



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2020

Computer Science
Coursework Project Brief
Higher and Ordinary Levels

Time: 10 weeks

90 marks

Information for candidates

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 ten school weeks, beginning when schools reopen in January 2020 after the holidays. The coursework must be completed by **Friday, 20 March 2020**. 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.

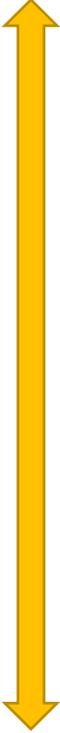
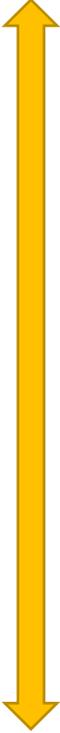
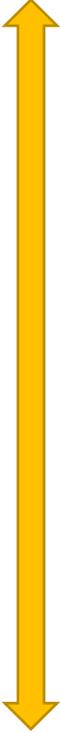
Apart from some aspects described later, you must carry out the project in school under the supervision of your teacher. This allows your teacher to authenticate your work to the State Examinations Commission. Authentication is an important part of how we in the State Examinations Commission ensure fairness 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.

Digital Portfolio characteristics

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

The project brief

Context of the Brief

In 2015, world leaders agreed to seventeen goals for a better world by 2030. It is stated that these goals have the power to end poverty, fight inequality and stop climate change. The intention of these goals is that everyone including governments, businesses, civil society and the general public can work together to build a better future for all. The full seventeen goals can be viewed at www.globalgoals.org.

Goal thirteen is **Climate Change** which is a critical and topical issue at the moment. It has the potential to impact all of our lives into the future. This goal recognises the role that everyone has to play in tackling climate change.

'Climate change is a real and undeniable threat to our entire civilisation. The effects are already visible and will be catastrophic unless we act now. Through education, innovation and adherence to our climate commitments, we can make the necessary changes to protect the planet. These changes also provide huge opportunities to modernize our infrastructure which will create new jobs and promote greater prosperity across the globe' - www.globalgoals.org



The Task

Design a computational artefact under the theme of **Climate Change**. The purpose of this artefact is to use existing data to educate people about the impact of climate change.

The artefact should make use of existing datasets and should allow the end user to interpret the chosen data and identify trends through graphs and/or visualisations. There should be an interactive element to the artefact so that the user can decide what data they wish to see represented in the graph or visualisation.

The artefact should be written primarily in Python and/or JavaScript. The user interface should be intuitive for the end user.

You should set out clearly the purpose of your artefact and what you are trying to achieve. The needs of the end user should also be carefully considered and set out in the report.

Basic Artefact Features

1. The chosen dataset must be prepared, cleaned and stored in a suitable file system or database.
2. A program should analyse and interpret the data from the file system.
3. There should be appropriate graphs or visualisations displayed for the end user.
4. The end user should be able to interact with the program.

Advanced Artefact Features

5. An interactive website that displays the graphs or visualisations.
6. The website should display data that is stored and retrieved from a database.
7. The interactive website demonstrates principles of good user-centred design.

Resources

Climate change

- <https://sustainabledevelopment.un.org/sdg13>
- <https://climate.nasa.gov>
- <https://www.globalchange.gov/climate-change>
- <https://www.nationalgeographic.com/environment/global-warming/global-warming-effects>
- <https://www.epa.ie/climate/communicatingclimatescience>
- <https://www.climateireland.ie>
- <https://www.gsi.ie/en-ie/geoscience-topics/climate-change/Pages/default.aspx>

Sample datasets

- <https://think.cs.vt.edu/corgis/python>
- <https://developers.google.com/earth-engine/datasets>
- <https://datahub.io/collections/climate-change>
- <https://data.world/datasets/global-warming>
- <https://knoema.com/WBCC2019/world-bank-climate-change>
- <https://data.gov.ie>
- <https://www.met.ie/climate/available-data/historical-data>

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 2500 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 good user interface 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 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. The video should only demonstrate the functionality of the artefact. Other information, relevant to the design and development of the artefact, should be contained in the report.

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.

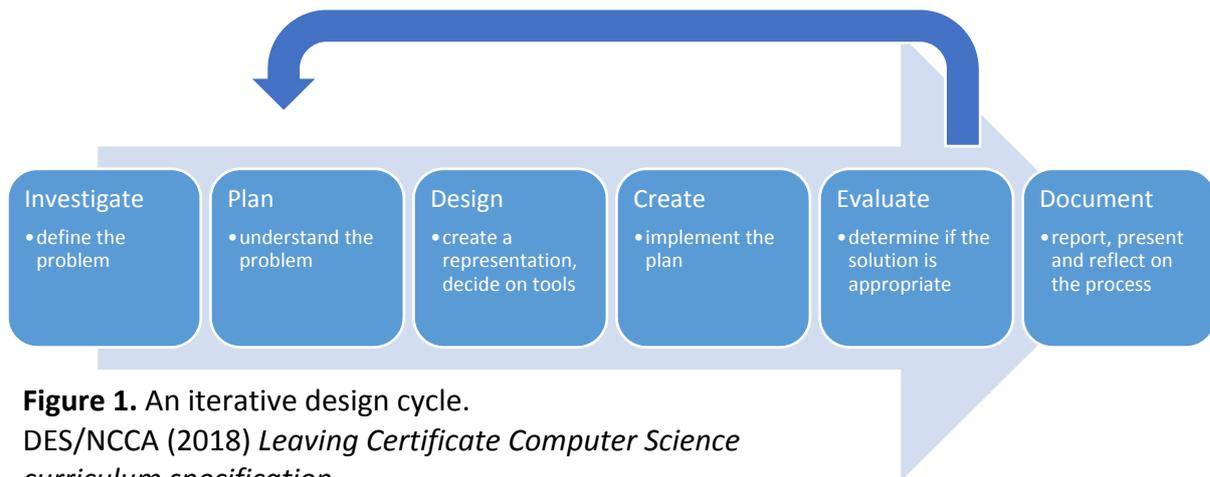


Figure 1. An iterative design cycle.
DES/NCCA (2018) *Leaving Certificate Computer Science curriculum specification*

You should show the timeline of your design and justify the key decisions.

3.2 Computational Thinking

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.

You could also select a certain section of code that you have produced and give an overview of the computational thinking process you went through in producing it.

3.3 Development of the Artefact

There should be a clear description of how the artefact meets the brief and works in an overall design sense. 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 appropriate.

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 good user interface 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 is 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

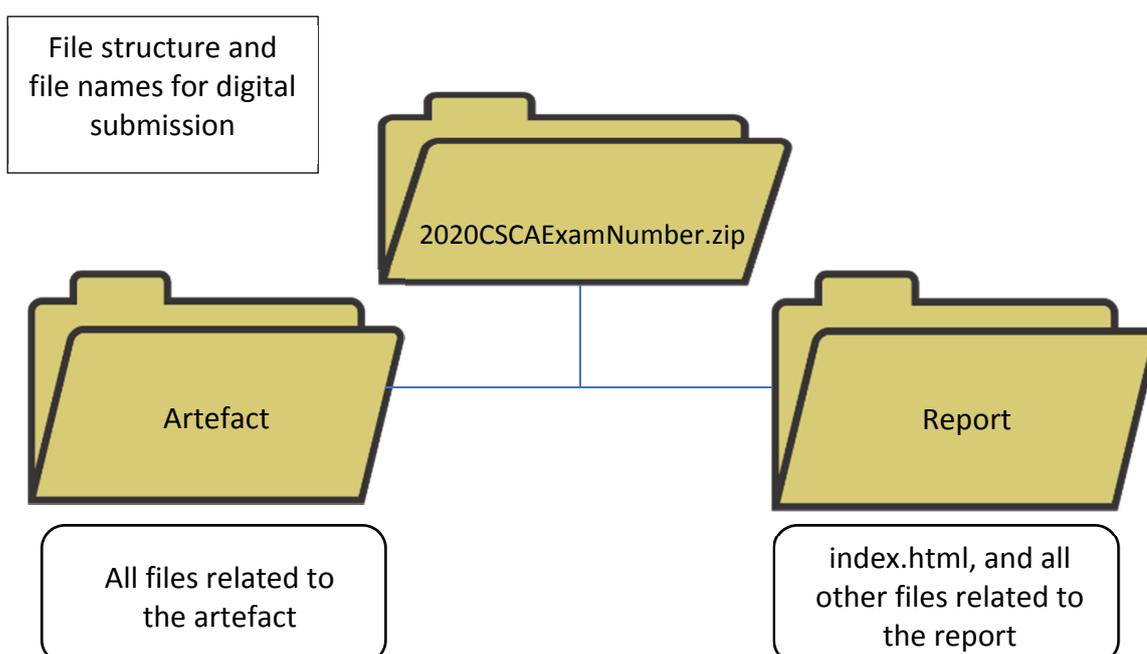
Instructions on completing and submitting the coursework

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 2500 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. Individuals should not be identifiable in the video but you may include a voiceover in order to explain the features of your artefact.

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, a snippet of code, etc. The report should not include more than 15 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). Instructions on how to submit your work to the State Examinations Commission will follow in advance of the submission date.
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. In instances where data is stored in a password protected cloud service or a local web server it is not expected that access is to be given to the examiner. This should be clearly flagged in the report and any features that access such data need to be clearly demonstrated in the video that you submit as part of the report.
10. **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.



11. 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 not using 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

Leaving Certificate Examination 2020

Ten weeks