minimal pseudocode (or suitable alternative) showing a few of the main blocks within the proposed solution. | Produced annotated pseudocode (or suitable alternative) showing most of the main blocks within the proposed solution. | Produced well annotated pseudocode (or suitable alternative) showing all or almost all of the main blocks within the proposed solution. |

**Solution development** (0–9 marks available)

The solution development should include:

1. evidence of the final solution in the form of annotated code
2. evidence that the final solution meets the original needs of the user.

0 marks awarded for no response or for responses not worthy of credit.

| | **1–3 marks** | **4–6 marks** | **7–9 marks** |
|---|---|---|---|
| **Solution development** | There is minimal evidence showing a minimal understanding of how the final solution meets the needs of the user. | There is some detailed evidence showing a good understanding of how the final solution meets the needs of the user. | There is detailed evidence showing a thorough understanding of how the final solution meets the needs of the user. |
| | There is a partially annotated code listing that may be incomplete demonstrating a minimal understanding of the programming techniques used. | There is a well annotated and mostly complete code listing that demonstrates a good understanding of the programming techniques used. | There is a fully annotated and complete code listing that demonstrates a thorough understanding of the programming techniques used. |

**Programming techniques used** (0–36 marks available)

The programming techniques used should include:

1. annotated evidence of the different programming techniques used
2. annotated evidence showing how the different programming techniques used combine to form a complete solution that solves the original problem
3. annotated evidence showing that the solution has been coded efficiently
4. a discussion of any data structures created with an explanation of why they are required
5. a solution that has been made robust by using techniques such as input validation, assertions and error handling, as appropriate to the language used.

0 marks awarded for no response or for responses not worthy of credit.

| | 1–6 marks | 7–12 marks | 13–18 marks | 19–24 marks | 25–30 marks | 31–36 marks |
|---|---|---|---|---|---|---|
| **Programming techniques used** | A few of the programming techniques used have been stated showing no or very little understanding. | A few of the programming techniques used have been stated showing a minimal understanding. | Most of the programming techniques used have been stated showing a reasonable understanding. | There is a description of a few of the programming techniques used that shows a good understanding. | There is a description of most of the programming techniques used that shows a very good understanding. | There is a discussion of most of the programming techniques used that shows a thorough understanding. |
| | The few techniques used show how one or two of the different parts of the solution work together to create a solution that may or may not work. | The techniques used show how a few of the different parts of the solution work together to create a solution that may only partially work. | The techniques used show how most of the different parts of the solution work together to create a solution that may only partially work. | The description shows how a few of the different parts of the solution work together to create a solution that may only partially work. | The description clearly shows how most of the different parts of the solution work together to create a working solution. | The discussion clearly shows how the different parts of the solution work together to create a fully working solution. |
| | There is a statement about the choice of one or two of the programming techniques used in an attempt to create a solution that has been partially coded efficiently. | There is a statement about the choice of a few of the programming techniques used to create a solution that has been coded efficiently. | There is a statement about the choice of most of the programming techniques used to create a solution that has been coded efficiently. | There is a description of the choice of a few of the programming techniques used to create a solution that has been coded efficiently. | There is a description of the choice of most of the programming techniques used to create a solution that has been coded efficiently. | There is a discussion justifying the choice of programming techniques used to create a solution that has been coded efficiently. |
| | The purpose and choice of one or two of the data structures used have been stated. | The purpose and choice of a few of the data structures used have been stated. | The purpose and choice of most of the data structures used have been stated. | The purpose and choice of a few of the data structures used have been explained. | There is evidence for an appropriate use of data structures with an explanation of the purpose of most of them. | There is evidence for an appropriate use of data structures with a discussion of the purpose of all or almost all of them. |
| | There is a statement of a minimal number of the techniques used (appropriate to the language chosen) within the code to make parts of the solution as robust as possible. | There is a statement of a few of the techniques used (appropriate to the language chosen) within the code to make the solution as robust as possible. | There is a statement of most of the techniques used (appropriate to the language chosen) within the code to make the solution as robust as possible. | There is a description of a few of the techniques used (appropriate to the language chosen) within the code to make the solution as robust as possible. | There is a description of most of the techniques used (appropriate to the language chosen) within the code to make the solution as robust as possible. | There is a discussion of all or almost all of the techniques used (appropriate to the language chosen) within the code to make the solution as robust as possible. |

**Testing and evaluation** (0–9 marks available)

The testing and evaluation should include:

1. a full test plan covering all of the major success criteria for the problem
2. evidence that the tests have been carried out with the results being documented
3. any remedial action that has been taken as a result of testing
4. an evaluation of how the solution meets the original needs of the user

The quality of the written communication will be assessed in this section.

0 marks awarded for no response or for responses not worthy of credit.

| | 1–3 marks | 4–6 marks | 7–9 marks |
|---|---|---|---|
| **Testing and Evaluation** | There is a minimal test plan that shows a few of the expected tests and includes a few examples of the test data to be used and/or the expected results. | There is a test plan that shows most of the expected tests and includes most of the test data to be used and the expected results. | There is a full or nearly full test plan that shows all or nearly all of the expected tests and includes the full test data to be used and the expected results. |
| | There is evidence that a few of the planned tests have been carried out and a record of the results. | There is evidence that most of the planned tests have been carried out and a record of the results showing whether each test was successful or not. | There is evidence that all or almost all of the planned tests have been carried out and a detailed record of the results showing the extent to which every test was successful. |
| | Where remedial action was required as a result of testing there is minimal evidence that an attempt to carry out the remedial action has been taken. | Where remedial action was required as a result of testing most has been carried out and a record of the actions taken has been provided. | Where remedial action was required as a result of testing this has been carried out and a record of the actions taken has been provided. |
| | There is an evaluation stating how the final solution meets a few of the original needs of the user. | There is an evaluation describing how the final solution meets most of the original needs of the user. | There is an evaluation discussing how the final solution meets the original needs of the user. |
| | There is a significant number of errors in the use of spelling, punctuation and grammar. The form and style of writing is only partially appropriate. Information is not always organised and the use of specialist vocabulary is minimal. | Most of the evidence is accurately spelt, punctuated and grammatically correct to make most of the meaning clear. The form and style of writing is mostly appropriate. Information is organised and specialist vocabulary has been mostly used appropriately. | The evidence is accurately spelt, punctuated and grammatically correct to make the meaning clear. The form and style of writing is appropriate. Information is clearly organised and specialist vocabulary has been used appropriately. |

# 4 Scheme of assessment

## 4a Aims and learning outcomes

GCSE courses based on this specification should encourage students to:

- be inspired, moved and challenged by following a coherent, satisfying and worthwhile course of study
- gain an insight into related sectors
- prepare themselves to make informed decisions about further learning opportunities and career choices.

GCSE courses based on this specification should enable students to:

- develop their understanding of current and emerging technologies and how they work and apply this knowledge and understanding in a range of contexts
- acquire and apply knowledge, some technical skills and an understanding of the use of algorithms in computer programs to solve problems using programming
- use their knowledge and understanding of computer technology to become independent and discerning users of ICT, able to make informed decisions about its use, and aware of the implications of different technologies
- acquire and apply creative and technical skills, knowledge and understanding of ICT in a range of contexts
- develop computer programs to solve problems
- develop the skills to work collaboratively
- evaluate the effectiveness of computer programs/solutions and the impact of and issues related to the use of computer technology in society.

## 4b Assessment Objectives (AOs)

The assessment components will assess the following assessment objectives in the context of the content and skills set out in Section 3 (**Subject content**).

| | Assessment objective |
|---|---|
| **AO1** | Recall, select and communicate knowledge and understanding of computer technology |
| **AO2** | Apply knowledge, understanding and skills to solve computing or programming problems |
| **AO3** | Analyse, evaluate, make reasoned judgements and present conclusions. |

### Weighting of Assessment Objectives

The table below shows the relationship between the assessments and the assessment objectives.

| Component | % of GCSE | | | Total |
|---|---|---|---|---|
| | AO1 | AO2 | AO3 | |
| **Component 1 – Practical programming (Task 1)** | 2.5–7.5 | 15–25 | 2.5–7.5 | **30** |
| **Component 1 – Practical programming (Task 2)** | 2.5–7.5 | 15–25 | 2.5–7.5 | **30** |
| **Component 2 – Computing fundamentals** | 15–25 | 2.5–7.5 | 10–20 | **40** |
| **Total** | **25–35** | **40–50** | **20–30** | **100** |

## Quality of Written Communication (QWC)

In GCSE specifications which require students to produce written material in English, students must:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

In this specification QWC will be assessed in both components. Information regarding the assessment of QWC in the controlled assessment is given within the marking criteria. QWC in the question paper is assessed by means of the extended answer questions.

# 4c National criteria

This specification complies with:

- the Code of Practice
- the GCSE Qualification Criteria
- the Arrangements for the Statutory Regulation of External Qualifications in England, Wales and Northern Ireland: Common Criteria
- the requirements for qualifications to provide access to Levels 1 and 2 of the National Qualification Framework.

Currently there are no subject criteria for GCSE Computing, however this specification compares to the GCSE ICT criteria in substance and range.



# 4d Previous learning requirements

There are no previous learning requirements.

However, any requirements set for entry to a course based on this specification are at your school/college's discretion.

# 4e Access to assessment: diversity and inclusion

GCSEs often need to assess a wide range of competences. This is because they are general qualifications designed to prepare students for a wide range of occupations and further study.

The revised GCSE qualification and subject criteria were reviewed to see whether any of the skills or knowledge needed by the subject presented a possible difficulty to any students, whatever their ethnic background, religion, sex, age, disability or sexuality. If there were difficulties, the situation was reviewed again to make sure that such tests of specific competences were only included if they were important to the subject. The findings were discussed with groups who represented the interests of a diverse range of students.

Arrangements are made for students with special needs to help them access the assessments as long as the competences being tested are not changed. Because of this, most students will be able to access any part of the assessment. More details are given in Section 5d.

The Assessment Objectives assess the ability of the students to:

| | AO1 | AO2 | AO3 |
|---|---|---|---|
| See | No | No | No |
| Speak | No | No | No |
| Hear | No | No | No |
| Read independently | No | No | No |
| Hand write | No | No | No |
| Manipulate manually | No | No | No |
| Perform physically | No | No | No |
| Work in a team | No | No | No |

The assessments allow the use of these access arrangements:

| | Yes/No | Components |
|---|---|---|
| Readers | Yes | All components |
| Scribes | Yes | All components |
| Practical Assistants | Yes | All components. The practical assistant may assist with controlled assessment tasks under instruction from the student. |
| Word Processors | Yes | All components |
| Transcripts | Yes | All components |
| BSL/ISL signers | Yes | All components |
| Live speaker | Yes | All components |
| MQ papers | Yes | All components |
| Extra Time | Yes | All components |

## Barriers to assessment

There are no barriers to assessment. However, controlled assessment tasks may be difficult for some disabled learners. Practical assistants are allowed to help overcome any potential barriers in these circumstances.

# 5 Administration

## 5a Availability of assessment components and certification

**Examinations and certification for this specification are available as follows.**

| | Availability of components | | Availability of certification |
|---|---|---|---|
| | Component 1 – Practical programming | Component 2 – Computing fundamentals | GCSE |
| June 2014 | ✓ | ✓ | ✓ |
| June 2015 and after | ✓ | ✓ | ✓ |

Assessments (both external assessments and moderation of controlled assessment) will only be available once a year in June with 100% of the assessment being taken in the examination series in which the qualification is awarded.

## 5b Entries

Please check the current version of **Entry Procedures and Codes** for up-to-date entry procedures. You should use the following entry code for certification.

GCSE certification – Computer Science [4512]

## 5c Private candidates

This specification is **not** available to private candidates.

# 5d Access arrangements, reasonable adjustments and special consideration

We have taken note of the equality and discrimination legislation and the interests of minority groups in developing and administering this specification.

We follow the guidelines in the Joint Council for Qualifications (JCQ) document: *Access Arrangements, Reasonable Adjustments and Special Consideration: General and Vocational Qualifications*. This is published on the JCQ website (**www.jcq.org.uk**) or you can follow the link from our website (**www.aqa.org.uk**).

## Access arrangements

We can arrange for students with special needs to access an assessment. These arrangements must be made **before** the examination.

## Reasonable adjustments

An access arrangement which meets the needs of a particular disabled student would be a reasonable adjustment for that student. The Disability Discrimination Act requires us to make reasonable adjustments to remove or lessen any disadvantage affecting a disabled student.

## Special consideration

We can give special consideration to students who have had a temporary illness, injury or serious problem such as death of a relative, at the time of the examination. We can only do this **after** the examination.

The Examinations Officer at the school/college should apply online for access arrangements and special consideration by following the eAQA link from our website (**www.aqa.org.uk**).

## 5e Examination language

We will only provide components for this specification in English.

## 5f Qualification titles

The qualification based on this specification is:

- AQA GCSE in Computer Science

## 5g Awarding grades and reporting results

GCSE qualifications will be graded on an eight-grade scale: A*, A, B, C, D, E, F and G. Students who fail to reach the minimum standard for grade G will be recorded as 'U' (unclassified) and will not receive a qualification certificate.

We will publish the minimum raw mark for each grade, for each component, when we issue students' results. We will report a student's component results to your school/college in terms of uniform marks and qualification results in terms of uniform marks and grades.

For each component, the uniform mark corresponds to a grade as follows.

**Component 1 – Practical programming:**
maximum uniform mark = 180

| Grade | Uniform Mark Range |
|---|---|
| A* | 162 – 180 |
| A | 144 – 161 |
| B | 126 – 143 |
| C | 108 – 125 |
| D | 90 – 107 |
| E | 72 – 89 |
| F | 54 – 71 |
| G | 36 – 53 |
| U | 0 – 35 |

**Component 2 – Computing fundamentals:**
maximum uniform mark = 120

| Grade | Uniform Mark Range |
|---|---|
| A* | 108 – 120 |
| A | 96 – 107 |
| B | 84 – 95 |
| C | 72 – 83 |
| D | 60 – 71 |
| E | 48 – 59 |
| F | 36 – 47 |
| G | 24 – 35 |
| U | 0 – 23 |



## 5h Examination series

Students have to enter all the assessment components at the end of the course, at the same time as they enter for the subject award.

Students will be allowed to carry forward their controlled assessment component result following the initial moderation and aggregation during the lifetime of the specification.

# 6 Controlled Assessment administration

The Head of Centre is responsible for making sure that controlled assessment work is conducted in line with our instructions and JCQ instructions.

## 6a Authenticating that controlled assessment work is genuine

To meet the requirements of the Code of Practice, we need the following.

- **Students** must sign the Candidate Record Form to confirm that the work they have handed in is their own.
- **Teachers and assessors** must confirm on the Candidate Record Form that the work marked is only that done by that student and was conducted in line with the conditions in the specification document (authentication declaration).
- **School/colleges** must give a mark of zero if students cannot confirm the work handed in for assessment is their own.

You should attach the completed Candidate Record Form for each student to his or her work. All teachers who have marked the work of any student entered for each component must sign the declaration that the work is genuine.

If you have doubts about signing the authentication declaration, you should follow these guidance points.

- If you believe that a student had additional assistance and this is acceptable within the guidelines for the relevant specification, you should award a mark which covers only the student's achievement without any help. You should sign the authentication declaration and give information on the relevant form.
- If you cannot sign the authentication declaration, the student's work cannot be accepted for assessment.

If, during the external moderation process, there is no evidence that the work has been authenticated, we will award a mark of zero.

## 6b Malpractice

You should let students know about our malpractice regulations.

Students must **not**:

- submit work that is not their own
- lend work to other students
- give other students access to, or the use of, their own independently-sourced research material (this does not mean that students cannot lend their books to another student, but that students should be stopped from copying other students' research)
- include work copied directly from books, the Internet or other sources without acknowledgement of the source
- hand in work typed or word-processed by someone else without acknowledgement.

These actions are considered malpractice, for which a penalty (for example, being disqualified from the exam) will be applied.

If malpractice is suspected, your Examinations Officer should be consulted about the procedure to be followed.

Where you suspect malpractice in controlled assessments after the student has signed the declaration of authentication, your Head of Centre must submit full details of the case to us at the earliest opportunity. The form JCQ/M1 should be used. Copies of the form can be found on the JCQ website (**http://www.jcq.org.uk**).

Malpractice in controlled assessments discovered prior to the student signing the declaration of authentication need not be reported to us, but should be dealt with in accordance with your school/college's internal procedures. We would expect you to treat such cases very seriously. Details of any work which is not the student's own must be recorded on the Candidate Record Form or other appropriate place.

## 6c Teacher standardisation

For controlled assessments we will provide support in explaining tasks in context and using the marking criteria.

It is likely that this specification will involve online teacher standardisation. Online standardising for controlled assessment is available throughout the year.

For further information go to:

**http://web.aqa.org.uk/support/teacher-online-standardisation/index.php**

If your school/college is new to this specification, you must have one of your teachers completing teacher standardisation. If you have told us you are a new school/college, either by sending us an intention to enter or an estimate of entry, or by contacting the subject team, we will contact you to invite you to undertake the standardisation.

We will also contact school/colleges in the following cases.

- If the moderation of controlled assessment work from the previous year has shown a serious misinterpretation of the controlled assessment requirements.
- If a significant adjustment has been made to a school/college's marks.

In these cases, you will be expected to have one of your teachers completing teacher standardisation. If your school/college does not fall into one of these categories you can choose whether or not to take part in teacher standardisation.

## 6d Internal standardisation of marking

Schools/colleges must have consistent marking standards for all students. One person must be responsible for ensuring that work has been marked to the same standard, and they need to sign the Centre Declaration Sheet to confirm that internal standardisation has taken place.

Internal standardisation may involve:

- all teachers marking some sample pieces of work and identify differences in marking standards
- discussing any differences in marking at a training meeting for all teachers involved in the assessment
- referring to reference and archive material, such as previous work or examples from our teacher standardising meetings.

## 6e Annotation of controlled assessment work

The Code of Practice states that the awarding body must make sure that teachers marking controlled assessments clearly show how the marks have been awarded in line with the marking criteria shown in the specification. The awarding body must provide guidance on how this is to be done. Annotation helps our moderators to see as precisely as possible where the teacher has identified that students have met the criteria in the specification.

Annotation could be used in either of the following ways:

- important pieces of evidence commented on in either the margin or in the text.
- comments on the work that refer to the assessment criteria.

## 6f Submitting marks and sample work for moderation

The total mark for each student must be sent to us and the moderator on the mark forms provided, by Electronic Data Interchange (EDI) or electronically by the date given (see **www.aqa.org.uk/deadlines/coursework_deadlines.php**).

Our moderator will contact you to let you know which pieces of work must be sent to them as part of the sample (please see section 7a for more guidance on sending in samples).

## 6g Factors affecting individual students

You should be able to accept the occasional absence of students by making sure they have the chance to make up missed controlled assessments. (You may organise an alternative supervised time session for students who are absent at the time the school/college originally arranged.)

If work is lost, you must tell us immediately the date it was lost, how it was lost, and who was responsible. Inform our Centre and Candidate Support Services using the JCQ form *Notification of Lost Coursework JCQ/LCW form 15*.

Where special help which goes beyond normal learning support is given, use the Candidate Record Form to inform us so that this help can be taken into account during moderation.

Students who move from one school/college to another during the course sometimes need additional help to meet the requirements of a scheme of controlled assessment work. How this can be dealt with depends when the move takes place. If it happens early in the course the new school/college should be responsible for controlled assessment work. If it happens late in the course it may be possible to arrange for the moderator to assess the work as a student who was 'Educated Elsewhere'. School/colleges should contact us as early as possible for advice about appropriate arrangements in individual cases at **ict-subjects@aqa.org.uk**

## 6h Keeping students' work

From the time the work is marked, your school/college must keep the work of all students, with Candidate Record Forms attached, under secure conditions, to allow the work to be available during the moderation period or should there be an Enquiry about Results. You may return the work to students after the deadline for Enquiries about Results, or once any enquiry is resolved.

# 7 Moderation

## 7a Moderation procedures

Controlled assessment work is moderated by inspecting a sample of students' work sent (by post or electronically) from the school/college to a moderator appointed by us. The school/college marks must be sent to us and the moderator by the deadline given (see **www.aqa.org.uk/deadlines.php**). Schools/colleges entering fewer students than the minimum sample size (and schools/colleges submitting work electronically) should send the work of all of their students. Schools/colleges entering larger numbers of students will be told which students' work must be sent as part of the sample sent in for moderation.

Following the re-marking of the sample work, the moderator's marks are compared with the school/college's marks to check whether any changes are needed to bring the school/college's assessments in line with our agreed standards. In some cases the moderator may need to ask for the work of other students in the school/college. To meet this request, schools/colleges must keep the controlled assessment work and Candidate Record Forms of every student entered for the examination under secure conditions, and they must be prepared to send it to us or the moderator when it is requested. Any changes to marks will normally keep the school/college's rank order, but where major differences are found, we reserve the right to change the rank order.

## 7b Consortium arrangements

If you are a consortium of schools/colleges with joint teaching arrangements (where students from different schools/colleges have been taught together but where they are entered through the school/college at which they are on roll) you must tell us by filling in the JCQ/CCA form *Application for Centre Consortium Arrangements for centre-assessed work*.

You must choose a consortium co-ordinator who can speak to us on behalf of all schools/colleges in the consortium. If there are different co-ordinators for different specifications, a copy of the JCQ/CCA form must be sent in for each specification.

We will allocate the same moderator to each school/college in the consortium and the students will be treated as a single group for moderation.

## 7c Procedures after moderation

When the results are published, we will give schools/colleges details of the final marks for the controlled assessment work.

We will return students' work to you after the exam. You will receive a report, at the time results are issued, giving feedback on any adjustments that were made to your marks.

We may keep some students' work for awarding, archive or standardising purposes and will inform you if this is the case.

# Appendices

## A Grade descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by students who were awarded particular grades. The descriptions should be considered in relation to the content outlined in the specification – they are not designed to define that content.

The grade awarded will depend on how well the student has met the assessment objectives (see Section 4). If a student has performed less well in some areas this may be balanced by better performances in others.

| Grade | Description |
|---|---|
| **A** | Students recall, select and communicate a thorough knowledge and understanding of the function, application, merits and implications of a broad range of computer hardware, software and other related technologies.<br><br>They systematically analyse problems, identifying and collecting the information required to solve them from the context of the problem. They apply knowledge, understanding and skills to design and implement effective computer programs which solve these problems. In their solutions, they effectively model situations, acquire and validate input data, sequence instructions, manipulate and process data and present the results of the processing in an appropriate format.<br><br>They work systematically and critically evaluate the way they and others use computer technology to solve problems. They iteratively review their work and make improvements where appropriate.<br><br>Students work systematically and understand and adopt safe, secure and responsible practices. They use ICT to communicate effectively, demonstrating a clear sense of purpose and audience. |
| **C** | Students recall, select and communicate a good knowledge and understanding of the function, application merits and implications of a range of computer hardware, software and other related technologies.<br><br>They analyse problems, identifying and collecting some information relevant to solve them from the context of the problem. They apply knowledge, understanding and skills to design and implement computer programs which solve these problems. In their solutions, they model situations, acquire input data, sequence instructions, manipulate and process data and present the results of the processing in a mostly appropriate format.<br><br>They review their work and evaluate the way they and others use computer technology to solve problems and make improvements on their work where appropriate.<br><br>Students work using safe, secure and responsible practices. They use ICT to communicate, demonstrating consideration of purpose and audience. |
| **F** | Students recall, select and communicate a basic knowledge and understanding of computer hardware, software and other related technologies.<br><br>They identify, with guidance, the information relevant to solve a problem from the context. They apply limited knowledge, understanding and skills to design and implement basic computer programs which solve these problems. In their solutions they use simple models, collect some necessary data, use simple instructions to process the data and present the results.<br><br>They sometimes review their work and provide comments on how they and others use computer technology to solve problems and make simple modifications to improve their work.<br><br>Students demonstrate some awareness of the need for safe, secure and responsible practices.<br><br>They use ICT to communicate, demonstrating limited awareness of purpose and audience. |

# B Spiritual, moral, ethical, social, legislative, sustainable development, economic and cultural issues, and health and safety considerations

We have taken great care to make sure that any wider issues (for example, spiritual, moral, ethical, social, legal, sustainable development, economic and cultural issues), including those relevant to the education of students at Key Stage 4, have been taken into account when preparing this specification. They will only form part of the assessment requirements where they are relevant to the specific content of the specification and have been identified in Section 3: Subject Content.

## European Dimension

We have taken the 1988 Resolution of the Council of the European Community into account when preparing this specification and associated specimen components.

## Environmental Education

We have taken the 1988 Resolution of the Council of the European Community and the Report 'Environmental Responsibility: An Agenda for Further and Higher Education' 1993 into account when preparing this specification and associated specimen components.

## Avoiding bias

We have taken great care to avoid bias of any kind when preparing this specification and specimen components.

# C Overlaps with other qualifications

There are no overlaps with any other qualifications.

# D Wider Key Skills

## The replacement of Key Skills with Functional Skills

The Key Skills qualifications have been replaced by the Functional Skills **(http://web.aqa.org.uk/qual/gcse/functional_skills.php**).

Students following a course of study based on this specification for GCSE Computing can be offered opportunities to develop and generate evidence of attainment in aspects of the Functional Skills.

**Basic Skills Adult Literacy Levels 1 and 2, Adult Numeracy Levels 1 and 2**

AQA Basic Skills qualifications will now be available until, at least, the June 2012 series. If you would like to check the funding provision, please contact the Skills Funding Agency:

**info@skillsfundingagency.bis.gov.uk**
0845 377 5000.

## Wider Key Skills

Students following a course of study based on this specification for GCSE Computer Science can be offered opportunities to develop and generate evidence of attainment in aspects of the Wider Key Skills of:

- Working with Others
- Improving own Learning and Performance
- Problem Solving.

The AQA Wider Key Skills qualifications are no longer available.

GCSE Computer Science

For exams June 2014 onwards

For certification June 2014 onwards

**Qualification Accreditation Number: 600/4908/X.**

Every specification is assigned a national classification code indicating the subject area to which it belongs.

Centres should be aware that candidates who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

Centres may wish to advise candidates that, if they take two specifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if candidates take two GCSE specifications that have different classification codes but have significant overlap of content. Candidates who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

To obtain specification updates, access our searchable bank of frequently asked questions, or to ask us a question, register with Ask AQA: **aqa.org.uk/ask-aqa/register**

You can also download a copy of the specification and support materials from our website: **aqa.org.uk**







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