

- When assessing a student’s work, teachers should read the level descriptors for each criterion until they reach a descriptor that most appropriately describes the level of the work being assessed. If a piece of work seems to fall between two descriptors, both descriptors should be read again and the one that more appropriately describes the student’s work should be chosen.
- Where there are two or more marks available within a level, teachers should award the upper marks if the student’s work demonstrates the qualities described to a great extent. Teachers should award the lower marks if the student’s work demonstrates the qualities described to a lesser extent.
- Only whole numbers should be recorded; partial marks, that is fractions and decimals, are not acceptable.
- Teachers should not think in terms of a pass or fail boundary, but should concentrate on identifying the appropriate descriptor for each assessment criterion.
- The highest level descriptors do not imply faultless performance but should be achievable by a student. Teachers should not hesitate to use the extremes if they are appropriate descriptions of the work being assessed.
- A student who attains a high achievement level in relation to one criterion will not necessarily attain high achievement levels in relation to the other criteria. Similarly, a student who attains a low level of achievement for one criterion will not necessarily attain low achievement levels for the other criteria. Teachers should not assume that the overall assessment of the students will produce any particular distribution of marks.
- It is recommended that the assessment criteria be made available to students.

## Internal assessment details—SL and HL

### Solution

**Duration:** 30 hours

**Weighting at SL:** 30%

**Weighting at HL:** 20%

### Introduction

The requirement of the internal assessment is to develop a solution for a specified client to a specified problem or an unanswered question.

The solution is assessed using five criteria.

- Planning
- Solution overview
- Development
- Functionality and extensibility of product
- Evaluation

### Key terms

The term “solution” refers to all the work submitted by the student for the internal assessment; the term “product” refers to the completed software only. The product is a subset of the solution.

The terms “developer” and “student” are synonymous.

The term “client” refers to the person for whom the product is being developed. The student may also be the client.

The term “adviser” refers to a third party the student **must** identify to assist him or her in the development of the product.

There are three scenarios for the development of the product.

1. The student is developing the product for a third party who is the client and also acts as the adviser.
2. The student is developing the product for a third party who is the client. Another person acts as the adviser.
3. The student is the client (developing the product for himself or herself). An appropriate adult must act as the adviser.

## Choice of topic

In identifying a problem, students can select any topic that interests them. It does not have to be directly related to the specified themes in the syllabus or to the option studied.

Students should undertake a challenging task using appropriate techniques to showcase their algorithmic thinking and organizational skills.

The solution may take one of these forms:

- Creating a new system, such as an OOP program, a relational database, a simulation or a stand-alone/web-based application
- Adding functionality to an existing system, such as connecting a webpage(s) to a database, writing a function for Moodle, writing a plug-in, or developing a stand-alone application

It is essential that whatever form the solution takes it ensures the student can explicitly demonstrate and document his or her algorithmic thinking skills.

Examples are illustrated in the teacher support material.

It should be noted that products created using templates that show no evidence of modification in their structure, design or functionality are not permitted. Examples of **inappropriate** products include:

- the development of a programming product only using copied code
- the development of a website (product) using a web-based template that determines its structure and layout
- the use of unmodified exemplar products or templates provided with software such as the Northwind database in MS Access
- a product that does not meet the ethical requirements outlined in the “Requirements and recommendations” section of this document.

## Choice of adviser

Students will need to work closely with the adviser throughout the development of the solution. Therefore it is recommended that wherever possible, students select an adviser who is known to them or their family. This could include members of the school community, local clubs or businesses.

## Requirements

The internal assessment consists of three parts:

1. A cover page
  - The cover page form to be used is included in HTML format within the zip file available on the OCC.
  - The cover page must be submitted in HTML format and should provide access to the product and associated documentation via **relative** hyperlinks.
  - The cover page is not included in the overall word count for the project, nor is its functionality assessed.
  - Information to access or locate the product, for example, a username and password, must be provided in the cell on the cover page.
  - The cover page must be called [cand\_no]\_[cand\_name]\_CoverPage.htm and be located in the top level folder.
2. The product
3. The documentation including a video
  - 3.1 The video must be in a commonly used format such as .avi or .wmv.

All three of these must be submitted digitally for moderation.

Instructions for the submission of student work can be found in the *Handbook of procedures for the Diploma Programme*.

## Components of the solution

### Product

Students should aim to develop a product that uses appropriate (complex) techniques, is fully functional and allows the moderator, if possible, access to its complete internal structure.

The moderator must be able to see the product functioning as a video. The video should address the success criteria stated in the planning criterion.

Any text within the product is not included in the overall word count for the solution.

### Documentation

This information must be read in conjunction with that in the “Organization of documentation” section.

A zip file is available on the OCC that contains the cover page and templates required for submitting the solution.

The final documentation consists of:

- **Information added to the *Record of tasks* form and in the information linked to the design overview**

The information added must be in the following style(s):

- bullet points or tables to list information
- scanned diagrams or other appropriate images as part of the design process
- other styles of non-extended writing or diagrammatic representation such as flow charts, Gantt charts or spider diagrams where appropriate.

If the student includes extended writing, the words will be included in the word count and the student will self-penalize if the total number of words in the documentation exceeds 2,000.

**The *Record of tasks form in the zip file must be used.***

- **A series of documents** that use text (extended writing) that:
  - describes the scenario, client requirements and/or adviser input
  - justifies the rationale behind the proposed product
  - explains the techniques used to develop the product
  - evaluates the success of the product in resolving the original problem and client and/or adviser feedback
  - recommends further improvements to the product.

This should be the **only** information that is included in the word count and it **must not exceed 2,000 words**.

**It is recommended that the blank files in the zip file are used for the documentation.**

- **Appendix/appendices** that show, if appropriate, any additional information such as:
  - evidence of consultation with the client/adviser
  - evidence of feedback from the client/adviser
  - additional videos or documents containing screenshots of the product functioning.

### Organization of documentation

The documentation must be located in the **Documentation folder**. It is associated with assessment criteria A—E and any additional material in the appendices of this guide.

*The table below indicates the content and nature of each of the files and the criterion that it relates to.*

| Document                           | Method of submission   | Criterion                                    |
|------------------------------------|--|--|
| Description of scenario            | Extended writing   | A Planning                                   |
| Rationale for the proposed product | Extended writing   | A Planning                                   |
| Success criteria for product       | Bullet points  | A Planning                                   |
| Record of tasks                    | <i>Record of tasks form</i>  | B Solution overview                          |
| Design overview                    | Design overview document, for example, screenshots, flowcharts, tables, diagrams | B Solution overview                          |
| Developing the product             | Extended writing with screenshot evidence  | C Development                                |
| The functioning product            | Video (2–7 minutes in length) demonstrating the product                          | D Functionality and extensibility of product |
| Extensibility of product           | Assessed through design overview and developing the product                      | D Functionality and extensibility of product |

| Document                                  | Method of submission                             | Criterion    |
|---|--|--------------|
| Evaluating the product                    | Extended writing                                 | E Evaluation |
| Recommendations for improving the product | Extended writing                                 | E Evaluation |
| Appendix                                  | To contain additional information if appropriate | n/a          |

## Development of the solution

Students are advised to use the following guidelines to develop the solution. This will ensure it fulfills the requirements of the assessment criteria.

Prior to developing the product the teacher must have:

- approved the choice of client/adviser and scenario
- reviewed preliminary designs and checked that the:
  - templates provided in the zip file are being used
  - proposed timeline for completing the product is realistic
  - scope and nature of the product are appropriate.

### Criterion A: Planning

#### The scenario

The following key questions should be considered.

- Who is the client/adviser?
- Is the choice of client/adviser appropriate?
- Why is the product being developed?

#### Rationale for proposed solution

The rationale behind the choice of the proposed product must be in **extended writing**, with reference to the student's consultations with the client and/or adviser, justifying how the choice of this particular product is an effective solution.

Before reaching a decision for the proposed product the student and/or computer science teacher must determine:

- if the student has the technical skills and access to the software required to develop the product
- whether the client's hardware and software is compatible with the product
- if the data required for the product can be obtained by either the student and/or appropriate third parties
- how any security implications for the development and operation of the product can be resolved.

#### Success criteria

The success criteria (that are evaluated in criterion E) should be listed in the form of bullet points.

If the student is the client, they must have an adviser who can review the success criteria and provide the validation of the product.

### Criterion B: Solution overview

A *Record of tasks* form in the zip file must be used for the product proposed in criterion A.

The record of tasks form addresses:

- a chronology of the key events in planning, designing, developing, testing and implementing the solution
- any other issues that may arise that may affect the development of the solution.

The design overview should include:

- design methodologies appropriate to the type of product being designed
- different levels of draft design, such as the overall structure and the internal layout of the product itself; this can also include investigation into specific elements used within the product (such as classes, sub-classes, tables, queries, style sheets, graphic elements, effects)
- evidence of a testing plan that addresses the main areas of functionality of the product.

The student must submit final versions of the *Record of tasks* form and the design overview. However, the teacher will need to see earlier versions to determine whether the product proposed is appropriate and feasible.

### Criterion C: Development

The product must be compatible with the information in criterion A and criterion B.

The student must present a list of the techniques used in developing the product.

The techniques may include algorithmic thinking, data structures, software tools and user interface. This list need not be exhaustive but should illustrate how the major components of the product were developed.

The student must provide evidence of algorithmic thinking.

The information in the development documentation must provide a detailed account, using extended writing and other appropriate information, to explain the following.

- The structure of the product and why it is appropriate
- The algorithmic thinking used in the development of the product
- The techniques used in the development of the product and reasons why they are appropriate to it (may include screenshots, exemplar data, reference to information in the appendix)
- Any existing tools that are used in the development of the product, such as code libraries, software packages, web hosting, security information or infrastructure issues

Any reference material such as templates, program code, applets or other materials that have been used or modified must be acknowledged in this criterion. The code used in the product can be included in the appendix.

### Criterion D: Functionality and extensibility of product

This criterion should be completed as two parts and does not require any additional written documentation.

#### Functionality of the product

The student must use the video to demonstrate the product functioning. This evidence will be supported, where possible, by the product on the CD-ROM/DVD or USB.

**Extensibility of product**

The student should design the product so that it can be maintained by another party and/or be further developed. Therefore the design of the product should include appropriate folder and data structures, intuitive file and/or class naming conventions and, where appropriate, comments in the code.

**Criterion E: Evaluation**

This criterion should be completed as two parts.

**Evaluation of the product**

The evaluation of the product should refer directly to the success criteria in criterion A, feedback from the client/adviser, as well as any other appropriate feedback obtained.

**Recommendations for the future development of the product**

The student will use the feedback and the evaluation of the specific performance criteria to recommend possible future developments to the product. These recommendations should explain the benefits of these developments.

## Internal assessment criteria—SL and HL

### Rationale

**General overview**

The computer science internal assessment focuses on the balance between the level of algorithmic thinking and problem-solving required to develop a product within the framework of the design cycle.

**The assessment criteria**

Criteria A, B and E are process-oriented and examine how the internal assessment task was carried out and allow common assessment criteria to be applied to different types of product from the different options. Criterion C is a holistic assessment of the final product and assesses the student's understanding of the concepts involved in its development. Criterion D is a holistic assessment of the functionality and future extensibility of the product.

**Criterion A: Planning (6 marks)**

The success criteria identified in criterion A will be used in criterion D to evaluate the effectiveness of the product.

| Marks | Description  |
|-------|--|
| 0     | The response does not reach a standard described by the descriptors below.   |
| 1–2   | An appropriate scenario for investigation for an identified client is stated. The rationale for choosing the proposed product is identified. The criteria for evaluating the success of the product are generally inappropriate. |

| Marks | Description   |
|-------|---|
| 3–4   | An appropriate scenario for investigation for an identified client, providing evidence of consultation, is stated. The rationale for choosing the proposed product is partially explained and includes some appropriate criteria for evaluating the success of the product. |
| 5–6   | An appropriate scenario for investigation for an identified client, providing evidence of consultation, is described. The rationale for choosing the proposed product is justified and includes a range of appropriate criteria for evaluating the success of the product.  |

### Criterion B: Solution overview (6 marks)

- The student must provide a record of tasks and a design overview that includes an outline test plan.
- The *Record of tasks* form must be used.
- The record of tasks and design overview must refer to the product proposed in criterion A.

| Marks | Description   |
|-------|---|
| 0     | The response does not reach a standard described by the descriptors below.  |
| 1–2   | The record of tasks and the design overview, including an outline test plan, are limited. From this information it is difficult to see how the product was developed.     |
| 3–4   | The record of tasks and the design overview, including an outline test plan, are partially complete. They provide a basic understanding of how the product was developed. |
| 5–6   | The record of tasks and the design overview, including an outline test plan, are detailed and complete. From this information it is clear how the product was developed.  |

### Criterion C: Development (12 marks)

- The student must identify techniques used in developing the product.
- The student must explain the techniques, with screenshots, that were used to develop the product identified in criterion A, explaining why they have been used and why they are adequate for the task.

| Marks | Description   |
|-------|---|
| 0     | The response does not reach a standard described by the descriptors below.  |
| 1–4   | The use of techniques demonstrates a low level of complexity and ingenuity or does not address the scenario identified in criterion A. It is characterized by limited use of existing tools. There is no explanation of why the techniques are used or how they are adequate for the task. Sources are used but are not identified. |



| Marks | Description   |
|-------|---|
| 5–8   | The use of techniques demonstrates a moderate level of complexity and ingenuity in addressing the scenario identified in criterion A. It is characterized by some appropriate use of existing tools. There is some attempt to explain the techniques used and why they are adequate for the task. All sources are identified. |
| 9–12  | The use of techniques demonstrates a high level of complexity and ingenuity in addressing the scenario identified in criterion A. It is characterized by the appropriate use of existing tools. The techniques are adequate for the task and their use is explained. All sources are identified.                              |

### Criterion D: Functionality and extensibility of product (4 marks)

This criterion assesses the extent to which the product:

- functions, as evidenced in the video
- can be expanded and modified by future users as evidenced in the design and development documentation.

| Marks | Description   |
|-------|---|
| 0     | The response does not reach a standard described by the descriptors below.  |
| 1–2   | The video shows that the product functions partially. Some expansion and modification of the product is possible but difficult. |
| 3–4   | The video shows that the product functions well. Some expansion and modifications of the product are straightforward.           |

### Criterion E: Evaluation (6 marks)

- The student must evaluate the effectiveness of the product based on feedback from the client/adviser. This must include direct references to the success criteria identified in criterion A.
- The student must recommend proposals for the future improvement of the product.

| Marks | Description  |
|-------|--|
| 0     | The response does not reach a standard described by the descriptors below.   |
| 1–2   | There is a limited attempt to evaluate the product against the success criteria identified in criterion A. There is limited evidence of feedback from the client/adviser and any recommendations for further improvement are trivial or unrealistic. |
| 3–4   | The product is partially evaluated against the success criteria identified in criterion A including feedback from the client/adviser. Recommendations for further improvement of the product are largely realistic.                                  |
| 5–6   | The product is fully evaluated against the success criteria identified in criterion A including feedback from the client/adviser. Recommendations for further improvement of the product are realistic.  |