The name of your project

CS39440 Major Project Report

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This report is submitted as partial fulfilment of a BSc degree in  
Computer Science (G400)

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Declaration of originality

I confirm that:

* This submission is my own work, except where clearly indicated.
* I understand that there are severe penalties for Unacceptable Academic Practice, which can lead to loss of marks or even the withholding of a degree.
* I have read the regulations on Unacceptable Academic Practice from the University’s Academic Registry (AR) and the relevant sections of the current Student Handbook of the Department of Computer Science.
* In submitting this work, I understand and agree to abide by the University’s regulations governing these issues.

Name Rhodri Smith

Date 22/04/2020

Consent to share this work

By including my name below, I hereby agree to this project's report and technical work being made available to other students and academic staff of the Aberystwyth Computer Science Department.

Name Rhodri Smith

Date 22/04/2020

Acknowledgements

I am grateful to…

I’d like to thank…

Abstract

Include an abstract for your project. This should be approximately 300 words.

The abstract is an overview of the work you have done. Highlight the purpose of the work and the key outcomes of the work.

Contents

1. Background, Analysis & Process 6

1.1. Background 6

1.2. Analysis 6

1.3. Process 6

2. Design 7

2.1. Overall Architecture 7

2.2. Detailed Design 7

2.2.1. Even More Detail 7

2.3. User Interface Design 7

2.4. Other Relevant Sections 7

3. Implementation 8

4. Testing 9

4.1. Overall Approach to Testing 9

4.2. Automated Testing 9

4.2.1. Unit Tests 9

4.2.2. User Interface Testing 9

4.2.3. Stress Testing 9

4.2.4. Other Types of Testing 9

4.3. Integration Testing 10

4.4. User Testing 10

5. Critical Evaluation 11

6. Annotated Bibliography 12

7. Appendices 13

A. Third-Party Code and Libraries 14

B. Ethics Submission 15

C. Code Samples 16

# Background, Analysis & Process

This section should discuss your preparation for the project, including background reading, your analysis of the problem and the process or method you have followed to help structure your work. It is likely that you will reuse part of your outline project specification, but as you write this report at the end of the project you should have more to discuss.

## Background

### Languages

Researching the different languages was a major section of research, without this the project would not have been able to be completed. This was mainly looking at the way the languages should be set out, e.g. should the languages be in separate files. The research also took into consideration how the files should be set out, e.g. for the database connection it should not be stored within the server, another would be to have a main CSS file that would store data for items that are on every page, e.g. the footer. Node.Js was another language that was look into briefly for the project

### Other sites

Some of the research that was done before the web application was started was to look at similar websites and try to look at the pros and cons of the websites. This meant that the project would be able to use the advantages of those websites while not having their disadvantages. An example of some pages, where that they did not store a user’s score for long term viewing while others forced the users to login to view the pages.

### The Game

Creating the game was a large area of research, how and what sort of game was. During this phase of the project a few different areas to do this was investigated. One area was creating a canvas game within JavaScript. Another method was to use a framework that uses a canvas and WebGL. This would have been phaser [1], which is free to use software that works within the browser. The final way that was investigated was to use just basic HTML to create basic games. Using just html would lower the amount of animation that could be done within the game, however.

The canvas element that could have been used for the game would have allowed a dynamic 2d shapes. It is not designed specifically around creating games however, it is possible to make them within the canvas.

Research was also looked into how the questions and answered would be saved on the page, would they be stored on the database and pulled into an array for the JavaScript to run, or would the page randomly create the questions. Storing the questions would require a table to store them all and a way to upload new questions. Randomly making them would not require this, but would require the creation of random questions and answers that are appropriate, e.g. incorrect answers need to be realistic to the real answer.

### The Table

Creating the table was another section that was investigated. During this time DataTables [2] was one table system that was looked into. DataTables [2] allow a more advanced way to create and interact with tables, this includes a search feature and a feature that added more than one page that a user can view. Data Tables [2] is a free to use plugin that uses jQuery JavaScript

### Security

Security was another item that needed to be researched, this is to stop anything happening that should not. The research was done into looking not only security of user’s data, but also into the security of the website, e.g. can a user just break the website by entering the wrong data or entering data where they should not. The security is paramount to the website not being taken down or data being stolen. A section of research within security investigated the login area of the project and investigated PHP commands that would do thing such as hashing passwords. Hashing passwords is a secure way to store the passwords. It changes the passwords from plane text and changes it into a bunch of random text. This means that if someone gets access into the database, the passwords are still security for the users.

### Database

Research into the database that was storing the information was a crucial part for the project, as it would need to put into detail how the data would be stored, what level of normalisation would be used and the formats that the data would be stored as, e.g. text or int. The type of database was also investigated and the two main types that where investigated was a PostgreSQL and MySQL. These are both popular database management systems and both are free to use (MySQL under the terms of the ‘GNU General Public License [3]’). PostgreSQL is more advanced with its datatypes, allowing support of arrays a user defined types while MySQL only allows standard types. Some of the detail that was taken into consideration was from a website: PostgreSQLTutorial.com [4]. This website took into consideration the pros and cons of PostgreSQL and MySQL. The database research also required investigation into how a group of users (school) data would be stored. This meant looking into should they have an entire database to themselves or only a table.

Looking at using the database long term, using command line was an option however, research was done into using other methods one method was the phpMyAdmin [5] tool. This tool allows for easy maintenance of use of the database without having to have the knowledge of the command line commands. It also allows a user to control the website from anywhere, whereas to do this otherwise a user would need to use something such as TeamViewer [6] to control the database off site. TeamViewer lets a user to connect to a device and control it from anywhere, e.g. at home.

### Design ideas

Before starting the project, a few design ideas where looked into, like how the user would get from one screen to another. This would range from the colours the website will have, to how the user would navigate the website. Would the user be able to navigate the website themselves or would they only be allowed onto certain pages that they are taken too.

## Analysis

### Aims and objectives

For the project, there were a few main aims and objectives that needed to be completed to fulfil the project. Other smaller aims where also made, however if these did not get completed, the main areas of the project would still be completed, and the project would run as needed. These aims where to have a game that would upload a users (student) score to a database, an area that another user (teacher) can view the score. The teacher would also need to be able to increase the difficulty for the students game. A login screen was also necessary for the project and an admin section. There would also need to be an option for a user to connect to the website through a guest account that would not save any details

One of the main aims and objectives that where created was to create a simple game that would track a user’s score and then upload it to a database. Without this section,

Another main objective was to complete a login screen for the user. This would allow the user to login only if they could. The page would have to take 4 different types of accounts to 2 different places. The first being a guest account and the student account, that needed to the game page of the website. The other 2 accounts where the

### Issues and Approach

During the time researching the project, a few issues came to light. One being that php and JavaScript did not work very well together, or in some areas not at all. This being an issue when needing to pass variables such as difficulty to the PHP functions, e.g. changing the user’s difficulty. To get around this issue, the website used forms and the submit button, as the php could read the data that was entered into the forms and work through it that way. Another way this could have been done would be through cookies and changing data within it and then getting the PHP to read that file for the needed data.

Another issue that came up was how would the website remember the users details once they go onto the next page. While researching, 2 ways came up more common that not on how to do this. Cookies and sessions, cookies storing the information locally and sessions storing them on the server side. For the project, sessions where used as no long-term data needed to be stored. The data that was passed from one page to another was just the user’s username and table name (school).

When creating the games for the website, research was done into what type of game should be created and how. Within the project, the HTML, non-canvas approach was taken, this was partly to do with the webpage being able to change size based on monitor resolution.

The approach for the table that was used within the project was to use the DataTables [2] as it gives a more advanced while still being easy to use for the user and developer.

Security is another issue that needed to be investigated and taken into consideration when creating the website. Website require a lot of security to stop users from either stealing information or breaking the website.

Taking into account the problem and what you learned from the background work, what was your analysis of the problem? How did your analysis help to decompose the problem into the main tasks that you would undertake? Were there alternative approaches? Why did you choose one approach compared to the alternatives?

There should be a clear statement of the objectives of the work, which you will evaluate at the end of the work.

In most cases, the agreed objectives or requirements will be the result of a compromise between what would ideally have been produced and what was determined to be possible in the time available. A discussion of the process of arriving at the final list is usually appropriate.

As mentioned in the lectures, think about possible security issues for the project topic. Whilst these might not be relevant for all projects, do consider if there are relevant for your project. Where there are relevant security issues, discuss how they will this affect the work that you are doing. Carry forward this discussion into relevant areas for design, implementation and testing.

## Process

You need to describe briefly the life cycle model or research method that you used. You do not need to write about all of the different process models that you are aware of. Focus on the process model that you have used. It is possible that you needed to adapt an existing process model to suit your project; clearly identify what you used and how you adapted it for your needs.

# Design

You should concentrate on the more important aspects of the design. It is essential that an overview is presented before going into detail. As well as describing the design adopted it must also explain what other designs were considered and why they were rejected.

The design should describe what you expected to do and might also explain areas that you had to revise after some investigation.

Typically, for an object-oriented design, the discussion will focus on the choice of objects and classes and the allocation of methods to classes. The use made of reusable components should be described and their source referenced. Particularly important decisions concerning data structures usually affect the architecture of a system and so should be described here.

How much material you include on detailed design and implementation will depend very much on the nature of the project. It should not be padded out. Think about the significant aspects of your system. For example, describe the design of the user interface if it is a critical aspect of your system, or provide detail about methods and data structures that are not trivial. Do not spend time on long lists of trivial items and repetitive descriptions. If in doubt about what is appropriate, speak to your supervisor.

You should also identify any support tools that you used. You should discuss your choice of implementation tools - programming language, compilers, database management system, program development environment, etc.

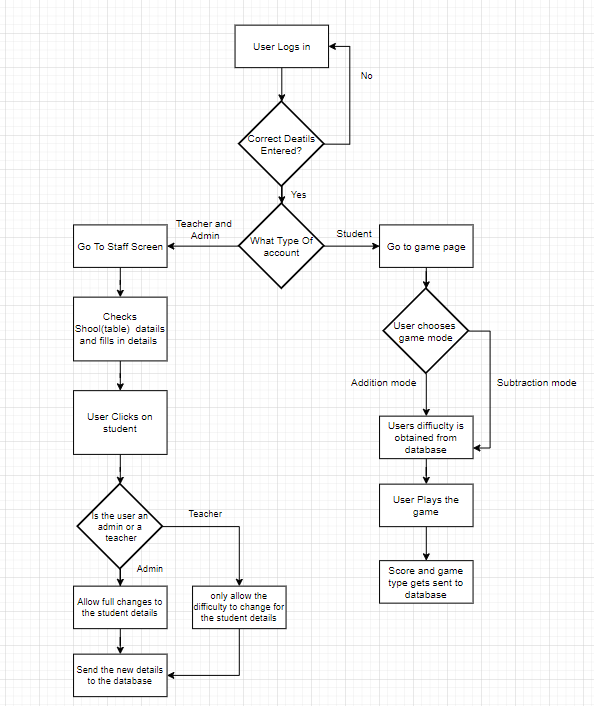
Some example sub-sections may be as follows, but the specific sections are for you to define.

## Overall Architecture

### Introduction, what I wanted it too to look like too

### UML and other diagrams

The diagram bellow shows the basic flow for the website, from what the user does to what the website also does backend.



## Detailed Design

### Login page

The login page’s design is designed to look simple, allowing people to easily go onto the site without any issues. The design makes it so the user only has to enter their details in, and are then taken to the correct place. The user has to enter their details into 3 boxes, one being the school box, this would be the table name within the code. The second two input boxes are for the username and password of the users, this gets used within the database to search for the user. The third box would only need to be filled in by and admin, and would just be the school name that they wish to connect too

The page uses HTML forms and PHP to complete the login and take the user to the correct place.

### Game Page

The Game screen was also created in a way that the user can easily use and get through. It works by requiring the user to click on the ‘click me’ button and then after that the user just clicks on one of the coloured boxes to answer. The game will then automatically submit the score for the user.

The users score is sent to the database through a form. The user will not see this form as never shows up on screen and the form is automatically filled in and submitted. This was done so that someone cannot accidently not submit their score and close the page.

### Staff and Admin Page

The staff and admin page contain a table within the centre, this table contains all the students that are within the table. The staff member or admin can edit the details within the table by clicking on the user’s row. By clicking on a student within the table, a form pops up and the user can change the details of the student they clicked on. If they are not an admin, they can only change the user’s difficulty. The admins can change all the details that are shown within the table. The admin can also remove any users that are on the table.

The user changes the datils through a form that then sends the users details into a php function that then changes the database. The remove button also uses php to remove the user from the database. Both the ‘submit’ and ‘remove’ buttons are submit buttons for the form, they both also use a hidden column within the table. The hidden column is the users number, this is something that a staff member would not necessarily need to see and could just lead to confusion, this cannot also be changed and is used to change the users details or remove the user from the database table.

A php function is also used to fill in the table, it does this by searching through the database and then uses the ‘echo’ command to place the text into the html code.

### Even More Detail

## User Interface Design

## Other Relevant Sections

# Implementation

The implementation should discuss any issues you encountered as you tried to implement your design. During the work, you might have found that elements of your design were unnecessary or overly complex; perhaps third-party libraries were available that simplified some of the functions that you intended to implement. If things were easier in some areas, then how did you adapt your project to take account of your findings?

It is more likely that things were more complex than you first thought. In particular, were there any problems or difficulties that you found during implementation that you had to address? Did such problems simply delay you or were they more significant?

You can conclude this section by reviewing the end of the implementation stage against the planned requirements.

# Testing

Detailed descriptions of every test case are definitely not what is required in this section; the place for detailed lists of tests cases is in an appendix. In this section, it is more important to show that you adopted a sensible strategy that was, in principle, capable of testing the system adequately even if you did not have the time to test the system fully.

Provide information in the body of your report and the appendix to explain the testing that has been performed. How does this testing address the requirements and design for the project?

How comprehensive is the testing within the constraints of the project? Are you testing the normal working behaviour? Are you testing the exceptional behaviour, e.g. error conditions? Are you testing security issues if they are relevant for your project?

Have you tested your system on “real users”? For example, if your system is supposed to solve a problem for a business, then it would be appropriate to present your approach to involve the users in the testing process and to record the results that you obtained. Depending on the level of detail, it is likely that you would put any detailed results in an appendix.

Whilst testing with “real users” can be useful, don't see it as a way to shortcut detailed testing of your own. Think about issues discussed in the lectures about until testing, integration testing, etc. User testing without sensible testing of your own is not a useful activity.

The following sections indicate some areas you might include. Other sections may be more appropriate to your project.

## Overall Approach to Testing

## Automated Testing

### Unit Tests

### User Interface Testing

### Stress Testing

### Other Types of Testing

## Integration Testing

## User Testing

# Critical Evaluation

Examiners expect to find a section addressing questions such as:

* Were the requirements correctly identified?
* Were the design decisions correct?
* Could a more suitable set of tools have been chosen?
* How well did the software meet the needs of those who were expecting to use it?
* How well were any other project aims achieved?
* If you were starting again, what would you do differently?

Other questions can be addressed as appropriate for a project.

The questions are an indication of issues you should consider. They are not intended as a specification of a list of sections.

The evaluation is regarded as an important part of the project report; it should demonstrate that you are capable not only of carrying out a piece of work but also of thinking critically about how you did it and how you might have done it better. This is seen as an important part of an honours degree.

There will be good things in the work and aspects of the work that could be improved. As you write this section, identify and discuss the parts of the work that went well and also consider ways in which the work could be improved.

In the latter stages of the module, we will discuss the evaluation. That will probably be around week 9, although that differs each year.

# Annotated Bibliography

[1] photonstorm.com, P., 2020. Phaser - A Fast, Fun And Free Open Source HTML5 Game Framework. [online] Phaser.io. Available at: <https://phaser.io/> [Accessed 28 April 2020].

[2] Datatables.net. 2020. Datatables | Table Plug-In For Jquery. [online] Available at: <https://datatables.net/> [Accessed 28 April 2020].

[3] Gnu.org. 2020. The GNU Operating System And The Free Software Movement. [online] Available at: <https://www.gnu.org/> [Accessed 29 April 2020].

[4] Postgresqltutorial.com. 2020. PostgresqlVs. Mysql: A Comprehensive Comparison. [online] Available at: <https://www.postgresqltutorial.com/postgresql-vs-mysql/> [Accessed 30 April 2020].

[5] contributors, p., 2020. Phpmyadmin. [online] phpMyAdmin. Available at: <https://www.phpmyadmin.net/> [Accessed 30 April 2020].

[6] TeamViewer. 2020. Teamviewer – Remote Support, Remote Access, Service Desk, Online Collaboration And Meetings. [online] Available at: <https://www.teamviewer.com/en/> [Accessed 30 April 2020].

This final section should list all relevant resources that you have consulted in researching your project. Each reference should also include a brief annotation.

1. Sylvia Duckworth. A picture of a kitten at Hellifield Peel. <http://www.geograph.org.uk/photo/640959>, 2007. Copyright Sylvia Duckworth and licensed for reuse under a Creative Commons Attribution-Share Alike 2.0 Generic Licence. Accessed August 2011.

This is my annotation. I should add in a description here.

1. Mark Neal, Jan Feyereisl, Rosario Rascunà, and Xiaolei Wang. Don’t touch me, I’m fine: Robot autonomy using an artificial innate immune system. In *Proceedings of the 5th International Conference on Artificial Immune Systems*, pages 349–361. Springer, 2006.

This paper…

1. W.H. Press et al. *Numerical recipes in C*. Cambridge University Press Cambridge, 1992.

This is my annotation. I can add in comments that are in **bold** and *italics*and then further content.

1. Various. Fail blog. <http://www.failblog.org/>, August 2011. Accessed August 2011.  
     
   This is my annotation. I should add in a description here.
2. Apache Software Foundation (2014) “*Apache POI - the Java API for Microsoft Documents*” (Online) Available at: <http://poi.apache.org> Accessed: 14th March 2014.

This is my annotation. I should add in a description here.

1. Apache Software Foundation (2004) “Apache License, Version 2.0” (Online) Available at: <http://www.apache.org/licenses/LICENSE-2.0> Accessed: 14th March 2014.

This is my annotation. I should add in a description here.

1. Neil Taylor, “MMP\_S08 Project Report and Technical Work”, 2019 (Online) Available at: <http://blackboard.aber.ac.uk/> Accessed 19th February 2019.

A document that outlines information about the marking guide for the Project Report and Technical Work. This is published in the Resources folder on Blackboard.

# Appendices

The appendices are for additional content that is useful to support the discussion in the report. It is material that is not necessarily needed in the body of the report, but its inclusion in the appendices makes it easy to access.

For example, if you have developed a Design Specification document as part of a plan-driven approach for the project, then it would be appropriate to include that document as an appendix. In the body of your report you would highlight the most interesting aspects of the design, referring your reader to the full specification for further detail.

If you have taken an agile approach to developing the project, then you may be less likely to have developed a full requirements specification. Perhaps you use stories to keep track of the functionality and the ’future conversations’. It might not be relevant to include all of those in the body of your report. Instead, you might include those in an appendix.

There is a balance to be struck between what is relevant to include in the body of your report and whether additional supporting evidence is appropriate in the appendices. Speak to your supervisor or the module coordinator if you have questions about this.

* 1. Third-Party Code and Libraries

If you have made use of any third-party code or software libraries, i.e. any code that you have not designed and written yourself, then you must include this appendix.

As has been said in lectures, it is acceptable and likely that you will make use of third-party code and software libraries. If third-party code or libraries are used, your work will build on that to produce notable new work. The key requirement is that we understand what your original work is and what work is based on that of other people.

Therefore, you need to clearly state what you have used and where the original material can be found. Also, if you have made any changes to the original versions, you must explain what you have changed.

The following is an example of what you might say.

**Apache POI library** – The project has been used to read and write Microsoft Excel files (XLS) as part of the interaction with the client’s existing system for processing data. Version 3.10-FINAL was used. The library is open source and it is available from the Apache Software Foundation [5]. The library is released using the Apache License [6]. This library was used without modification.

Include as many declarations as appropriate for your work. The specific wording is less important than the fact that you are declaring the relevant work.

* 1. Ethics Submission

This appendix includes a copy of the ethics submission for the project. After you have completed your Ethics submission, you will receive a PDF with a summary of the comments. That document should be embedded in this report, either as images, an embedded PDF or as copied text. The content should also include the Ethics Application Number that you receive.

* 1. Code Samples

This is an example appendix. Include as many appendices as you need. The appendices do not count towards the overall word count for the report.

For some projects, it might be relevant to include some code extracts in an appendix. You are not expected to put all of your code here - the correct place for all of your code is in the technical submission that is made in addition to the Project Report. However, if there are some notable aspects of the code that you discuss, including that in an appendix might be useful to make it easier for your readers to access.

As a general guide, if you are discussing short extracts of code then you are advised to include such code in the body of the report. If there is a longer extract that is relevant, then you might include it as shown in the following section.

Only include code in the appendix if that code is discussed and referred to in the body of the report.

Random Number Generator

The Bayes Durham Shuffle ensures that the pseudo random numbers used in the simulation are further shuffled, ensuring minimal correlation between subsequent random outputs.

// Some example code here…