

### 3e. Assessment of extended responses

The assessment materials for this qualification provide learners with the opportunity to demonstrate their ability to construct and develop a sustained line of

reasoning and marks for extended responses are integrated into the marking criteria.

### 3f. Non exam assessment

#### Programming project (Component 03 or 04) Guidance

This qualification has one non exam assessment which takes the form of the Programming project (Component 03 or 04).

The project is a substantial piece of work which assesses a variety of different skills including the development and demonstration of computational thought processes. The following guidance should be considered before learners embark on this particular assessment.

#### Acceptable programming languages

Appendix 5e in this specification gives a list of programming languages which OCR will accept. If the task demands another choice of language that does not appear in the list, the task outline, the details of the programming language and the reasons for the choice of this language should be submitted to OCR for consideration. Please contact [computerscience@ocr.org.uk](mailto:computerscience@ocr.org.uk) for further advice and guidance.

#### Context Choice

Learners will need to choose in liaison with their teacher a well defined user driven problem. Whilst OCR will not be quality assuring the contexts chosen by learners the following criteria should be considered. The choice of project must enable learners to:

- meet all assessment requirements as contained in the specification
- use an appropriate programming language which is non-trivial and has a substantial coded element (see appendix 5e)
- solve a problem sensibly within the constraints of resources available
- facilitate the successful completion of a whole task from its definition to its acceptance and evaluation by that user

- involve all elements of the skills of analysis, design, development and evaluation.

#### Evidence Generation

It is important that learners establish thorough and robust working practices at an early stage. The projects should contain as standard the following:

Title	✓
Contents list	✓
Description of investigation	✓
Justification of investigation	✓
Analysis, design and methods used	✓
Evaluation	✓
Bibliography	✓
Pages numbered	✓

Appropriate annotated evidence should be used to support the report – e.g. screen dumps or photographs taken of screen layouts, for example. It is important that each learner generates their own individual, authentic evidence to show that they have met key assessment criteria. Any evidence submitted to demonstrate the development of solution must be able to be assessed without the use of any specific hardware or software.

Whilst there is no word count for this particular assessment learners need to focus on the command words used within the assessment criteria. These command words indicate the depth of coverage that is required at each stage of the process and should drive the evidencing approach taken by learners.

The teacher has an important role in supporting learners through the evidence generation process. Whilst it is not appropriate for teachers to over direct learners in their generation of evidence it is acceptable for them to reinforce concepts and assist with the development of knowledge and understanding at various stages of the process. Acceptable forms of intervention include:

- offering learners advice about how best to approach each of the tasks
- exercising continuous supervision of work in order to monitor progress and to prevent plagiarism
- ensuring work is completed in accordance with the specification requirements and can be assessed in accordance with the specified marking criteria and procedures.

### Assessing Evidence

It is important that centre staff responsible for marking learner projects are familiar with the principles of best fit assessment to ensure that a consistent marking approach is taken.

For each of the marking criteria assessors select the band descriptor provided in the marking grid that most closely describes the quality of the work being marked.

Marking should be positive, rewarding achievement rather than penalising failure or omissions.

The award of marks must be directly related to the marking criteria.

- Each band descriptor covers all of the relevant criteria for a particular section of the specification content related to analysis, design, development and evaluation.
- The descriptors for each section should be read and applied as a whole.
- An answer does not have to meet all of the requirements of a band descriptor before being placed in that band. It will be placed in a particular band when it meets more of the requirements of that band than it meets the requirements of other bands.

When deciding the mark within a band, the following criteria should be applied:

- the extent to which the statements within the band have been achieved.

For example:

- an answer that convincingly meets nearly all of the requirements of a band descriptor should be placed at or near the top of that band. Where the learner's work convincingly meets the statement, the highest mark should be awarded
- an answer that meets many of the requirements of the band descriptor should be placed in the middle of the band. Where the learner's work adequately meets the statement, the most appropriate mark in the middle range should be awarded
- if an answer is on the border-line between two bands but it is decided that it fits better the descriptors for the lower of these two bands, then it should be placed near the top of that band. Where the learner's work just meets the statement, the lowest mark should be awarded.

Assessors should use the full range of marks available to them and award full marks in any band of work that fully meets the descriptor. This is work that is 'the best one could expect from learners working at that level'.

Learners or centres must declare that the work is the learner's own (see section 4d).

## Authentication

It is important that centres put in place the necessary measures to both guard against and detect malpractice when it has occurred. As well as the use of the authentication process it is important that learners take responsibility for ensuring the work they produce is their own, is appropriately referenced and is a true reflection of their ability (see Section 4d).

## Ongoing Support

OCR will support teachers in the teaching and learning of this component by providing an extensive range of support material including sample assessment materials and schemes of work to provide exemplar ideas. These resources will be available online to support the launch of the qualification [www.ocr.org.uk](http://www.ocr.org.uk)

## Assessment criteria

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Learners are expected to demonstrate their ability to analyse, design, develop, test, evaluate and document a program written in a suitable programming language. The problem must be solvable effectively in the chosen language so it is important there is a good match between the requirements of the problem and the language that is chosen.

The nature of the problem chosen is significant in that learners should be able to demonstrate, through their solutions, an appropriate range of skills identified by the specification; trivial problems, no matter how well they are executed will not be able to provide this evidence.

Learners are expected to apply the computational thinking approach identified in Algorithms and programming (Component 02) to a practical coding

problem and are expected to apply principles from an agile development approach to the project development.

The project should be assessed holistically and, while the assessment criterion are organised into discrete sections, it is unlikely evidence can be similarly organised in the learner's work. Evidence to support the assessment may be found throughout the project report and should be noted, by reference to page number, or otherwise, on the assessment grid. The assessment criterion are defined in mark bands and teachers should use a best-fit approach, selecting the most appropriate description and quality of match to that description, in order to place the work at the right level in the right mark band.

## Programming project (Component 03 or 04) marking criteria – 70 marks

AO 2.2 Analysis (maximum 10 marks)			
1–2 marks	3–5 marks	6–8 marks	9–10 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>Identified some features that make the problem solvable by computational methods.</li> <li>Identified suitable stakeholders for the project and described them and some of their requirements.</li> <li>Identified some appropriate features to incorporate into their solution.</li> <li>Identified some features of the proposed computational solution.</li> <li>Identified some limitations of the proposed solution.</li> <li>Identified some requirements for the solution.</li> <li>Identified some success criteria for the proposed solution.</li> </ul>	<ul style="list-style-type: none"> <li>Described the features that make the problem solvable by computational methods.</li> <li>Identified suitable stakeholders for the project and described how they will make use of the proposed solution.</li> <li>Researched the problem looking at existing solutions to similar problems identifying some appropriate features to incorporate into their solution.</li> <li>Identified the essential features of the proposed computational solution.</li> <li>Identified and described some limitations of the proposed solution.</li> <li>Identified most requirements for the solution.</li> <li>Identified some measurable success criteria for the proposed solution.</li> </ul>	<ul style="list-style-type: none"> <li>Described the features that make the problem solvable by computational methods and why it is amenable to a computational approach.</li> <li>Identified suitable stakeholders for the project and described them and how they will make use of the proposed solution and why it is appropriate to their needs.</li> <li>Researched the problem in depth looking at existing solutions to similar problems identifying and describing suitable approaches based on this research.</li> <li>Identified and described the essential features of the proposed computational solution.</li> <li>Identified and explained any limitations of the proposed solution.</li> <li>Specified the requirements for the solution including (as appropriate) any hardware and software requirements.</li> <li>Identified measurable success criteria for the proposed solution.</li> </ul>	<ul style="list-style-type: none"> <li>Described and justified the features that make the problem solvable by computational methods, explaining why it is amenable to a computational approach.</li> <li>Identified suitable stakeholders for the project and described them explaining how they will make use of the proposed solution and why it is appropriate to their needs.</li> <li>Researched the problem in depth looking at existing solutions to similar problems, identifying and justifying suitable approaches based on this research.</li> <li>Identified the essential features of the proposed computational solution explaining these choices.</li> <li>Identified and explained with justification any limitations of the proposed solution.</li> <li>Specified and justified the requirements for the solution including (as appropriate) any hardware and software requirements.</li> <li>Identified and justified measurable success criteria for the proposed solution.</li> </ul>

0 marks = no response or no response worthy of credit.

AO 3.1 Design (maximum 15 marks)			
1–4 marks	5–8 marks	9–12 marks	13–15 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>Described elements of the solution using algorithms.</li> <li>Described some usability features to be included in the solution.</li> <li>Identified the key variables / data structures / classes (as appropriate to the proposed solution).</li> <li>Identified some test data to be used during the iterative or post development phase of the process.</li> <li></li> </ul>	<ul style="list-style-type: none"> <li>Broken the problem down systematically into a series of smaller problems suitable for computational solutions describing the process.</li> <li>Defined the structure of the solution to be developed.</li> <li>Described the solution fully using appropriate and accurate algorithms.</li> <li>Described the usability features to be included in the solution.</li> <li>Identified the key variables / data structures / classes (as appropriate to the proposed solution) and any necessary validation.</li> <li>Identified the test data to be used during the iterative development of the solution.</li> <li>Identified any further data to be used in the post development phase.</li> </ul>	<ul style="list-style-type: none"> <li>Broken the problem down systematically into a series of smaller problems suitable for computational solutions explaining the process.</li> <li>Defined in detail the structure of the solution to be developed.</li> <li>Described the solution fully using appropriate and accurate algorithms explaining how these algorithms form a complete solution to the problem.</li> <li>Described, explaining choices made, the usability features to be included in the solution.</li> <li>Identified and justified the key variables / data structures / classes (as appropriate to the proposed solution) explaining any necessary validation.</li> <li>Identified and justified the test data to be used during the iterative development of the solution.</li> <li>Identified and justified any further data to be used in the post development phase.</li> </ul>	<ul style="list-style-type: none"> <li>Broken the problem down systematically into a series of smaller problems suitable for computational solutions, explaining and justifying the process.</li> <li>Defined in detail the structure of the solution to be developed.</li> <li>Described the solution fully using appropriate and accurate algorithms justifying how these algorithms form a complete solution to the problem.</li> <li>Described, justifying choices made, the usability features to be included in the solution.</li> <li>Identified and justified the key variables / data structures / classes (as appropriate to the proposed solution) justifying and explaining any necessary validation.</li> <li>Identified and justified the test data to be used during the iterative development of the solution.</li> <li>Identified and justified any further data to be used in the post development phase.</li> </ul>

0 marks = no response or no response worthy of credit.

AO 3.2 Developing the coded solution (maximum 25 marks)			
Iterative development of a coded solution (maximum 15 marks)			
1–4 marks	5–8 marks	9–12 marks	13–15 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>• Provided evidence of some iterative development for a coded solution.</li> <li>• Solution may be linear.</li> <li>• Code may be inefficient.</li> <li>• Code may not be annotated appropriately.</li> <li>• Variable names may be inappropriate.</li> <li>• There will be little or no evidence of validation.</li> <li>• There will be little evidence of review during the development.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence for most stages of the iterative development process for a coded solution describing what they did at each stage.</li> <li>• Solution will have some structure.</li> <li>• Code will be briefly annotated to explain key components.</li> <li>• Some variable and/or structure names will be largely appropriate.</li> <li>• There will be evidence of some basic validation.</li> <li>• There will be evidence that the development was reviewed at some stage during the process.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence of each stage of the iterative development process for a coded solution relating this to the break down of the problem from the analysis stage and explaining what they did at each stage.</li> <li>• Provided evidence of some prototype versions of their solution.</li> <li>• The solution will be modular in nature.</li> <li>• Code will be annotated to explain all key components.</li> <li>• Most variables and structures will be appropriately named.</li> <li>• There will be evidence of validation for most key elements of the solution.</li> <li>• The development will show review at most key stages in the process.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence of each stage of the iterative development process for a coded solution relating this to the break down of the problem from the analysis stage and explaining what they did and justifying why.</li> <li>• Provided evidence of prototype versions of their solution for each stage of the process.</li> <li>• The solution will be well structured and modular in nature.</li> <li>• Code will be annotated to aid future maintenance of the system.</li> <li>• All variables and structures will be appropriately named.</li> <li>• There will be evidence of validation for all key elements of the solution.</li> <li>• The development will show review at all key stages in the process.</li> </ul>
Testing to inform development (maximum 10 marks)			
1–2 marks	3–5 marks	6–8 marks	9–10 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>• Provided some evidence of testing during the iterative development process.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided some evidence of testing during the iterative development process.</li> <li>• Provided evidence of some failed tests and the remedial actions taken.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence of testing at most stages of the iterative development process.</li> <li>• Provided evidence of some failed tests and the remedial actions taken with some explanation of the actions taken.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence of testing at each stage of the iterative development process.</li> <li>• Provided evidence of any failed tests and the remedial actions taken with full justification for any actions taken.</li> </ul>

0 marks = no response or no response worthy of credit.

AO 3.3 Evaluation (maximum 20 marks)			
Testing to inform evaluation (maximum 5 marks)			
1 mark	2 marks	3–4 marks	5 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>• Provided evidence of some post development testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided evidence of final product testing for function.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided annotated evidence of post development testing for function.</li> <li>• Provided annotated evidence for usability testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Provided annotated evidence of post development testing for function and robustness.</li> <li>• Provided annotated evidence for usability testing.</li> </ul>
Evaluation of solution (maximum 15 marks)			
1–4 marks	5–8 marks	9–12 marks	13–15 marks
<b>The candidate will have:</b>			
<ul style="list-style-type: none"> <li>• Commented on the success or failure of the solution with some reference to test data.</li> <li>• The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</li> </ul>	<ul style="list-style-type: none"> <li>• Cross referenced some of the test evidence with the success criteria and commented on the success or otherwise of the solution.</li> <li>• Provided evidence of usability features.</li> <li>• Identified some limitations on the solution.</li> <li>• The information has some relevance and is presented with limited structure. The information is supported by limited evidence.</li> </ul>	<ul style="list-style-type: none"> <li>• Used the test evidence to cross reference with the success criteria to evaluate the solution identifying whether the criteria have been met, partially met or unmet.</li> <li>• Provided comments on how any partially or not met criteria could be addressed in further development.</li> <li>• Provided evidence of the usability features.</li> <li>• Considered maintenance issues and limitations of the solution.</li> <li>• There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</li> </ul>	<ul style="list-style-type: none"> <li>• Used the test evidence to cross reference with the success criteria to evaluate the solution explain how the evidence shows that the criteria has been fully, partially or not met in each case.</li> <li>• Provided comments on how any partially or unmet criteria could be addressed in further development.</li> <li>• Provided evidence of the usability features justifying their success, partial success or failure as effective usability features.</li> <li>• Provided comments on how any issues with partially or unmet usability features could be addressed in further development.</li> <li>• Considered maintenance issues and limitations of the solution.</li> <li>• Described how the program could be developed to deal with limitations of potential improvements / changes.</li> <li>• There is a well developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</li> </ul>

0 marks = no response or no response worthy of credit.