Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2023

Computer Science

Coursework Project Brief

Higher and Ordinary Levels

Time: 12 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 twelve school weeks, beginning on **Monday December 5th 2022**. The coursework must be completed by **Wednesday March 22nd 2023**. You will present the report in the form of a website comprising of one or more webpages.

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. You will capture video footage and/or images of the artefact in operation and embed this into your report.

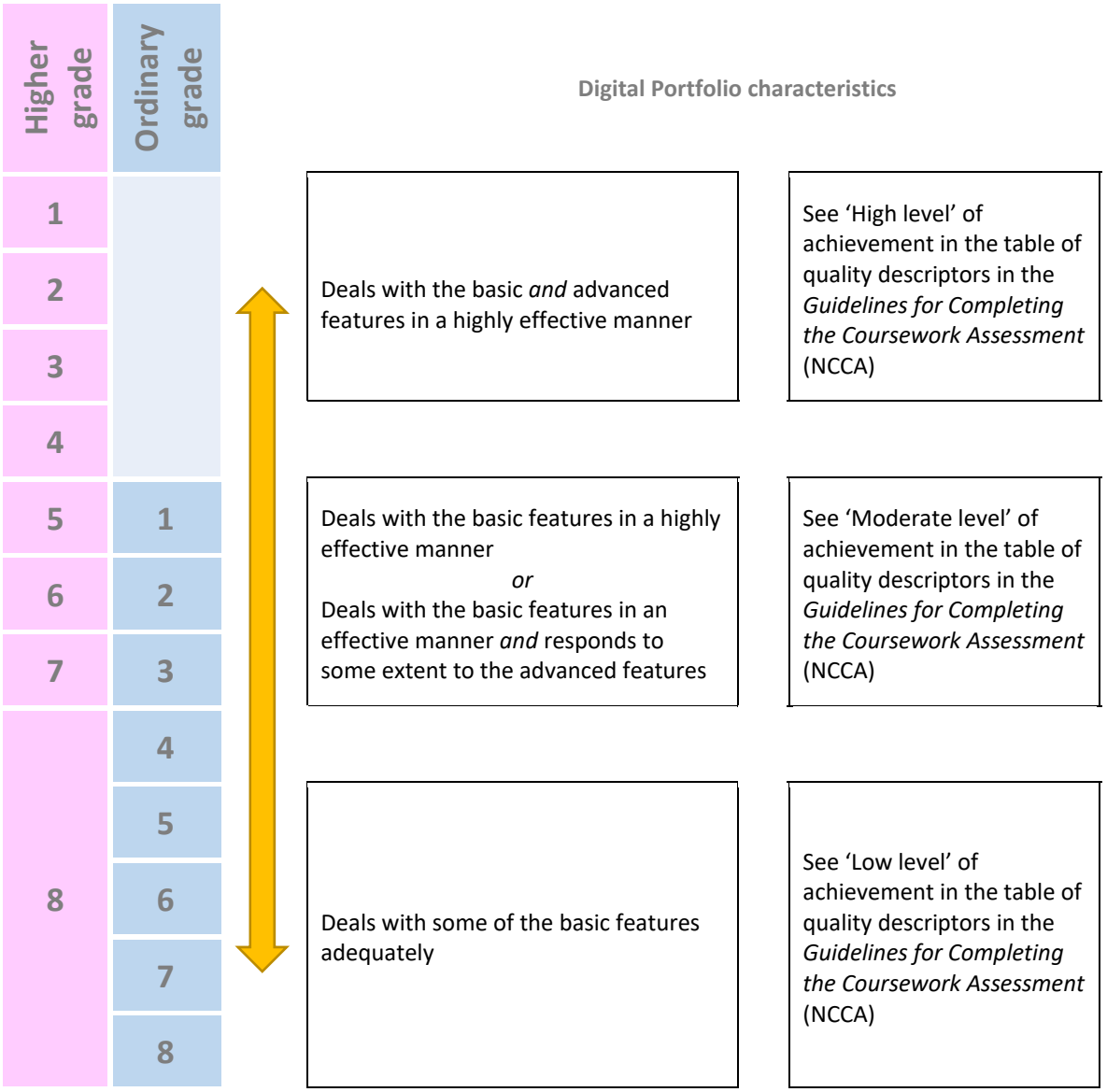
Although you are used to carrying out projects for the *Applied Learning Tasks* in groups, this is an *individual* project. You must carry it out independently of other candidates, and the work you submit must be your own unaided work.

Apart from your initial investigation and research, 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. 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, 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 project brief sets out some *basic requirements* and *advanced requirements* of the artefact. The way that the standards at the two levels are aligned with each other is illustrated on the left-hand side of the graphic on the next page. 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.

It should be noted that it is possible to achieve full marks at Ordinary level by attempting the basic features only.


Higher grade
Ordinary grade
Digital Portfolio characteristics
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
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

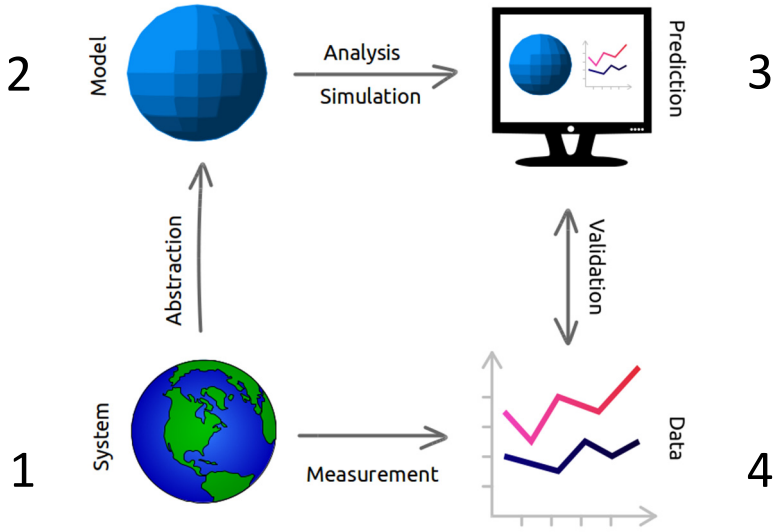
'Modelling, programming and coding require careful analysis of patterns and relationships to solve problems.' (Leaving Certificate Computer Science Subject Specification, page 23).

This project is about modelling, simulation and analysis of real-world systems – specifically about modelling, simulation and analysis of games, such as card games, board games and children's games.

Computer modelling, simulations and data analytics are core activities of computer science. Models enable us to abstract key characteristics of real-world systems so that they might be more easily understood or explored. A simulation shows what happens when a model is applied in a certain situation using a specific set of data as inputs. Analytics is about examining datasets to test hypothesis, discovering patterns, examining evidence and reaching conclusions.

In this sense modelling and simulation can be used to predict future behaviour as well as confirm what we already know about a system. This project will focus on modelling of a particular game chosen by you. You can consider any game that you have played with your family or friends. Examples include but are not limited to Connect Four, Snakes and Ladders, Hangman, Sudoku, X's & O's, Rock-Paper-Scissors, card games, dice games, etc.

The following diagram depicts what is meant by modelling and the relationship between modelling and data.



Source: https://allendowney.github.io/ModSimPy/chap01.html

Starting at number 1, the system would be a real-world item that exists, such as a game in this instance.

Moving from a real-world system to the model (number 2) we apply abstraction. This means removing the unnecessary details which we do not need and keeping the essential parts that we do need. For example, in a card game you may not need any graphics of a card and only have text representing the card itself.

We can then use a model to make predictions (number 3) by running simulations and carrying out analysis on the data. For example, instead of playing numerous rounds of a game, you could run a simulation to play 100 rounds in a matter of seconds and have a data set of results.

Any information can be stored as data (number 4). In the context of a game this could be previous scores, top scores, fastest time, winning strategies and also statistical information such as mean, mode and median scores / times. Validation can be used to compare simulated results to actual results of your game.

Further Context

Below are some links to more detailed information relating to the context of the brief. The list is neither exclusive nor exhaustive and is supplied to assist you with your own ideas and research. Some may provide inspiration for the task set out in the next section of this document.

https://phet.colorado.edu/
https://www.itgsnews.com/computer-models-simulations-models/
https://education.mit.edu/project/starlogo-nova/
https://www.youtube.com/watch?v=0ZGbIKd0XrM
https://ethics.csc.ncsu.edu/risks/models/examples.php
https://helloworld.raspberrypi.org/issues/10 (page 72)
http://www.red3d.com/cwr/boids/
https://www.sas.com/en_us/insights/analytics/what-is-analytics.html
https://www.gamedeveloper.com/design/levels-of-abstraction-in-game-design
https://realpython.com/simpy-simulating-with-python/

The Task

Design and develop an interactive computer model based on a game of your choice. The user should be able to interact with the model so that they can play the game to completion.

Your model does not have to be an exact replica of the actual game on which it is based. In other words, you can modify the rules in order to simplify the game. Alternatively, you may decide not to implement the game in its entirety and just focus on modelling a certain aspect of the game.

Basic requirements

1. Create a computer model of a game of your choice. The user should be able to interact with the model so that they can play the game to completion. The game should include a certain amount of randomness so that it can behave differently each time it is run.
2. Accept a minimum of three different inputs – all data should be validated using appropriately defined validation rules.
3. The game should be interactive and operable in a variety of modes - single player, multi-player and allow simulation play.

Advanced requirements

1. Extend the basic model so that each time it is run, it stores results data from the game that has been played in a file or database e.g. fastest time, top score, previous results, strategy data, etc.
2. Develop algorithms that perform some statistical analysis e.g. find the frequency, mean, median and mode of the aforementioned data set, and effectively communicate the resulting information in a graphical format.
3. Use the model to test hypotheses (such as answering 'what-if' type questions) and make future predictions by changing parameters within the game.

Coursework report – content and structure

The report should be presented as a website and be structured using the headings outlined in the following pages and in the outline marking scheme.

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.

Your report must use the headings provided in this section. Marks will only be awarded for information provided under the relevant heading.

1. Meeting the Brief **(max 500 words)**

As part of your report you are required to include a video showing the artefact in operation. The video must not be more than 5 minutes in duration and be no more than 1GB in size.

The video should be used to demonstrate how your artefact meets the basic and/or advanced requirements of the brief. It is suggested that you deal with each requirement you attempted in the video and demonstrate how you have achieved it.

You may wish to include a brief written description with images demonstrating how your artefact meets each of the requirements. You will not be penalised marks for not including any text if your video is sufficient in describing how you meet each of the requirements.

2. Investigation and Plan **(approximately 400 words)**

In this section of the report you should show evidence of your own research on the thematic brief, including research on existing solutions, systems or ideas that are aligned to the brief. As a starting point you may consider using the URLs provided earlier in this document, but please note that this list is neither exclusive nor exhaustive. All references should be included in the reference section of your report.

Based on your research you should provide a detailed description of your chosen project. You should explain clearly the objectives of your project.

3. Design **(approximately 400 words)**

This section of the report should contain a clear description of the design of your project and how it will meet your objectives.

You should include a detailed flowchart which gives an overview of how your system will work. You should explain how modelling and abstraction will be applied to your project.

4. Implementation (approximately 500 words)

This section should provide a clear description of how the system was implemented. You should explain the process you went through in creating your artefact.

You should explain one of the problems that you encountered during the implementation and describe how you overcame the problem.

You should select and explain an algorithm or section of code you designed that was essential in creating your project.

5. Testing (approximately 350 words)

You should describe the extent of testing you carried out, and major problems you encountered during the testing process. Details of testing should include the type of testing carried out and any implications to the design as a result of the testing.

You should include a test table to highlight your test cases, expected results, outcomes and test data that were used.

6. Evaluation (approximately 350 words)

You should evaluate the final product in relation to your initial design and your project objectives set out in section 2 of the report.

You should suggest, with justification, how your artefact could be improved or iterated upon in the future.

7. References

You must reference any information used in your report or in the creation of your artefact, such as: publications including books, professional journals and government reports; online sources and other types of media; source code. To include such material without properly referencing the source will be considered plagiarism. The word count in this section does not count towards your overall word count.

8. Summary word count

You must include a summary of the word count of your report. This could be presented in the form of a table, as shown below, and should show the word count for each section as well as the overall word count.

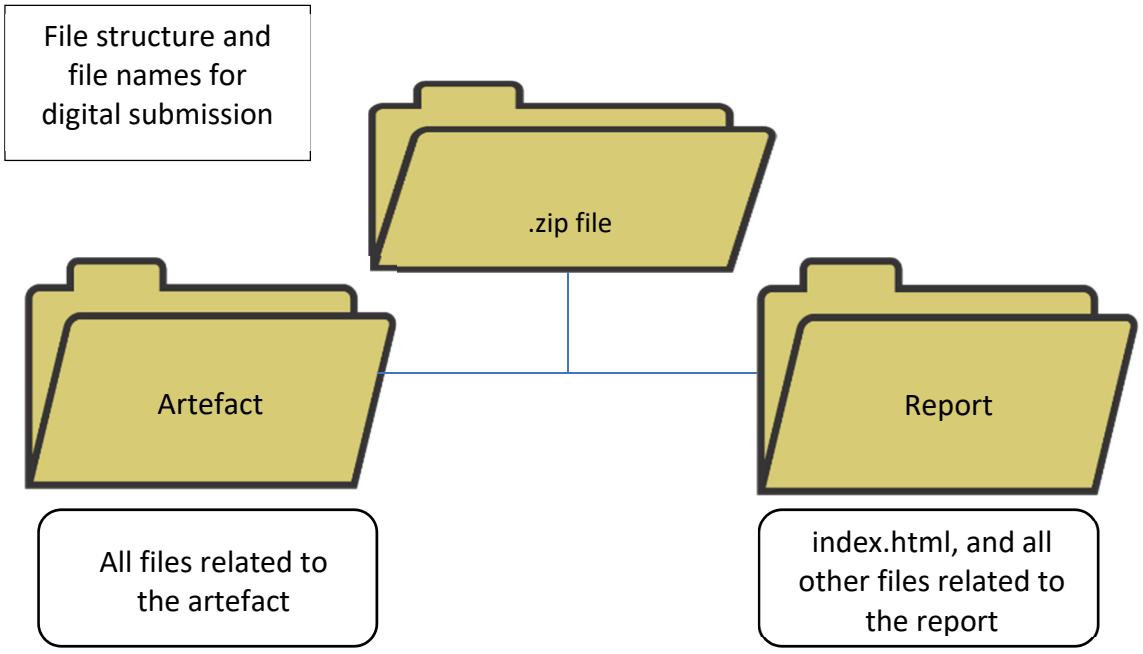
Section	Word Count
1. Meeting the Brief	
2. Investigation and Plan	
3. Design	
4. Implementation	
5. Testing	
6. Evaluation	
Total:	

Outline marking scheme

Coursework (90 marks in total)	
1. Meeting the Brief	***Marks***
• Meeting the basic requirements of the brief. • Meeting the advanced requirements of the brief.	**27**
2. Investigation and Plan	
• Research into the context of the brief, existing solutions and initial thoughts on your own project. • A detailed description of the chosen project and the objectives.	**14**
3. Design	
• A clear detailed description of how the project will be developed. • A flowchart diagram to show how the project will work. • A description of how abstraction and modelling will be applied.	**14**
4. Implementation	
• An overview covering the key milestones of the development process. • Explain a problem that was encountered in the development of the project and how it was overcome. • An explanation of a piece of code or algorithm that was important in the development of the project.	**14**
5. Testing	
• An overview of the testing carried out. • A detailed test case table.	**11**
6. Evaluation	
• An evaluation of your project based on your initial design and your project objectives. • Suggest how you would further improve/iterate this project.	**10**
References and Summary word count	
• You must also include references and/or a bibliography. • Include a summary of the word count of the report, including the total word count.	**0**

Instructions on completing and submitting the coursework

1. Your coursework project 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, submitted on a website, 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. Penalties may apply where the overall word count or video length or size is exceeded.
2. Some of the research and investigation that you carry out for the project and describe in section 1 of your report, 'Investigate and Plan', 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 coursework project must be saved in a single zipped file (.zip). The project will be submitted through the online Schools Portal, with details, including the naming convention for the zip file, following in advance of the submission date.
4. The .zip file, when extracted, should be a folder that contains exactly two subfolders, as in the diagram below.



a. 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 be accessible via links from within this file to local files. 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.

b. The other sub-folder should be called “Artefact” and should contain the essential digital components of your 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.

5. 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.

6. All data and information in the artefact 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.

7. 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 may lose marks 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.

IMPORTANT
It is essential that you double check that your artefact and report can be accessed by the examiner or you will not be credited for the work you have done. If a particular element of your project, such as the video, artefact files or report, is not included you may forfeit marks.
Once completed, put the zipped project on a removable medium, bring it to a device that was not used when working on any part of the project. Disconnect that device from the internet. Unzip the project and check that the artefact and the report including all images, video(s), and other files are present and that all links between them are working correctly.