edexcel

GCSE 2016 Computer Science

Launch Event

U367

Background image: © Kheng Ho Toh

Origami: © Justin Hoffmann & Mark Bolitho Pearson Education Ltd

Agenda

- Introducing our specification
- GCSE reforms and new requirements for Computer Science
- Changes to grading
- Our approach
- Overview of new specification subject content

Break

- Overview of assessment of Components 1, 2, 3
- New assessment requirements
- Support and resources
- Next steps

Supporting Confidence in Computer Science

A real study of computation, in context, backed up by a comprehensive study of computer science principles

Using Computer Science methods in today's global world, modelling and creating solutions to aspect of real-world situations and understanding how technology can be used proactively

Clear and coherent structure: Three components assessing theoretical and practical skills

Clear and **straightforward** question papers, mark schemes and assessment grids

Excellent support with planners, lesson activities and solutions

The GCSE Reforms

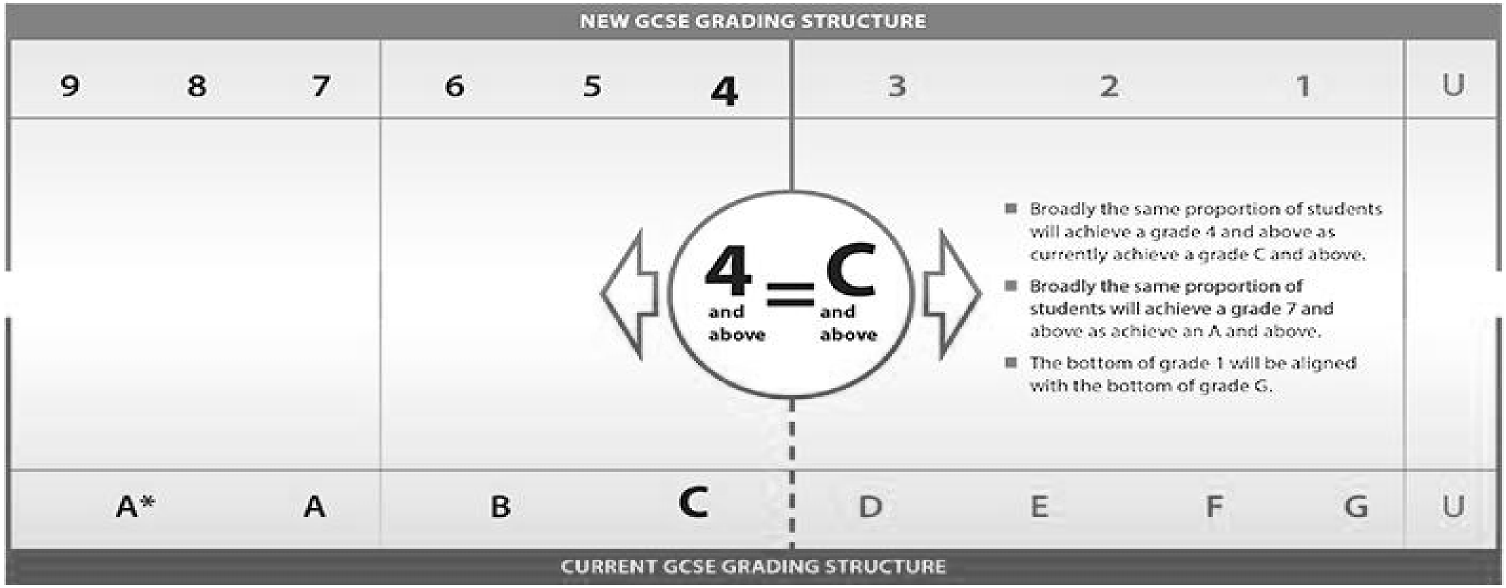
- Updated content and assessment requirements from DfE and Ofqual
- Fully linear structure
- New 9-1 grading scale, with 9 the top level
- Tiering only in certain subjects such as Maths (**no** tiering in Computer Science)
- External examinations only, unless coursework or controlled assessment is the only valid option – **there is 20% coursework/80% exam for Computer Science**
- No change to guided learning hours

Timeline

	2015	2016	2017	2018
Current 2013 specification	First assessment	Summer series as normal	Final assessment	
New 2016 specification		First teaching of two-year GCSE		First assessment

- The last available assessment for the current GCSEs will be June 2017
- The reformed GCSEs will be reported in the 2018 performance tables

9 – 1 Grading



NEW GCSE GRADING STRUCTURE

9 8 7 | 6 5 4 | 3 2 1 | U

4 and above = C and above

- Broadly the same proportion of students will achieve a grade 4 and above as currently achieve a grade C and above.
- Broadly the same proportion of students will achieve a grade 7 and above as achieve an A and above.
- The bottom of grade 1 will be aligned with the bottom of grade G.

A* A | B C | D E F G | U

CURRENT GCSE GRADING STRUCTURE

- Broadly the same proportion of students will achieve a **grade 4** and above as currently achieve a **grade C** and above.
- Broadly the same proportion of students will achieve a **grade 7** and above as currently achieve an **A** and above.
- The bottom of **grade 1** will be aligned with the bottom of **grade G**.

Progress 8

- **Progress 8**: based on students' progress measured across eight subjects: English; maths; three other EBacc subjects (sciences, computer science, geography, history and languages); and three further subjects.
- **Attainment 8**: pupils' average achievement in the same suite of subjects as the Progress 8 measure.
- **EBacc**: A*-C in English, maths, two sciences, a humanities (history or geography) and a language.

Key requirements for Computer Science from 2016 that all boards must follow

- **Focus on computational thinking** using abstraction and decomposition in problem-solving
- **Key new content**:
  - Cybersecurity, network protocol layers, sound and graphics data representation, ‘contemporary secondary storage
- **High level programming languages** with a textual definition
  - Specified and justified by the Awarding Organisation
- **Non-examination assessment 20% of qualification, 20 hours**
  - must be a program designed, written, tested and refined by the Learner
    - To a specification or to solve a problem
    - Written report

Ofqual Requirements – Assessment Objectives

	Assessment 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%

Our research:

Research carried out with:

- Teachers from schools across the country in face-to-face interviews, phone interviews, email conversations and survey
- Subject advisory group, including representatives from the teaching community, universities, CAS and BCS
- Analysis of international and UK models

This built on our research for the 2013 specification

Research: Key Findings

- A wide range of programming languages in the specification
- Ofqual defined content is about 85% of our subject content. Teacher research helped us decide on the remaining 15%.
- Teachers wanted a coursework component so that refinement of systems could develop over an extended period
- It was important to make proposed specification models accessible to all students; real-life context scenarios could play a key part in this.

Our Design Principles

- A focus on applying computational thinking as well as studying theoretical concepts of computer science
- A scenario approach
- Two exam papers
  - A spread of content across both papers
- The non-examination assessment written report should not include unnecessary detail, only evidence for assessment
- The non-examination assessment is set by Pearson Edexcel and marked by the centre
- Accessible to the full range of ability levels

Overview of new specification

Component	Title	Overview	Summary of assessment
Component 1 (40%) 1hr 40	Principles of Computer Science	All Topics	Examination. Multiple choice, short and extended open response questions
Component 2 (40%) 2 hr	Application of Computational Thinking	Main focus on Topics 1 and 2, but may draw on all other topics	Examination, based on a scenario. Short and extended open response questions
Component 3 (20%) 20 hours	Project	A designed, tested and refined program and a written report	Non-examination supervised assessment. A levels-based mark scheme, over four stages of development

Subject Content - Overview

- Ofqual provides a framework of subject content which all Awarding Organisations have to include in their specification.
- We have included some content to supplement this framework

Additional Content	Rationale
Databases	Research findings, helps progression
Input-Process-Output	Not ‘ICT’, but to reinforce internal hardware components and program structure
Internet	Exemplifies cybersecurity and contemporary secondary storage
Files - practical	Research findings, links to record structures

Subject Content – Topics

We have split the content into the same subject areas in our 2013 specification:

- Topic 1: Problem Solving
- Topic 2: Programming
- Topic 3: Data
- Topic 4: Computers
- Topic 5: Communication and the Internet
- Topic 6: The Bigger Picture

There are slight changes within these topics to cover the new Ofqual Subject Content, which sets out the knowledge, understanding and skills common to **all** AO specifications.

Subject Content – Topics Overview

- **Topic 1: Problem Solving**
  - Students are expected to develop a set of computational thinking skills that enable them to understand how computer systems work, and design, implement and analyse algorithms for solving problems.
- **Topic 2: Programming**
  - Students should be competent at designing, reading, writing and debugging computer programs.
- **Topic 3: Data**
  - Computers store and manipulate large quantities of data. Students are expected to learn how different types of data are represented in a computer using binary data.

Subject Content – Topics Overview

- **Topic 4: Computers**
  - Students must be familiar with the hardware and software components that make up a computer system and recognise that computers take many forms from embedded microprocessors to distributed clouds
- **Topic 5: Communication and the Internet**
  - Many computer applications in use today would not be possible without networks. Students should understand the key principles behind the organisation of computer networks.
- **Topic 6: The Bigger Picture**
  - Students should be aware of the influence of emerging trends in computing technology and that this impacts on the world in which they live.

Computing-related Maths

- A02 has a requirement to include computing-related maths content.
- We have allocated this in questions which target, for example:
  - Arithmetic/logical calculations
  - Binary notation
  - Logical shifts
  - Constructing/deriving equations

Subject Content – Topic Detail

Please turn to Page 7 in the new specification

A mapping document between the 2013 and the 2016 subject content is in your pack

Any further questions on the Subject Content?

Assessment - Design Principles

Component 1 – Principles of Computer Science

- Assessment over all Topics, all content may be assessed.
- Tests breadth

Component 2 – Application of Computational Thinking

- Focuses on Topics 1 and 2, but may draw on all other topics
- Uses a scenario to reflect a real world context
- Requires more application and analysis of problems
- Tests depth

Component 3 – Project

- Synoptic and practical NEA assessment

Component 1 – Principles of Computer Science

Targets Assessment Objectives A01 and A02

- Demonstrate and Apply knowledge and understanding of key concepts and principles
- This paper consists of multiple-choice, short-open response and extended open response answer questions.
- All questions are compulsory.
- 1 hr 40 mins

Component 2 – Application of Computational Thinking

Targets all Assessment Objectives

- Short open response, open response and extended open-response answer questions (extended questions may be algorithms)
- All questions are compulsory
- 2 hrs
- Scenario throughout
- More application and analysis of problems
  - Decomposition, algorithms, programming knowledge
- Pseudo-code

Any further questions on the Examined Components?

Component 3 – Project Requirements (all boards)

- 20 hours duration
- 20% of the qualification
- Must ensure authentication of Learners' work
- 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.

Joint statement from Awarding Organisations, in agreement with Ofqual

In order to ensure the quality of marking in centres and to reduce the likelihood of malpractice, all awarding organisations (AOs) have developed a common approach for the additional monitoring of centres' marking. This approach is in addition to standard moderation processes.

After the written assessments have been sat and marked, AOs will conduct a statistical comparison of written paper marks and NEA marks. Work from centres which is seen to have an unusual pattern of marks will be subject to an additional moderation check, this additional check may result in centre marks being adjusted. After the issue of results, each AO will select a sample of centres for inspection visits.

The visits will take place from autumn 2017, and from each autumn thereafter following issue of results. Inspection visits will check the processes in place in the centre for the delivery of the NEA, including a review of procedures and the teaching resources used during the course.

Our project:

- We will issue a problem
- Centres will mark students’ work
- We will moderate
    - To the joint AO procedures
- No internet
- Supervised conditions
- Programming syntax printouts are permitted

Component 3 – Project

Assessment targets A02 and A03

A02:

- Apply knowledge and understanding of key principles of computer science

A03:

- Analyse problems in computational terms:
  - To make reasoned judgements
  - To design, program, evaluate and refine solutions

Project Stages

We have followed some stages in Systems Development

- but no specific methodology

Stage 1 Analysis

Stage 2 Design

Stage 3 Implementation

Stage 4 Testing, refining and evaluation

What is submitted?

The Program itself

- Electronic format

The Written Report

- Documents the work which will be assessed
- No unnecessary screenshots!

The Written Report

- Our principle is that the **content** of the written report provides **evidence for assessment**.
- The report itself is not assessed.
  - There is no need for numerous screenshots.
  - There is no need to explain what techniques were used

Stage 1 Analysis

- The purpose of the analysis stage is to identify the requirements of the problem, and what the proposed solution will do to meet the requirements.
- The report should include:
  - a short introduction to the problem
  - a list of the requirements of the problem that will be programmed
  - decomposition of the problem into sub-problems, including
    - a short description of what each of the sub-problems will do
    - a short explanation of the reasoning behind the decomposition submitted.

Stage 2 Design

The purpose of the design stage is to describe what has to be done when implementing the solution and to suggest an appropriate strategy to test the solution.

2 Parts:

1. Solution design
2. Test strategy and Initial Test Plan

Stage 2 Design

Solution design

- The report should include:
  - The algorithm(s)
  - Any refinements to the design identified during implementation, with reasons

Stage 2 Design

Test strategy and Initial Test Plan

- The report should include:
  - The test strategy
  - An initial test plan

Test no.	Purpose of the test	Test data	Expected result

The initial test plan is marked in this stage.

Stage 3 Implementation

Subject to DRAFT Ofqual accreditation

The purpose of this stage is to program the solution to the problem.

2 Parts:

1. Implementing the Design
2. Building the solution

However these parts will be worked on together and should be marked together.

It may be that amendments to the original design solution become apparent during this stage and these refinements should be implemented and documented as additions to the design, and in the program code by using comments.

Programming Languages

We have included the following programming languages:

- Python
- Java
- Pascal/Object Pascal
- Visual Basic.NET
- C-Derived (C, C++, C#)

Stage 3 Implementation

Implementing the Design:

- This is where the learner uses their knowledge of the chosen programming language to translate their design into program code.

Building the solution:

- While translating the design into program code, learners should focus on addressing the requirements and producing a functional solution.
- When errors arise, students should use debugging tools (manual or the tools available in the language).

Stage 3 Implementation

- The report should include:
  - A copy of the program code. Any refinements should be noted as comments in the final program.
  - screenshots demonstrating effective use of debugging skills to correct errors.

Stage 4 Testing, refining and evaluating

The purpose of this stage is to show that the final program solution has been tested along with any refinements, the solution evaluated against the original requirements.

- The report should include:
  - the updated and complete Test Plan (labelled ‘Final Test Plan’)
  - the evaluation.

Stage 4 Testing, refining and evaluating (continued)

Add two more columns to the Initial test plan:

Test no.	Purpose of the test	Test data	Expected result	Actual result	Action Needed / Comments

The evaluation should include how successfully the program meets each of the original requirements and the reason for adding refinements to the final solution

Marking the Project

- The mark scheme is levels-based.
- Look for 'best fit'

Please turn to Page 18 in the specification

Marking the Project

What if students can't complete the analysis or design? See page 16

- Supervisors must not give students hints on how to improve their work. For example, if some data requirements have been omitted from the analysis then supervisors should not tell students to add the missing data requirements to their analysis. However, supervisors may provide support if the student is not able to carry out sufficient work at one stage to enable them to progress to the next stage. Teachers must not provide assistance to students who have produced an incomplete analysis or design solution that will not prevent them from progressing on to the next stage.
- Any help given should be noted on the centre assessor record sheet (available on our website) and marks awarded accordingly.

Any further questions on the Project?

Supporting you through change

- Course Planner
- Schemes of Work
- Lesson Activities, with solutions
- Programming guidance
- SAMs

Support for assessment

- Additional specimen papers so that you can get to grips with the format of the papers and the level of demand as quickly as possible, and have extra papers to use with students in preparing for the exams.
- Student exemplars with commentary
- Coursework marking training

ResultsPlus

- **ResultsPlus** provides the most detailed analysis available of your students' exam performance. This free online service helps you identify topics and skills where students could benefit from further learning, helping them gain a deeper understanding of Computer Science.

Pearson Published Resources

Our brand new published resources will provide comprehensive support for the new Edexcel GCSE Computer Science specification*, including:

- **Student Book and Institutional Activebook:** supporting great computer science teaching through a scenario-based approach to problem solving and computational thinking

- **Revision Guide and Workbook:** new Revision Guide and Workbook written to support your students with their GCSE mocks and final exam preparation.

**Learning resources are available from a number of publishers. You do not need to purchase any resources, including those from Pearson to deliver our qualifications.*

Additional endorsed resources

- From **Hodder Education:**
  - Edexcel Computer Science for GCSE Student Book
  - Edexcel Computer Science for GCSE Student eTextbook

Subject Advisor

Tim Brady
Computer Science and
ICT Subject Advisor

Phone:
UK: 0844 372 2186
Intl: +44 (0) 207 010 2186

Email:
TeachingComputerScience@pearson.com

Twitter:
@Pearson_CS

Facebook:
https://www.facebook.com/groups/140885586105397/

Pearson is recruiting for GCSE Computer Science

We have exciting opportunities to become an examiner for Computer Science and:

- get closer to the qualification you are teaching
- gain insight on National Standards
- grow your career.

To find out more please visit:
www.edexcel.com/aa-recruitment

Information email: aaresourcing@pearson.com

Next Steps

Please complete your evaluation form for today's event

Sign up to Tim Brady's updates: email **TeachingComputerScience@pearson.com**

Visit the website to download further copies of the draft specification and support materials: **http://qualifications.pearson.com/en/qualifications/edexcel-gcses/computer-science-2016.html**

Look out for information about our Getting Ready to Teach events