Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2020

Computer Science

Sample Coursework Project Brief

Higher and Ordinary Levels

Time: 8 weeks

90 marks

Information for candidates

This is a sample coursework project brief to show you what the actual coursework project that you will carry out in the second term of your final year will be like.

The project is worth 90 marks, which is 30% of the overall marks for Leaving Certificate Computer Science. The remaining 210 marks (70%) are for the final examination. You will carry out the project over a period of eight school weeks, beginning when schools reopen in January 2020 after the holidays. You will present the report in the form of a webpage.

Carrying out the project involves responding to a brief by producing a computational artefact and an accompanying report. You will submit the project in digital form. If your artefact has physical elements, such as might arise with an embedded system, you will not be sending these physical items to the State Examinations Commission. Instead, you will capture video footage and/or images of the artefact in operation and send this to us.

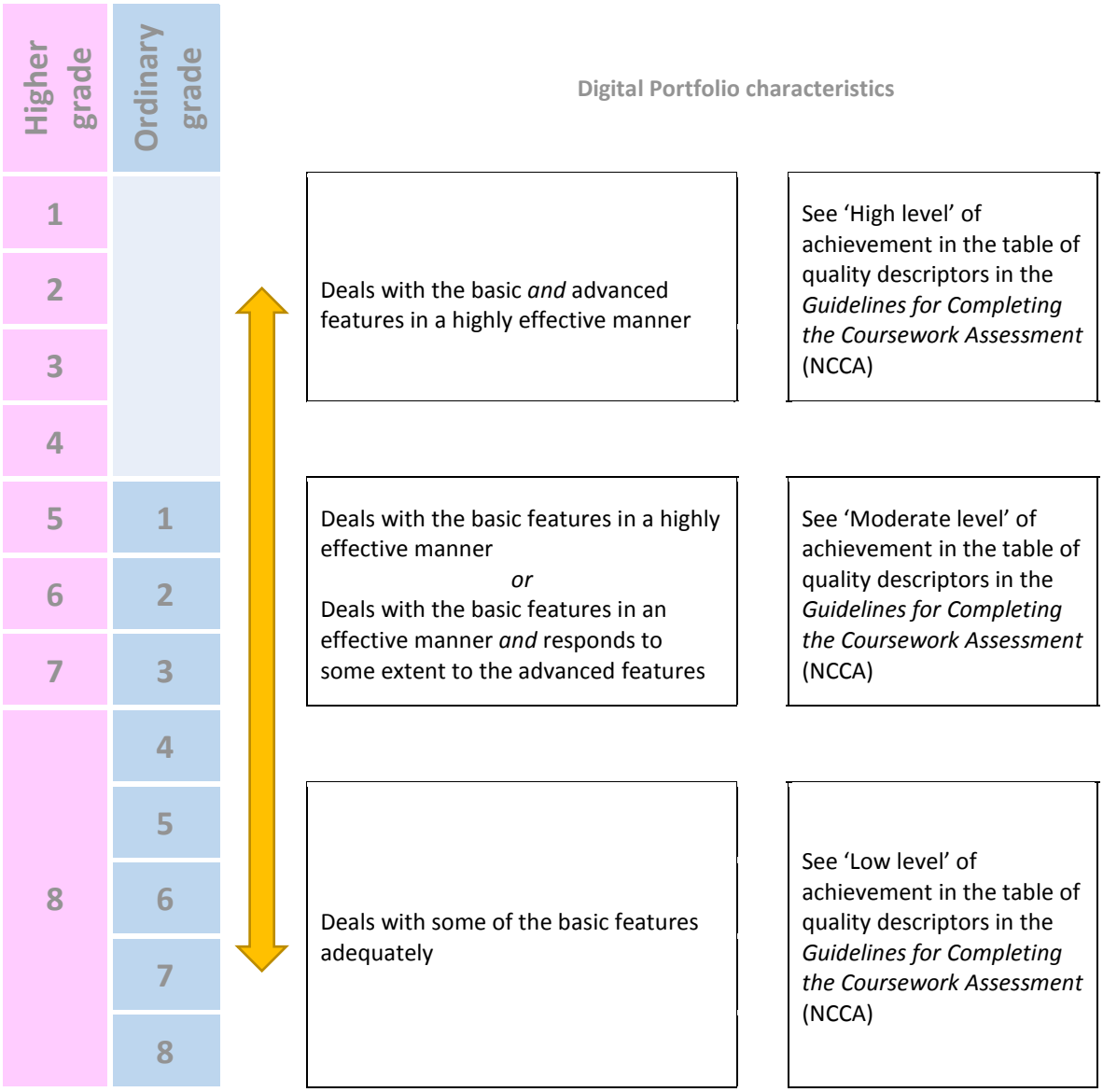
Although you are used to carrying out projects for the *Applied Learning Tasks* in groups, this is an *individual* project. You must carry it out independently of other candidates, and the work you submit must be your own unaided work.

Apart from some aspects described later, you must carry out the project in school under the supervision of your teacher. This allows your teacher to authenticate your work to the State Examinations Commission. Authentication is an important part of how we in the State Examinations Commission ensure fairness for everybody in the assessment of coursework. Because you are carrying out the work under teacher supervision, the teacher is able to guarantee to us that it is your own work, and that nobody gave you any inappropriate help. If you include work that was not supervised by your teacher, then they cannot authenticate it, even if they believe that you really did do it yourself. We cannot accept work for assessment if your teacher cannot authenticate it, so you will forfeit the marks for the project work. Note also that we cannot give partial marks for 'partially authenticated' work. That is, unless *all* of your work can be authenticated by your teacher, we cannot accept *any* of it for marking.

The same project brief applies to Higher and Ordinary level candidates. However, a higher standard of work is needed to score well at Higher level than at Ordinary level. You do not need to make a final decision about which level you are taking when you submit your project. We will grade your project in line with the standards that apply to the level at which you take the final examination.

The way that the standards at the two levels are aligned with each other is illustrated on the left-hand side of the graphic below. This means that, for example, a project that would get a grade 2 at Ordinary level will automatically get a grade 6 at Higher level. You can also see that any project that would get a grade 4 or better at Higher level exceeds the highest standard of work expected at Ordinary level. Because of this, a project of this quality would automatically get full marks at Ordinary level.

The project brief sets out some *basic features* and *advanced features* of the artefact. The following graphic shows how the grading standards relate to how well you deal with these features. The grading standards also relate to the quality of work demonstrated both in the reporting and in the design of your artefact.


Higher grade
Ordinary grade
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
Digital Portfolio characteristics
Deals with the basic *and* advanced features in a highly effective manner
See 'High level' of achievement in the table of quality descriptors in the *Guidelines for Completing the Coursework Assessment* (NCCA)
Deals with the basic features in a highly effective manner
or
Deals with the basic features in an effective manner *and* responds to some extent to the advanced features
See 'Moderate level' of achievement in the table of quality descriptors in the *Guidelines for Completing the Coursework Assessment* (NCCA)
Deals with some of the basic features adequately
See 'Low level' of achievement in the table of quality descriptors in the *Guidelines for Completing the Coursework Assessment* (NCCA)

The project brief

Context of the Brief

Measuring a person's response to an external stimulus is a vital part of research in a wide variety of fields. A reliable system for measuring a person's speed of reaction or indicating the strength of their memory is required for areas such as:

- The effect of sleep deprivation
- Analysis of the effects of aging
- Effects of drugs such as alcohol or caffeine
- Sports science
- Effects from prolonged time online or using social media.

Below are some examples of reaction time tests, memory tests, and various other tests, along with information on factors affecting response times.

Reaction time tests, visual and memory tests are available online.

- https://www.humanbenchmark.com/tests/reactiontime/
- https://www.bbc.co.uk/science/humanbody/sleep/tmt/
- https://www.justpark.com/creative/reaction-time-test/
- https://humanbenchmark.com/tests/memory

Reaction time tests are used as part of sports science.

- https://www.youtube.com/watch?v=aveegpbB3Lk

Factors affecting human reaction time.

- The following document, with references, provides an overview of factors involved. In addition the references provide benchmarked times for different end users and different environments.
  http://www.cti-home.com/wp-content/uploads/2014/01/Factors-Affecting-Reaction-Time1.pdf
- https://quizlet.com/38152029/factors-that-may-affect-reaction-time-flash-cards/
- http://www.actforlibraries.org/factors-that-affect-human-reaction-time/

Montreal Cognitive Assessment Test (MOCA).

- https://www.verywellhealth.com/alzheimers-and-montreal-cognitive-assessment-moca-98617

The Stroop Test.

- https://en.wikipedia.org/wiki/Stroop_effect

Background research.

- http://psychology.wikia.com/wiki/Reaction_time
- https://en.wikipedia.org/wiki/Methods_used_to_study_memory

In order to effectively analyse a person's performance there should be other data to compare it to, such as how the user's performance compares to that of other users or how the user's performance now compares to previous performances over time.

The Task

In this context, design a computational artefact using a program written primarily in Python, and/or a webpage that includes JavaScript, that presents a self-explanatory user interface to measure the response of the subject (user) to a stimulus. The artefact should be measuring speed of response to simple or more complex stimuli and/or accuracy of memory. The stimulus could be one of more of the following, or a mixture of similar types of response tests.

- Binary responses (selecting one of two options)
- Multiple responses (selecting one or more of many options)
- A visual or audio stimulus that triggers a response in the user
- A memory test.

The artefact might involve the use of an embedded system.

You should set out clearly the needs of the envisaged end user of the artefact. This could be your peers, your school, the wider community, or you could consider yourself to be a typical target user. The artefact should inform the user how their performance compares to the performance of other users, to their own performance on previous occasions and/or to some other set of standards. The artefact should demonstrate the principles of good user interface design.

Basic Artefact Features

1. A program written in Python and/or JavaScript, that interfaces with the user by means of a webpage, an app, an embedded system or otherwise to perform a measurement of the user's response to a stimulus, or a set of stimuli.
2. Multiple instances of data are stored in a file or database.
3. The user's performance is analysed and compared to an appropriate dataset, and presented in a suitable fashion, such as tabular or graphical form.

Advanced Artefact Features

4. An interactive system that displays multiple users' data from a database, which may be relational, in a user-friendly and informative manner. The database is updated with each user interaction. The interactive system could be, for example, an app or a website.
5. The artefact captures more than one type of performance measurement (such as reaction speed and accuracy of response; reaction speed and memory accuracy).
6. Innovative or sophisticated use of an embedded system or other user interface.

Coursework Report – Content and Structure

The report should be presented as a webpage in html and be structured according to the headings below. The report should contain no more than 2000 words. You should ensure that the file structure of your artefact is clear, so that you can clearly reference files or programs in your report. The presentation of content and the demonstration of universal design principles in the creation of the webpage are important elements of the assignment.

Further information about the content and structure of the report can be found in the *Guidelines for Completing the Coursework Assessment* on www.curriculumonline.ie.

1. A Rationale for the Approach to the Brief

1.1 Research

There should be evidence of research of the thematic brief and analysis of other artefacts that fulfil a similar function.

1.2 Response to the Brief

You should explain your reasons for decisions you make in the way you respond to the brief. You should provide reasons for your specification of the initial design parameters, and the typical end users you envisage.

2. The Artefact in Operation

You must embed a video presentation showing the artefact in operation. The video must not be more than 5 minutes in duration.

In deciding the content of your video, you should refer back to the description of the task. The video should show all the features of the artefact that you want the examiner to be aware of, as this is the main piece of evidence on which the examiner will judge the quality of the artefact. The video should demonstrate the quality of the user interface and the full functionality of the artefact.

3. Design and Development of the Artefact

3.1 The iterative design process

You should show evidence of an iterative design approach, in line with the process shown in Figure 1. There should be a concise description of how the artefact evolved through the iterations. This description could focus on one particular element of the artefact rather than the artefact as a whole. The structure of this section should reflect the iterative process you adopted.

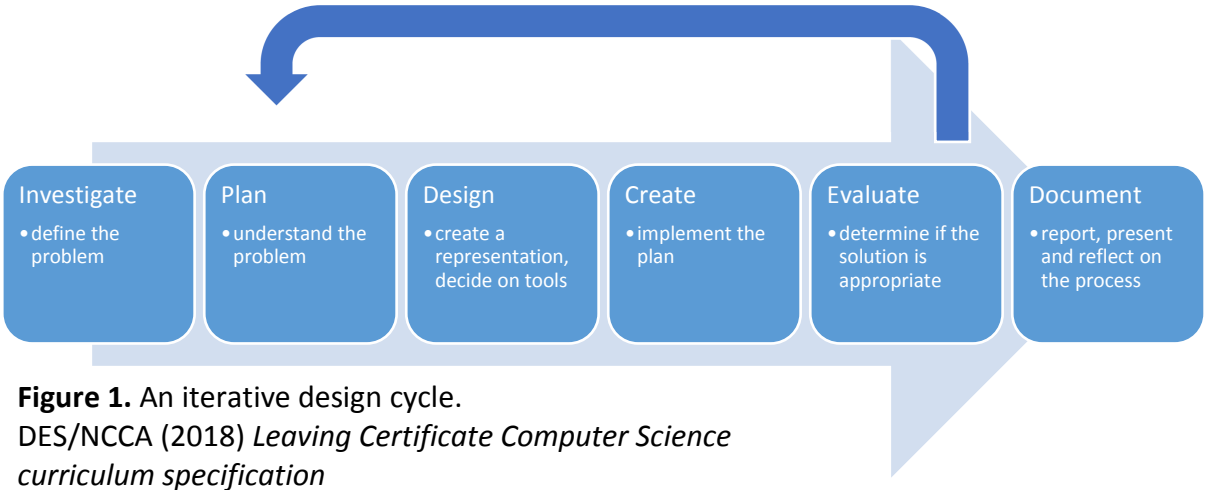


Figure 1. An iterative design cycle.
DES/NCCA (2018) *Leaving Certificate Computer Science curriculum specification*

You should show the timeline of your design and justify the key decisions in the timeline of the iterations in the design and development of your artefact. There should be an abstracted version of the overall algorithm and design, highlighting the computational thinking involved. In particular, in any programs written in the prescribed languages, you could for example describe your use of pattern recognition, data structures, abstraction or decomposing problems into smaller problems.

3.2 Development of the Artefact

There should be a clear description of how the artefact meets the brief and works in an overall design sense. This section should contain the video presentation of the artefact in operation. You should include all of the following areas in addition to any others you consider appropriate.

File Structure – The hierarchy of any programs should be clearly described and programs suitably named. The main supervising program should be clearly identified in the report, and readily accessed in the Artefact folder.

User Interface Design – The principles of good user interface design should be applied. Features should include consistency, clear and succinct display of output, and a sufficient degree of control for the user in their interaction with any software or hardware in your artefact.

Data Gathering and Validation – You should explain how your artefact gathers, stores and validates data. If a dataset of responses generated using the artefact needs to be formed, it should be illustrated with a minimum of 10 samples.

Testing – The development and function of the artefact should be tested as comprehensively as possible. All programs should be debugged and operational. You should describe the extent of testing you carried out, and major problems you encountered during the testing and development cycle.

4. Evaluation of the artefact

4.1 Reflection on meeting the brief

You should evaluate the final product in relation to the brief. In particular, you should reflect on:

- How well you achieved your design ambitions.

- The degree to which you met the requirements of the brief – you should examine each of the artefact features listed in the brief, and explain how your artefact meets, or does not meet, each feature.
- How well the needs of the envisaged end user were met. Include reference to any unexpected results encountered in the application of your artefact.

4.2 Future development of the artefact

Suggest, with justification, how your artefact could be improved in future iterations of the design cycle.

If you can, identify other possible applications of your artefact, whether as it currently is or as it might be with future improvement or expansion.

Outline marking scheme

Coursework (90 marks in total)			
		Description	***Marks***
	Presentation of report	Quality of report structure and layout; evidence of student's adherence to the principles of universal design when creating the webpage.	**5**
1.	**Research**	Shows evidence of research and investigation of the context and the task.	**10**
	Response to the brief	Clearly explains choices made; offers clear rationale behind the overall design approach.	
2.	**Meeting the brief**	The artefact is consistent with the context and theme of the brief.	**45**
	Functionality	The requirements of the brief are met; identified end user needs are met; a clear self-explanatory user interface design is offered to the user.	
	Originality	There is a well-thought out design algorithm; problem solving and heuristics***** are used to overcome difficult development issues.	
	Computational thinking skills	The construction of the artefact shows skills such as abstraction, decomposition, algorithmic thinking, evaluation and testing.	
	Programming skills	Fundamental skills are demonstrated, such as using a modular approach, using high level data structures, testing and debugging, minimal duplication of code, readability, effective use of commenting.	
	Use of computing technologies	Shows an awareness of adaptive technology; creative and appropriate use of technology; an awareness around data and user issues.	
3.	**Iterative design process**	Presents a design timeline with justification of key decisions; explains the iterative design approach adopted.	**20**
	Development of the artefact	Clearly describes how the operation of the artefact meets the brief; shows evidence of computational thinking, UI design principles, hierarchical file structure where appropriate, and testing and debugging. All descriptions and explanations are consistent with the artefact itself and its operation.	
4.	**Evaluation**	Explains the extent to which the artefact meets the design ambition; how well the needs of the envisaged end user are met; how the artefact could be modified and improved.	**10**

*****_heuristics_ is identified in the curriculum specification as a Higher-level concept, and so no reference to it is needed unless you are aiming for Higher level grades 1 to 4.
Note1 Outline marking schemes may vary somewhat from year to year. The outline scheme applying in any year will be distributed with the brief, as illustrated in this sample brief.

Instructions on completing and submitting the coursework

1. Your coursework digital portfolio that is submitted for assessment must comprise of the following two components:
   - The digital components of the computational artefact, including all relevant programs in the prescribed languages.
   - A coursework report of no more than 2000 words, including a video presentation of no longer than 5 minutes. The video should be no more than 1GB in size. This readily can be achieved by using standard definition (720 x 480) at 25 frames per second and a suitable commonly used format.

   You may wish to include some images in the report, such as, for example, a diagram of a database structure, initial sketches of the design approach, a flowchart, etc. The report should not include more than 10 images in total.

2. Some of the research and investigation that you carry out for the project and describe in section 1 of your report, ('research and response to the brief'), can be completed outside of class time. However, the actual writing of the report and all of the work on the artefact itself must be done in class under the supervision of your teacher so that they can authenticate your work.

3. Your digital portfolio must be saved in a single zipped file (.zip). We will issue instructions in due course on how to submit the file.

4. The name of the file submitted should contain your candidate examination number and be in the following format "YearCSCAExamNumber". For example, if your examination number is 123456, the file will be called "2020CSCA123456.zip"

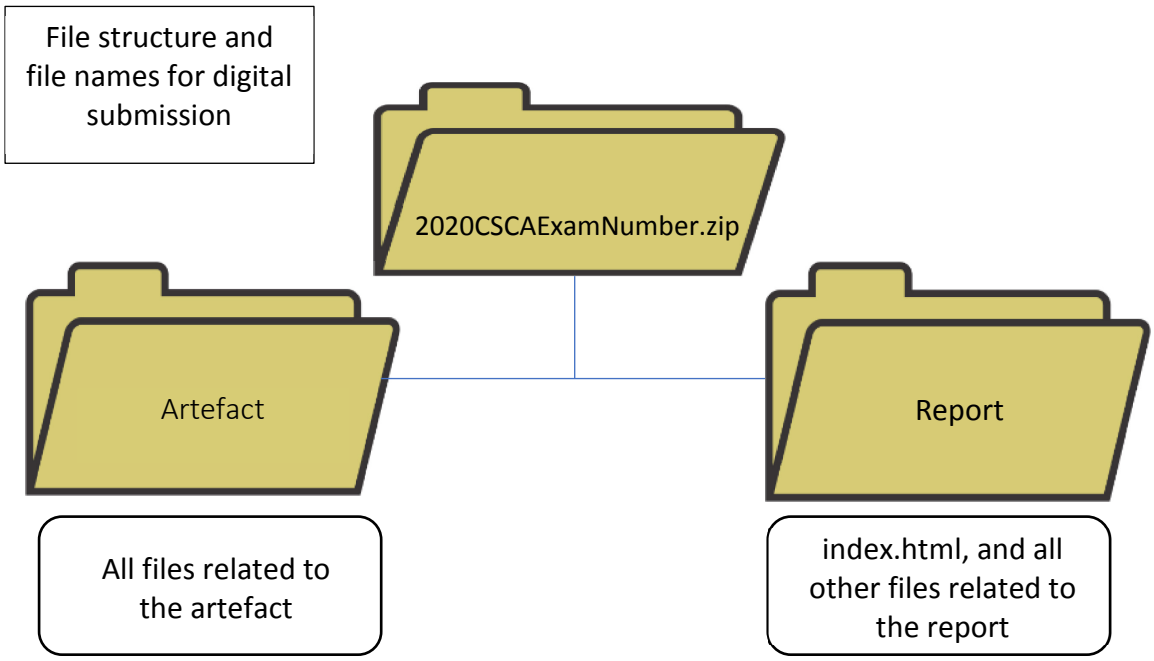
5. The .zip file, when extracted, should be a folder that contains exactly two subfolders. One of these sub-folders should be called "Report" and should contain all of the files relating to the report. It should be possible to access the complete report by opening a file named "index.html" at the top level within the "Report" folder. That is, all of the content of the report should either be in this file itself or accessed via links from within this file. Any subsidiary files, such as additional html files, css stylesheets, image files, and so on, must also be in the "Report" folder, either at the same level as index.html or within a further suitable folder structure. As part of the report you must embed a video of not more than 5 minutes, so this video file should also be within this folder. All content of the report (images, video or other) must comply with the school's Acceptable Usage Policy and with General Data Protection Regulation (GDPR).

6. The other sub-folder should be called "Artefact" and should contain the essential digital components of your artefact. Accordingly, if the artefact is purely digital, without any physical elements such as might arise with an embedded system, then this folder contains the complete artefact. The file structure of your artefact should be made clear. For example, if there is a main, supervising program, from which other programs are imported or called, this program should be clearly named in the sub-folder and referenced in the description in the coursework report.

7. It is **your** responsibility to ensure that all electronic materials submitted are free from viruses, so that examiners can open all required files for assessment, and all code supplied can be evaluated.

8. **Python and JavaScript Programs:** All programs predominantly written in Python and/or JavaScript should be clearly identifiable. If there is a hierarchy of programs, this should be described in the report. In the case of JavaScript code that is embedded in a HTML file, then the entire HTML file should be included. It is your responsibility to ensure key programs can be readily executed (for example, that any supplied HTML file can be executed in a range of commonly used browsers) or that Python or other code is presented in a way that facilitates an examiner in copying and pasting the relevant code into an integrated development environment (IDE) to verify its functionality. You are encouraged to include properly tagged comments in your code to explain or describe how particular elements of the code work.

9. **Other relevant components**: Any dataset used by your artefact, or data gathered from users of the artefact, should be stored, clearly labelled and readily accessible in the "Artefact" sub-folder. All data should be anonymised and comply with GDPR. If an artefact uses programming languages other than Python and JavaScript, these files can also be included in this sub-folder. In such cases, you cannot assume that the examiner will be familiar with the programming language concerned, so the responsibility for demonstrating its accuracy rests with you. Any online applications or IDEs used in the creation of the artefact should also be clearly specified in the report.



10. It is your responsibility to ensure that all of the required files are contained in the zipped file prior to submission of the work. You will lose marks under the relevant headings in the marking scheme if required files are omitted. Marks may be lost for not conforming to the filing structure outlined above, and for a clearly labelled file structure for the artefact. A **backup copy** of the submitted files must be retained in your school until the assessment process is complete.

Leaving Certificate – Higher and Ordinary Levels

Computer Science, Coursework

Sample
Eight weeks