



National  
Qualifications

# Computing Science Project

## General assessment information

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This pack contains general assessment information for centres preparing candidates for the project Component of Advanced Higher Computing Science Course assessment.

It must be read in conjunction with the specific assessment tasks for this Component of Course assessment which may only be downloaded from SQA's designated secure website by authorised personnel.

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# Introduction

This is the general assessment information for the Advanced Higher Computing Science project.

This project is worth 90 marks out of the total of 150 marks. This is 60% of the overall marks for the Course assessment. The Course will be graded A-D.

Marks for all Course Components are added up to give a total Course assessment mark which is then used as the basis for grading decisions.

This is one of two Components of Course assessment. The other Component is a question paper.

This document describes the general requirements for the assessment of the project Component for this Course. It gives general information and instructions for assessors.

It must be read in conjunction with the assessment task for this Component of Course assessment.

## Equality and inclusion

This Course assessment has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled candidates and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: [www.sqa.org.uk/sqa/14977.html](http://www.sqa.org.uk/sqa/14977.html)

Guidance on inclusive approaches to delivery and assessment in this Course is provided in the *Course/Unit Support Notes*.

# What this assessment covers

This assessment contributes 60% of the total marks for the Course.

The assessment will assess the skills, knowledge and understanding specified for the project in the *Course Assessment Specification*. These are:

- ♦ practical application of knowledge and skills from across the Course to develop a solution to an appropriately challenging and complex computing science problem
- ♦ skills in analysing a problem, designing, implementing and testing a solution to the problem, evaluating and reporting on that solution

# Assessment

## Purpose

The purpose of this assessment is to generate evidence for the Added Value of this Course by means of a project.

## Assessment overview

The project will be based on a meaningful task, providing appropriate challenge and requiring application of knowledge, understanding and skills.

The project should clearly demonstrate significant application of knowledge and skills, at an appropriate level, from the software design and development and information system design and development sections of the Course (as defined in 'Further mandatory information on Course coverage' in the *Course Assessment Specification*).

The project is designed to allow candidates to demonstrate their ability to work independently, as they are required to do in the other Component of the Course assessment, the question paper.

The project is set by centres within SQA guidelines. Candidates may choose the topic for their project in discussion with centre staff.

Marks will be awarded for:

- ◆ producing a detailed project plan
- ◆ producing a requirements specification and test plan
- ◆ iterative design and development of the solution
- ◆ final testing of the solution
- ◆ evaluating the solution and development process

The project will be internally marked by centre staff, in line with the Marking Instructions provided in this document.

Full instructions for candidates are contained within the assessment task.

Suitable projects could include, but are not limited to, the following:  
Designing and developing a:

- ◆ program/information system that processes, stores and allows updating of sporting or other results
- ◆ 2-dimensional game with ability to pause and store state of the game and restart, such as Connect4, Battleships, Minesweeper, Noughts & Crosses, Chess, Draughts, Sudoku, etc

- ◆ small social media website, that allows registered users to blog and share information
- ◆ database-driven website, that allows users to search content and display, edit and update it appropriately
- ◆ multi-player card game such as 'Top Trumps' or a card-matching game
- ◆ question-based quiz, that randomises questions, processes and stores results, for example 'Who wants to be a Millionaire', 'Mastermind', 'Pointless'
- ◆ simulation of the operation of a queue, a stack or a sort algorithm, or other similar computing science concept/process
- ◆ interactive computer assisted learning tool that gathers and stores information
- ◆ or any other projects offering similar challenge and complexity to the candidate

It is important for mentors/assessors to discuss potential project ideas with candidates to ensure that they involve sufficient complexity and challenge to be appropriate for Advanced Higher, but are also achievable within the constraints of time, expertise and resources available.

## Assessment conditions

Assessors must exercise their professional responsibility in ensuring that evidence submitted by a candidate is the candidate's own work.

This assessment will be carried out over a period of time. Candidates should start at an appropriate point in the Course. This will normally be after they have started work on the Units in the Course.

This is an open-book assessment. There are no restrictions on the resources to which candidates may have access.

### **Independent working and 'reasonable assistance'**

Candidates must undertake the assessment independently. However, reasonable assistance may be provided prior to, and during the formal assessment process, as described below.

Reasonable assistance should be limited to constructive comment and/or questioning. Assessors should **not** adopt a directive role or provide specific advice on how to re-phrase, improve responses or provide model answers as this would constitute support for assessment and assessors need to be aware that this would be going **beyond** reasonable assistance.

### **Preparing candidates for assessment**

In addition to providing learning activities to develop candidates' subject knowledge and skills, assessors may give advice on generic skills such as how to produce a project plan or conduct research. This would normally be given to a class or group of candidates.

### **Advising candidates on choice of topic/problem**

Candidates are not assessed on choosing a suitable problem for their project, so assessor input and advice on the candidate's choice of a problem should be given, to ensure that the chosen problem is suitably complex and challenging, but is achievable.

### **Additional support and guidance to candidates during the project**

Candidates should work independently once the formal assessment process has started, with assessor input limited to constructive comment and/or questioning, as described above.

However, it may be necessary to provide more significant assessor input and advice for some candidates at the early stages of the project – project planning, producing a requirements specification and test plan – to allow them to continue to later stages. Any significant advice and guidance, over and above reasonable assistance, given to a candidate should be recorded by the assessor and be reflected in the marks awarded for those aspects. This would generally mean a mark from the lower bands for these aspects.

### **Supervision**

The project will be conducted under some supervision and control. This means that although candidates may complete part of the work outside the learning and teaching setting, assessors should put in place processes for monitoring

progress and ensuring that the work is the candidate's own and that plagiarism has not taken place. For example:

- ◆ regular checkpoint/progress meetings with candidates
- ◆ short spot-check personal interviews
- ◆ checklists which record activity/progress
- ◆ photographs, film or audio evidence

Group work approaches as part of the preparation for assessment can be helpful to simulate real-life situations, share tasks and promote team working skills. However, group work is not appropriate once formal work on assessment has started.

**Once the project has been completed and submitted, it must not be returned to the candidate for further work to improve the mark.**

## **Evidence to be gathered**

The following candidate evidence is required for this assessment:

- ◆ the detailed project plan, requirements specification and test plan
- ◆ the candidate's 'record of progress' through the project including reflective commentary and all items of evidence specified within the task (including program listings, screenshots, web page source files, data files or similar as appropriate)
- ◆ evidence of final testing
- ◆ qualitative evaluation of the solution and development process

This evidence must be retained for quality assurance purposes.

### **Record of progress**

Entries in the candidate's 'record of progress' contribute to the marks to be awarded for the process-based aspects of the project: planning, designing and implementing the solution.

### **Research/analysis and evaluation**

Marks for these aspects may be based on evidence produced at various stages throughout the project, and are not limited to initial research and analysis or final evaluation.



# General Marking Instructions

In line with SQA's normal practice, the following general Marking Instructions are addressed to the marker. They will also be helpful for those preparing candidates for Course assessment.

The assessment task will be set by centres within SQA guidelines and conducted, marked and internally verified in centres under conditions specified by SQA.

All marking will be quality assured by SQA.

## General Marking Principles for the project

*This information is provided to help you understand the general principles you must apply when marking candidate responses to this project. These principles must be read in conjunction with the detailed Marking Instructions, which identify the key features required in candidate responses.*

- (a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the detailed Marking Instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

## Detailed Marking Instructions for the project

Marks will be awarded for the following aspects:

	Marks available
Producing a detailed project plan	10
Producing a requirements specification	10
Producing a test plan	10
Iterative design and development of solution:	
— interface design	10
— program/data structure design	10
— implementation	20
Final testing of solution	10
Evaluation of the solution and the development process	10

Assessors should allocate a mark for each of these aspects of assessment, by following the instructions given below. This mark should be recorded on the assessment record, **with detailed comments justifying why each mark was awarded.**

Marks for internally-assessed Components must be submitted to SQA by the centre. Evidence for this assessment should be retained in the centre for SQA quality assurance purposes. Further information on this will be provided by SQA.

For each of the aspects, the assessor should **select the band descriptor which most closely describes** the evidence gathered. Note, this means that, in some cases, the evidence does not match exactly all the elements listed for any of the band descriptors, and an element of judgement will be required by the assessor.

Once the best fit has been selected, follow this guidance:

- ◆ If the evidence almost matches the level above, the highest available mark from the range should be awarded.
- ◆ If the candidate's work just meets the standard described, the lowest mark from the range should be awarded.
- ◆ If neither of the above is appropriate, then the mark from the middle of the range should be awarded.

**Notes:**

- ♦ If the evidence completely matches the highest level band descriptor for any aspect and has been produced by the candidate working independently, full marks should be awarded for that aspect.
- ♦ Zero (0) marks should be awarded for any aspect where no appropriate evidence has been produced by the candidate.

## Producing a detailed project plan

In order to fully complete the requirements for this stage the candidate should have evidence of:

- ◆ a project proposal
- ◆ research including
  - feasibility study
  - user survey(s)
  - analysis of findings
- ◆ an outline project plan
- ◆ a detailed project plan, eg a Gantt chart detailing
  - identifiable sub tasks
  - resources
  - time allocation
- ◆ on-going refinement
- ◆ reflective commentary justifying changes to plan within the 'record of progress'

Band descriptors for producing a detailed project plan	Total marks 10
Complete and detailed project plan, meeting all requirements listed above.	9-10
Almost complete project plan, meeting the majority of the requirements listed above.	6-8
Partially completed project plan, meeting only a few of the requirements listed above.	3-5
Minimal or no evidence of a project plan.	0-2
<p><b>Information for assessors:</b> <i>This aspect of the project is likely to be revisited throughout the project as the candidate makes changes and decisions. It is unlikely that the plan will remain unaltered throughout the process.</i></p> <p><i>The intention of the plan is to assist the candidate throughout the project. For example they will have to consider what activities they will have to carry out and when, what resources will be needed, any special resources to be acquired or booked, and interim and final deadlines. It will also assist them in reflecting on their successes and any challenges faced within the project. Updates and refinement to the project plan should be dated to show the frequency and regularity of review. Review does not always need to result in changes – where this is the case, it should be noted. The plan could be in the form of a Gantt chart which shows revisions in the form of versions over the period of the project, eg project plan version 1.0, 1.1, 1.2 etc.</i></p> <p><i>It may be that some candidates are unable to produce a logical or useful</i></p>	

*project plan which will allow them to progress the project in a meaningful way. Where this is the case, it should not be seen as a barrier to progressing. The assessor can choose to assist the candidate in producing a minimum project plan.*

*In such cases, the candidate should be marked on the work produced independently, with appropriate assessor comments made against this section in the candidate's marking record to support the mark awarded.*

## Providing a requirements specification

In order to fully complete this stage, the candidate should have evidence of:

- ◆ a detailed requirements specification, based on analysis and research, which includes descriptions of:
  - scope and boundaries
  - end users
  - user requirements
  - functional requirements
  - inputs and outputs
- ◆ reflective commentary justifying changes to plan within the ‘record of progress’

Band descriptors for producing a requirements specification	Total marks 10
Complete and detailed requirements specification, meeting all the requirements listed above.	9-10
Almost complete requirements specification, meeting the majority of the requirements listed above.	6-8
Partially complete requirements specification, meeting only a few of the requirements listed above.	3-5
Minimal or no evidence of requirements specification.	0-2
<p><b>Information for assessors:</b> <i>To create a detailed requirements specification candidates will need to draw on their initial research and analysis of the problem.</i></p> <p><i>The intention of the requirements specification is to describe what the solution will do and what its functional and non-functional requirements are. It should provide enough detail to inform the design and implementation processes and decisions made during these stages will be based on the requirements specification.</i></p> <p><i>It may be that some candidates are unable to produce a minimum specification which will allow them to take the project forward in a meaningful way. Where this is the case, it should not be seen as a barrier to progressing. The assessor can choose to assist the candidate in producing a minimum specification. In such cases, the candidate should be marked on the work produced independently, with <b>appropriate assessor comments</b> made against this section in the marking candidate’s marking record to support the mark awarded.</i></p>	

## Providing a test plan

In order to fully complete this stage the candidate should have evidence of:

- ◆ a comprehensive test plan for final testing. This test plan should indicate:
  - how the solution will be tested
  - how the results of testing are recorded
  - the input validation testing that will be carried out
- ◆ a test plan for end-user testing
- ◆ reflective commentary justifying changes to plan within the ‘record of progress’

Band descriptors for producing a test plan	Total marks 10
Complete and detailed test plan, meeting all the requirements listed above.	9-10
Almost complete test plan, meeting the majority of the requirements listed above.	6-8
Partially completed test plan, meeting only a few of the requirements listed above.	3-5
Minimal no evidence of test plan.	0-2
<p><b>Information for assessors:</b> <i>The test plan should test both functional and non-functional requirements and include criteria for end-user testing.</i></p> <p><i>It may be that some candidates are unable to produce a test plan which will allow them to take the project forward in a meaningful way. Where this is the case, it should not be seen as a barrier to progressing. The assessor can choose to assist the candidate in producing a minimum specification. In such cases, the candidate should be marked on the work produced independently, with <b>appropriate assessor comments</b> made against this section in the marking candidate’s marking record to support the mark awarded.</i></p>	

## Interface design

In order to fully complete this stage, the candidate should have evidence of:

- ◆ a detailed user-centred interface design which:
  - uses a recognised design notation
  - meets all requirements
  - indicates expected inputs/outputs
  - indicates validation criteria for all inputs
- ◆ reflective commentary justifying changes to interface design within the 'record of progress'

Band descriptors for interface design	Total marks 10
Complete and detailed user-centred interface design meeting all requirements listed above.	9-10
Almost complete user-centred interface design meeting majority of requirements listed above.	6-8
Partially complete user-centred interface design meeting only a few aspects of the requirements listed above.	3-5
Minimal or no evidence of interface design.	0-2
<p><b>Information for assessors:</b></p> <p><i>Candidates' interface design is expected to reflect on the findings from their research and analysis of end users and their requirements specification. The interface design should show expected inputs and outputs, and candidates should describe how these will be implemented and validated. Candidates should be able to describe the purpose and function of all screen elements.</i></p> <p><i>Reflective commentary should include justification of initial design decisions made with reference to the end users, principles of good user-centred design and the requirements specification. Many candidates will refine their design as they go through the implementation process and any changes should be noted and justified in their reflective commentary.</i></p>	



## Program/data structure design

In order to fully complete this stage the candidate should have evidence of:

- ◆ a detailed program design / data structure design which:
  - uses a recognised design notation
  - correctly reflects requirements section
  - validates input
- ◆ reflective commentary justifying changes to design within the ‘record of progress’

Band descriptors for program/data structure design	Total marks 10
Complete and detailed program/data structure design, meeting all requirements listed above.	9-10
Almost complete program/data structure design, meeting majority of requirements listed above.	6-8
Partially completed program/data structure design, meeting only a few of the requirements listed above.	3-5
Minimal or no evidence of program or data structure design.	0-2
<p><b>Information for assessors:</b></p> <p><i>Candidates’ program or data structure design is expected to reflect on the requirements specification and should be completed using an appropriate design notation or methodology. If creating a program it should show use of sub-programs and indicate the data flow between modules/programs. In a data structure design the fields, data types and constraints should be indicated, for each table. Design of any coding for client/server-side script, and the design of complex queries should also be clearly indicated.</i></p> <p><i>Many candidates will refine their design as they go through the implementation process and these changes should be noted in their reflective commentary with justification of changes made.</i></p>	

## Implementation

In order to fully complete this stage the candidate should have evidence of:

- ◆ an interface that matches the design
- ◆ a program/data structure that matches the design
- ◆ a program/data structure that meets the requirements
- ◆ implementation that reflects an appropriate range of techniques which should include two from:
  - 2D arrays, arrays of records or linked lists
  - a binary search, sort algorithm or other coding of similar complexity
  - recursion
  - HTML form processing using server-side scripting
  - appropriate SQL operations
- ◆ reflective commentary showing on-going testing of the implementation within the 'record of progress'

Band descriptors for implementation	Total marks 20
Complete implementation of interface and program/data structure design, to meet all requirements listed above.	19-20
Almost complete implementation of interface and program/data structure design, to meet majority of requirements listed above.	15-18
Partially complete implementation of interface and program/data structure design, meeting more than half of the requirements listed above.	11-14
Partially complete implementation of interface and program/data structure design, meeting less than half of the requirements listed above.	7-10
Incomplete implementation of interface and program/data structure design, meeting only a few of the requirements listed above.	3-6
Minimal no evidence of implementation.	0-2
<p><b>Information for assessors:</b>            For this aspect of the project, candidates must base their implementation on their interface and program/data structure designs and meet all aspects of the requirements specification.</p> <p>Implementation must include an appropriate range of techniques at Advanced Higher level, including at least two from:</p> <ul style="list-style-type: none"> <li>◆ 2-D arrays, arrays of records or linked lists</li> <li>◆ a binary search, a sort algorithm or other coding of similar complexity</li> <li>◆ recursion</li> <li>◆ form structure using HTMLHTML form processing using server-side scripting</li> <li>◆ appropriate SQL operations</li> </ul>	

*Throughout the implementation process, candidates should be testing the component parts as they go along, maintaining evidence of ongoing tests, and noting any corrections and/or refinements made as a result. Candidates' notes should reflect and justify the decisions made.*

## Final testing of solution

In order to fully complete this stage the candidate should have evidence of:

- ◆ final testing against all elements of test plan with evidence
- ◆ test results recorded in a structured way
- ◆ evidence of end-user testing
- ◆ reflective commentary regarding the testing within the 'record of progress'

Band descriptors for final testing of solution	Total marks 10
Complete testing of completed solution, meeting all requirements listed above.	9-10
Almost complete final testing of completed solution, meeting the majority of requirements listed above.	6-8
Partially complete final testing of solution, meeting only a few of the requirements listed above.	3-5
Minimal or no evidence of final testing.	0-2
<p><b>Information for assessors:</b></p> <p><i>Candidates should carry out final testing of their solution based on the test plan created earlier in the project. They should complete all required tests, and record the results in a structured way. Test failures should be noted with a description of the nature of the problem and what action is required. If testing uncovers serious problems, candidates should demonstrate that they have returned to relevant aspects of the design first, before implementing any changes.</i></p> <p><i>Any corrective maintenance or changes candidates make to the solution as a result of testing should be noted in their reflective commentary or 'record of progress'.</i></p>	

## Evaluation of the solution and development process

In order to fully complete this stage the candidate should have evidence of:

- ◆ evaluation of the solution including commentary on:
  - how closely the solution matches the requirements specification
  - the final testing
  - the end-user testing
  - further developments
  - valid and relevant conclusion
- ◆ evaluation of the development process
- ◆ evaluation of candidates performance

Band descriptors for evaluation of the solution and development process	Total marks 10
Complete and detailed qualitative evaluation of the solution, meeting all requirements listed above.	9-10
Almost complete qualitative evaluation of the solution, meeting the majority of the requirements listed above.	6-8
Partially complete qualitative evaluation of the solution, meeting only a few of the requirements listed above.	3-5
Minimal or no evidence of evaluation.	0-2
<p><b>Information for assessors:</b></p> <p><i>Candidates should give a qualitative evaluation of their solution describing how closely it matches the specification, results of final and end-user testing, and justifying design or implementation refinements made as a result. They should provide some valid and relevant conclusions based on their evaluation.</i></p> <p><i>Candidates should also identify critical points in the process of the development referring to their own performance, identifying what went well or not so well, what they might have done differently, what they have learned and responses to feedback.</i></p> <p><i>Candidates should clearly draw on the reflective comments they recorded in their 'record of progress' to help them with their evaluation.</i></p>	

# Administrative information

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## History of changes

Version	Description of change	Authorised by	Date
2.0	Removal of the need to present/communicate the solution throughout the document. 'Providing a requirements specification' and providing a test plan' have been separated into two separate sections. Marking Instructions reworded to specify what is required to meet the requirements for each section.	Qualifications Manager	September 2016

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