

Mocktime

Designing a reliable mock examination system to enhance student learning experience and tutor interaction



Jomin Kaitholil George

Student ID: 130303750

G400 BSc Computer Science

Supervisor: Dr. Ellis Solaiman

Date: Saturday, 30 April 2016

Total Pages:

Word Count:

# **Abstract**

Web-based mock examination will be used towards to educational institution, to help students prepare towards to their end of year/term exams. In addition, it is a way for the examiner to analyse and gather statistics on student’s knowledge. This could be seen as a way for lectures and students to interact with each other and to be able to build a stronger understand in the contents that has been delivered at the lecture. With the use of an online mock examination system it will be easier for the lecturer/teacher to add or modify any questions that they believe is related to the content which was taught at the lecture. This way, students will have the ability to log into the online mock examination with their login credential and access it from anywhere at any time to analyse their learning progress.

# **Declaration**

“I declare that this dissertation represents my own work except where otherwise stated.”

Jomin Kaitholil George

# **Acknowledgements**

I would first of all like to thank my project supervisor, Dr. Ellis Solaiman, for introducing this field to me and also for all the valuable support that he has provided throughout the process.

Last but not least, I would like to thank my parents for all the support they have given to me throughout my entire university life.

**Contents**

[**Abstract** 1](#_Toc449796906)

[**Declaration** 2](#_Toc449796907)

[**Acknowledgements** 3](#_Toc449796908)

[**Chapter 1: Introduction** 6](#_Toc449796909)

[**1.1.** **Introduction** 6](#_Toc449796910)

[**1.2.** **Motivation** 6](#_Toc449796911)

[**1.3.** **Project Aim and Objectives** 7](#_Toc449796912)

[**1.3.1** **Aims** 7](#_Toc449796913)

[**1.3.2** **Objectives** 7](#_Toc449796914)

[**1.4.** **Deliverables** 8](#_Toc449796915)

[**1.5.** **Relevance to Degree** 8](#_Toc449796916)

[**1.6.** **Project Plan** 8](#_Toc449796917)

[**1.7.** **Project Structure** 9](#_Toc449796918)

[**Chapter 2: Background Research** 10](#_Toc449796919)

[**2.1** **Existing Examination Tools or Products** 10](#_Toc449796920)

[**2.1.1** **Respondus** 10](#_Toc449796921)

[**2.1.2** **Moodle Quiz** 11](#_Toc449796922)

[**2.1.3** **Conduct Exam** 12](#_Toc449796923)

[**2.1.4** **Speed Exam** 12](#_Toc449796924)

[**2.1.5** **Pro Profs Quiz Maker** 13](#_Toc449796925)

[**2.1.6** **Existing Products Summary** 14](#_Toc449796926)

[**2.2** **Graphical Visualisation** 15](#_Toc449796927)

[**2.2.1** **Bar Diagrams** 15](#_Toc449796928)

[**2.2.2** **Pie Diagrams** 15](#_Toc449796929)

[**2.2.3** **Line Diagram** 15](#_Toc449796930)

[**2.3** **Web Frameworks** 16](#_Toc449796931)

[**2.3.1** **PHP Frameworks** 16](#_Toc449796932)

[**2.3.1.1** **Codeigniter** 16](#_Toc449796933)

[**2.3.1.2** **Zend** 16](#_Toc449796934)

[**2.3.1.3** **Summary of PHP Framework** 17](#_Toc449796935)

[**2.3.2** **Bootstrap** 17](#_Toc449796936)

[**2.4** **Possible Technologies** 18](#_Toc449796937)

[**2.4.1** **Client Side Scripting** 18](#_Toc449796938)

[**2.4.2** **Server Side Scripting** 18](#_Toc449796939)

[**2.5** **Version Control** 18](#_Toc449796940)

[**2.6** **Database** 18](#_Toc449796941)

[**2.6.1** **MySQL** 18](#_Toc449796942)

[**2.6.2** **PostgreSQL** 18](#_Toc449796943)

[**2.6.3** **Oracle** 18](#_Toc449796944)

[**2.6.4** **Summary of Database** 18](#_Toc449796945)

[**2.7** **Methodology** 18](#_Toc449796946)

[**Bibliography** 19](#_Toc449796947)

[**Websites** 19](#_Toc449796948)

[**Books** 22](#_Toc449796949)

[**Appendix A – Existing Products Features** 23](#_Toc449796950)

[**Respondus** 23](#_Toc449796951)

[**Appendix B -** 23](#_Toc449796952)

# **Chapter 1: Introduction**

## **Introduction**

Examinations are used as a technique to judge someone else’s personality and knowledge in a particular area or field. Most of the examination systems provide the end user with their results as soon as the candidate finish the exam. Candidate is given a limited time to answer all the question in an exam which will be set by the examiner and after the time expires, candidate won’t be able to modify or answer any other questions. Examiner then will evaluate each candidate’s answers either by using automated or manual marking process and then the results will be published or sent to the candidate through the website. (Tests, 2012)

Web-based mock examination is aimed for Educational Institute to prepare an exam and to enhance student learning by helping them prepare towards to their end of year/term exams. Most of the examination system which are available requires the examiner to manually mark or go through each question in order to ensure that the system has marked each question for the student accurately. In most of the online examination system there would be an additional check in place for question types which are hard to mark (such as fill-in-blank, essay based questions) by the system. For example, a question like “what is a router?” can have many answer and the examiner wouldn’t be able to place a mark scheme for the online examination software to check since it is impossible (students can answer in many ways). Also it would take up more time if the examiner has to mark it manually (roughly 200 students).

Solution to this would be, not requiring examiner to manually mark the mock examination questions instead the student mark their self-based on a mark scheme that will be given at the end of the mock exam. Each student will be asked to mark their answer based on a set of marking scheme which will be provided by the examiner. This way the examiner can see how well the students understood the material which was taught at the lecture. The key point here is that it’s a mock exam and whatever the student scores would not take in consider for their assessment criteria’s instead it’s a way for the student to tell the examiner what they have not understand or did understand within a topic (each question will be linked into a topic from the lecture) from the lecture material.

I believe it is vital to provide the examiner with detailed reports and analytics on the performance of each student. There will be a wide range of reports that can be collected after an exam to show the examiner which questions are poorly answered by the majority of the students and that will give the examiner/lecturer an idea of which topics should be covered in more detail.

## **Motivation**

Introducing a mock examination system into curriculum will encourage students to learn from their mistakes and progress towards to a target set by their selves. With the help of internet, it create opportunities for creating and managing exams more reliably and consistently.

Research suggests that around 75% of students consider themselves to be procrastinator (Busch, 2015), researcher Pier Steel states “the further away an event is, the less impact it has on people’s decisions.” Mock exam is seen as the best practice for revision and there are several memory strategies which have been found to be effective. Testing yourself over and over again with the help of Mock Exam is a way to improve your knowledge and having that ability to improve your understanding.

Pressure can lead into nervousness, anxiety problems, frustrations and also results in making poor performances (Nhs.uk, 2016). However this is not the case for everyone, some people concentrate more when they are under pressure. Mock exam is a great prospect from student’s side, for them to figure out and practise an exam within an exam condition (e.g. time limit).

## **Project Aim and Objectives**

### **Aims**

To develop a mock examination engine that enables student’s self-assessment and to give the examiner ways of analysing the performance of each student.

### **Objectives**

1. **To explore current mock examination software used by educational centres.**

This involves in researching into current software’s or project related to mock examination software and then looking at what sort of features and functions that they have in place to support with the end user.

1. **To understand how current mock examination software which can be improved to enhance student learning.**

I will be looking at what the current systems offer for the end user (e.g. different functions and features) and then coming up with ideas on how it can be improved to enhance student learning from using my system.

1. **To implement an improved mock examination software that help examiners to analyse students’ performance.**

This will be looking into ways that I could improve the system for the examiner to provide them with logical data analyses which would offer wide range of possibilities on how well the student is doing and what they are struggling on.

1. **To evaluate the effectiveness of the system in terms of quality characteristics (e.g. maintainability, reliability).**

Once I implement the system, I will ensure that I have evaluate the system in terms of quality characteristics (e.g. would the system be running 24/7 and would it be reliable from errors to occur).

## **Deliverables**

Upon completion of this project, the following deliverables will be presented:

* Detailed report on each stages of the project.
* Fully functional website which will be designed both for examiner and student.

## **Relevance to Degree**

This project requires knowledge gained from the modules over the three years of study at Newcastle University. The creation of database within this project clearly points out Database Technology (CSC2024) to be as a beneficial module since it contains examples of good practice in Database Design and UML. Another module which is relevant would be the Web Technology which give an overview of current languages for the within the website field and their features. Overall, the skills developed and gained throughout studying computing are strongly tested throughout this project.

## **Project Plan**

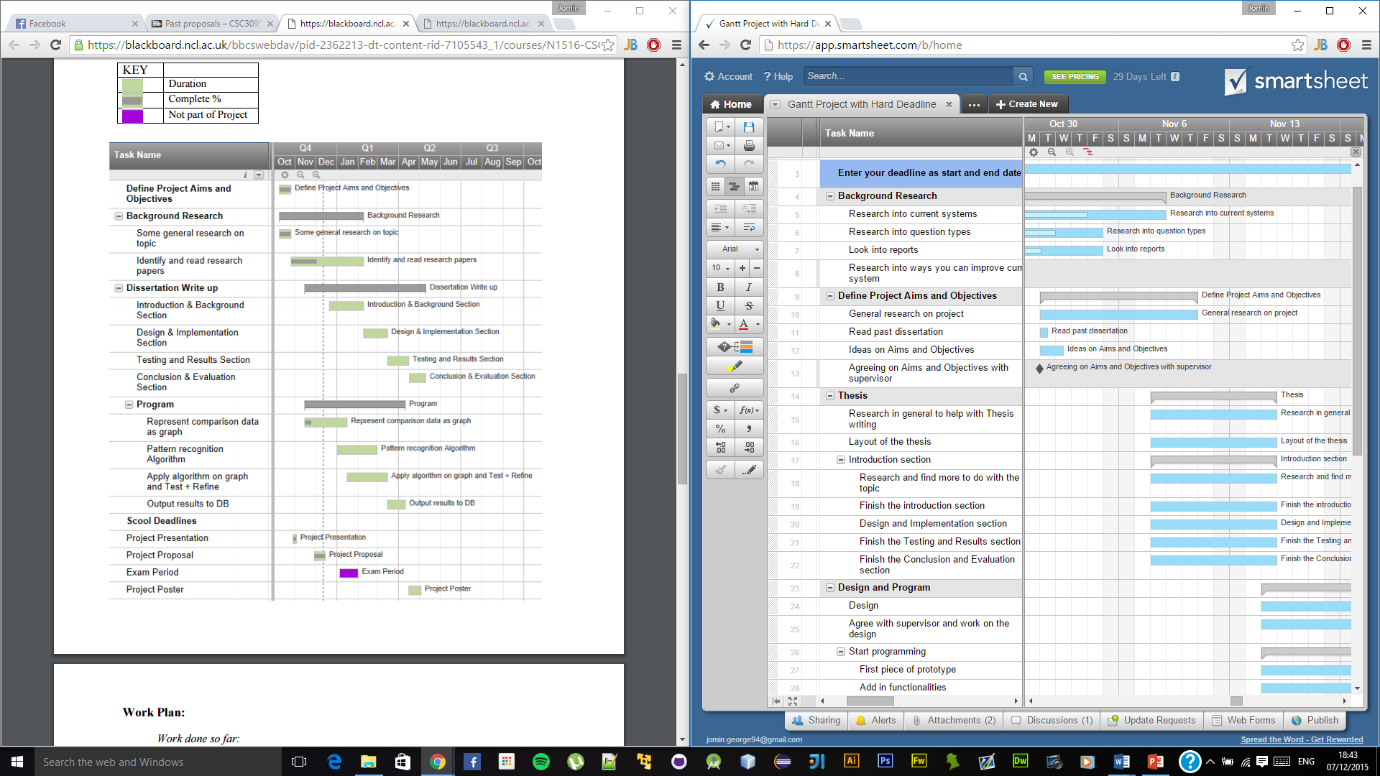
Figure 1 shows a snippet of the Gantt chart, showing the work plans that is proposed for this project.

Figure 1.6: Gantt chart

## **Project Structure**

Chapter one will be the **Introduction**¸ details the motivation behind this project as well as identifying the current problems within an existing project/area. In addition, within this section it will state the research aims and objectives as well as identifying the importance of the proposed research area.

Chapter two provides **Background Research** which involves in review of a detailed study of the current systems/projects that are available and then analysing each one against this project.

Chapter three will be **Requirement Gathering and Analysis**¸ within this section, there will be a complete analysis of the current system and what the new system will have in order to solve the issue (e.g. functional requirements, non-functional requirements). In addition, this chapter will also include preliminary research (interviews to find what different users found about a system).

Chapter four is **Design** which will present diagrams and datagram models of my system. This will be done by taking reviews of the system design in a detail to ensure that every core aspect of this project has been met.

Chapter five is **Testing and** **Implementation**, within this section it will give an overview of the tasks and process to reach goal of the research. In addition, this chapter will explain and discuss all the implementation decisions that had to be taken for this project, for example the various elements of the language learning course. With the help of this chapter, it will help to identify issues within the new built system.

Finally, Chapter six will be **Evaluation**, provides an overall evaluation on the project based on the evidence gathered and how the project has met the criteria. In addition, this chapter also talks about what possible works can be done in the future for this project.

# **Chapter 2: Background Research**

## **Existing Examination Tools or Products**

There are a variety of Examination products which are designed and implemented to aid the end user to conduct an examination utilising the Internet. By the end of this chapter, it will provide a good amount of information and requirements for a new system. Analysing and evaluating systems which exists currently will help to explain in detail about the implementation and user expectations that has to a system.

### **Respondus**

Respondus offers varies different products such as Respondus 4.0, LockDown Browser, Respondus Monitor and Study Mate (Respondus.com, 2016). All these products have been used for the purpose of assessment in the educational institutes (over 2,000 colleges and universities in over 50 countries uses Respondus to enhance learning system). Respondus works closely with partners and they provide an easy integration with their partners system (e.g. Blackboard, Design Science, Moodle, and Pearson).

Respondus 4.0 is the 4th version of Respondus, it is a windows based application which makes it easier for the end user to create and manage exams for technology partners such as Blackboard Learn, Moodle, Canvas, and other eLearning systems (Version 4.0, 2016). Respondus 4.0 supports up to 15 question types including calculation and algorithmic formatted. Since the end user have access to the Test Bank Network (contains thousands of test banks for leading books in higher education e.g. Pearson) it makes it easier for the examiner to set an exam. Respondus allows the examiner to import questions which are saved on a MS Word, RTF format, and tab/comma delimited format. In addition, Respondus also provides “Spell Check” for an entire exam file which will consists of American English, British English, Dutch, German, French and medical dictionary (Features, 2016). See Appendix A to see every feature that this product offers.

LockDown Browser is a custom browser that Respondus provides for the purpose of assessment. When an assessment starts, students are locked within the browser until they submit their exam for marking. Everything else apart from accessing the browser for carrying out the exam will be locked out and limited to functionality to prevent anyone from cheating. LockDown integrates with most of the well-known eLearning assessment system such as Blackboard, Canvas, Moodle, and Sakai. Assessments are displayed full screen using the browser and cannot minimise or maximise. Copying, pasting, print screen, print, task switching and any other features that operating system provides are all blocked from running (Browser, 2016).

Respondus Monitor is an additional application for LockDown Browser which make use of the webcam and video hardware peripherals to prevent anyone from cheating during an exam. During an online exam, it will automatically notify the examiner if the student has been caught in any way for suspicious behaviour such as taking screenshots, using copy/paste functions or even different person entering the video frame. With the help of this product, it guarantees that right person is taking the test since a video will be monitor from the start of an exam session (Monitor, 2016).

Study Mate is mainly designed to develop the students learning knowledge within a course material. In order to make it collaborative and combined for everyone Respondus designed different types of activities such as self-assessment, games and even learning activities which engages students with the course contents. Crosswords, fill in the blank, fact cards, flash cards and order matching are some of the games that Respondus offers (Respondus, 2016).

### **Moodle Quiz**

Moodle is an eLearning platform which is primarily designed to provide examiner and the learner with a secure and robust system to create and manage learning environment such as exam, making course material available and interact with lecture materials with the use of games/activities provided. (Moodle, 2016).

Moodle Quiz supports different form of questions this includes essay, matching, multiple choices, short answer, true and false and many more. Moodle provides the examiner the control on who can see the quiz, when and how they will be get scored, how feedback will be provided and also statistics to get from an exam. Moodle quiz tools is very powerful and flexible in terms of monitoring and diagnosing the students’ performance. “Chapter check” is an example of feature that Moodle provides to ensure that the student have read and understood a chapter that was told by the examiner/teacher. Creating a little mini test will help to identify how many students in a class has read and understood the material, also most importantly provides the examiner/teacher with data which will show the students’ knowledge within each aspect of the reading material and pin point where each person is doing good or bad(Moodle, 2016).

Since test and quizzes that are set up using Moodle requires outside class work, there is a high chance of people could end up in cheating. However to prevent this from happening Moodle take precautions such as randomising the questions order and also the answer order, timer in place for each question or the entire exam, and also limitation in the number of time a student can take a specified exam. Moodle is now been proven and trusted by worldwide education institutions as well as organisations. Moodle provides scalability to any size, Moodle can be scaled to support a small number of people in class to thousands working for an organisation (Quiz Practices, 2016).

Statistics is an important part of an exam, Moodle ensure that the examiner is given with detailed analysis of how students participated on an exam. There are different variety type of reports that Moodle offers such as Statistic report (analyse the quiz and the questions within it and create a report based on that), Grade report (student’s attempt on an exam and the grade boundaries as well as the option to export the result into selection of formats), and many more (Reports, 2016).

### **Conduct Exam**

Conduct Exam is an online examination system developed by RK Infotech and it provides services to education institution as well as many leading corporation/organisations. Conduct Exam states that their aim is to “help the students as well as the clients to transcend the time constraints and geographical boundaries with highly skilled administrator and monitor” (Conductexam.com, 2016).

Conduct Exam separated their product for two users which are administrator (who has the privilege to create and modify exams) and user (student or client who will be sitting for an exam). Conduct Exam provides the examiner the choice to import questions from word/excel format on to the web based system. It also supports different type of questions including most images, formula related questions, videos and many more. Provides the examiner with detailed statistics of the exam and how students have participated within an exam (e.g. number of students registered for an exam, analytics report on each questions that belongs to an exam and many more reports). Students get their result straight away after submitting the online test since the marking is done automatically with the use of regex that the examiner can specify for each individual questions for an exam. Student are also given the options to see a detailed report showing their performance on an exam. This allows the students to see where they have went wrong and what could they have done to get the question correct for the next time.

Students can take the online test using multiple languages 24/7 from any device since the website is user friendly to any platforms. Study material is another feature that Conduct Exam provides and it allows the students to share study materials with each other and have the ability to download it for their exam preparation. Student have also have the choice to opt-in to a notification which will notify them when any new online test, study materials or results been published.

### **Speed Exam**

Speed Exam is an online examination system, offers services to education institutions, recruitment, manufacturing, banking and also for health care organisations. With the help of Speed Exam it is possible to create an exam just under one minute and communicate with the candidate with the integrated email and SMS system. Offer wide range of question types including drag and match, multiple choice, fill in the blank, essay, vide based question and also calculation based questions.

Exam Monitoring is a premium feature that Speed Exam has implemented within their system which allows the examiner to watch live exams and see current activities of each individual candidates who are taking the exam. It allows examiner to see how many participants have got the questions right so far into the exam, how many of them finished the exam and also live capturing on what each participants currently doing. Speed Exam has tools in place to prevent anyone from having multiple sign-in, copy, paste and print screen. Examiner will be notified instantly with the participants IP address, location and also the browse details used within that incident. All exam related alert are logged and available to review and resolve the alerts at any time by the examiner (admin account).

Analytical reports will be produced after an exam, which will show the examiner overall performance of all the sections within an exam and detailed graphical representation on how well each student found each individual question (Overview, 2016).

Speed exam site is responsive this means it can go really well with any device, be a PC, laptop smartphone or tablet. This will allow the examiner to create an exam from anywhere at any time. Candidate can self-register their self in order to access the website, Speed Exam has checks in place to ensure a proper email verification is made for the candidate to prevent anyone from signup using fake details (e.g. disposable email address).

### **Pro Profs Quiz Maker**

Pro Profs is the last and final product that is currently available to create an engaging quizzes with the use of features that they have provided. They support up to six different question types including, checkboxes, matching, video/audio based, true or false and many more. When adding question, examiner has been given an optional choice to add a note to help explain it to the candidate (e.g. hint). Examiner can rearrange the questions as well as give specific marks for each individual questions. Questions are randomly asked to prevent anyone from cheating. Some of the questions are marked automatically and some are left for the examiner to manually mark it by their self.

Pro Profs offers over 100, 000 ready to use quizzes and questions on any educational or organisational topics (Proprofs.com, 2016). Examiner has a wide range of options available such as specifying the result type (e.g. pass rate should be 40%), order of questions (e.g. examiner can set it to be random so each individual student will see random questions), assign time to each individual questions or the entire exam and many more.

With the advanced analysis, examiner can easily search on the exam result and find whatever they are looking for. This can be from finding what each individual candidate has performed within the exam (i.e. time taken to finish the exam, when the candidate took the exam) to having that ability to see the breakdown summary of each questions (i.e. finding out how many candidate got each questions correct) in different graphical visualisation. With the help of advanced statistics it will provide the examiner with what should be done to improve the candidate’s performance for the next time.

### **Existing Products Summary**

The following table provides a breakdown of all the products that I have covered above and showing what features each of them have to stand-out from one another.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Features | Respondus | Moodle Quiz | Conduct Exam | Speed Exam | Pro Profs |
| Different question types | Yes | Yes | Yes | Yes | Yes |
| Fully automated | No | No | Yes | No | No |
| Option to manually mark | Yes | Yes | No | Yes | Yes |
| Marked by students | No | No | No | No | No |
| Password Protection for entering exam (optional) | Yes | Yes | No | Yes | Yes |
| Students can see their result straight after submitting an exam | No | Yes | Yes | No | No |
| Students can see the mark scheme and improve their knowledge for next time | Yes | Yes | Yes | Yes | Yes |
| Live exam monitoring | No | No | No | Yes | No |
| Student self-registration | No | No | No | Yes | Yes |
| Student get notification when new exam or material is added | No | No | Yes | Yes | No |
| Examiner can create sub admins and assign roles | Yes | No | Yes | Yes | Yes |
| Student registration using csv | Yes | Yes | No | No | Yes |
| Option to customise admin and candidate panel | Yes | No | No | Yes | Yes |
| Time limit for each question or entire exam | Yes | Yes | Yes | Yes | Yes |
| Detailed analysis | Yes | Yes | Yes | Yes | Yes |
| Print Reports | Yes | Yes | Yes | Yes | Yes |
| Graphs to support analysis | Yes | No | Yes | Yes | Yes |
| Exam integration with other organisations | Yes | Yes | Yes | Yes | Yes |
| Reports can be exported using different file formats | Yes | Yes | Yes | Yes | Yes |

See Appendix A - Existing product features for detailed feature listing of each products.

## **Graphical Visualisation**

Graphical representation is an effective way of displaying data and statistical reports with the use of different type of graphs such as charts, diagrams, plots and many more (Gale, 2016). One of the main advantage of using Graphs is to have a complete overview of the problem or scenario instead of having to read hundreds of pages to get what is on other people’s mind. Within an instant view it makes it more clearly on the data and more importantly information process make it quicker.

Below there is a list of different type of graphs with detailed explanation on what they are mainly used for. These diagrams will be considered towards to this project, to help examiner and students with a better understanding of the data (e.g. performance of students on an exam).

### **Bar Diagrams**

Bar diagrams are good for showing how data is changed over time. Most common bar diagram is the vertical graph where the independent variables are plotted on the horizontal axis from left to right. With the use of bar graph it makes it easier to analyse the data since the trends on the graphs highlights the data or a pattern much more clearer compared to result displayed on the a table (Africa Geography Blog, 2016). However one of the disadvantage of using bar diagram would be having to add in additional explanation to support the end-user with the graphical visualisation. This is due to the complexity of the graph, when the data gets difficult to show on graph it ends up in this situation.

### **Pie Diagrams**

Pie diagrams are used as an efficient way of showing percentage of proportional of a data. The independent variable is plotted around the pie diagram either a clockwise direction or an anticlockwise direction. When using pie diagrams, it would be best to use around five or six categories. When there are more categories it will then become difficult for the end user to distinguish from one other. This type of graph help the end user with summarising a large data set in a well explained visual form (Geographyfieldwork.com, 2016).

### **Line Diagram**

Line diagrams are used to display data that changes over time. Independent data are on the horizontal axis (e.g. time) and dependent data are on the vertical axis. Line graphs are very useful in terms of showing the trends over a certain period of time and it makes it easier to predict about the result of data which has not yet been provided with (Betterevaluation.org, 2016).

Study shows that graphical representation of data make much more sense and can be understand by anyone (even by an illiterate person) because it doesn’t involve in having to go through line by line of descriptive report to recognise the content.

## **Web Frameworks**

### **PHP Frameworks**

There are many PHP frameworks that are mainly used to structure a system and most importantly to reduce repetitive coding to create dynamic websites. In order to build this project, there should be a clear idea on whether or not to use framework and therefore this part of the research was crucial.

#### **Codeigniter**

Codeigniter is one of the powerful PHP framework with a good documentation, making it to be a popular framework than can be used to build dynamic web applications or sites. (Codeigniter.com, 2016). One of the main advantage of Codeigniter is that it uses MVC (Model-view-controller) which allows great separation between logic and presentation (Paragoncorporation.com, 2016).

Codeigniter provides other useful libraries and packages that are required for creating a dynamic website such as database, email server, session maintains, and further more (EllisLab, 2016).

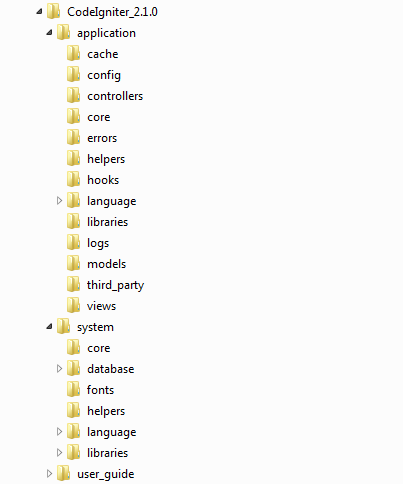


Figure 2.3.1.1: shows the directory structure of Codeigniter (3.bp.blogspot.com, 2016)

#### **Zend**

Zend is another popular PHP framework, and is a VC framework as only has view and controller but it doesn’t have a model implementation (Framework.zend.com, 2016). Zend has an extensive validation mechanism in place which can be used to validate data that are getting passed from a form (Bautista, 2010). One of the main advantage of using Zend is that it provides vast amount of libraries and support including user authentication, RSS feed, creating forms, and many more.

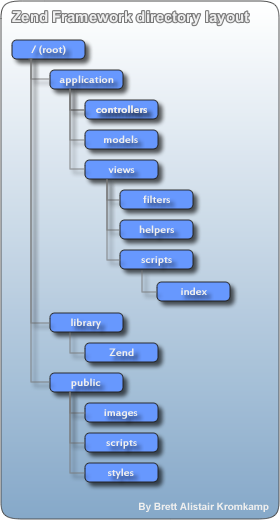


Figure 2.3.1.2: shows the directory structure of Zend (Kromkamp, 2016)

#### **Summary of PHP Framework**

For this project after considering all the different PHP framework, decided to just use PHP without any framework due to lack of knowledge within the framework. Learning a new framework would be very advantageous however it is not practical to do so within the time limit. In addition, it will also require me to start from the basics to get a grasp in knowing more about a specific framework.

Building a website system without any framework would be tougher however research shows that novice user who hasn’t had experience of using framework will struggle and find hard to manage work due to the complexity and the time spent to developing the system. Custom coding will work faster than setting up a framework for a small project.

### **Bootstrap**

Bootstrap is most popular front end framework that supports in terms of HTML, CSS, and JavaScript for responsive website (will be compatible to run on any device). In order to use Bootstrap there is not much knowledge needed, anybody with just basic knowledge of HTML and CSS can make a good start on Bootstrap. Bootstrap is now compatible with all browsers including Chrome, Firefox, Internet Explorer and Opera.

One of the main advantage of using Bootstrap is to speed up the development in designing your website with the use of libraries and packages that it offers with. Bootstrap also provides with ready-made theme and modify it based on your needs (W3schools.com, 2016).

## **Possible Technologies**

### **Client Side Scripting**

### **Server Side Scripting**

## **Version Control**

## **Database**

### **MySQL**

### **PostgreSQL**

### **Oracle**

### **Summary of Database**

## **Methodology**

# **Bibliography**

### **Websites**

1. Tests, O. (2012). Tech Blogs by BIS.: Online Exam System: The Future of All Examinations and Tests. [online] Blog.softwarehouse.co.

Available at: <http://blog.softwarehouse.co/2012/05/online-exam-system-future-of-all.html> [Accessed 03 Feb. 2016].

1. Busch, B. (2015). Practice makes perfect: why mock exams are great for students’ brains. [Online] the Guardian.

Available at: <http://www.theguardian.com/teacher-network/2015/dec/03/practice-makes-perfect-why-mock-exams-students-brains> [Accessed 03 Feb. 2016].

1. Nhs.uk. (2016). Coping with exam stress - Stress, anxiety and depression - NHS Choices. [online]

Available at: <http://www.nhs.uk/conditions/stress-anxiety-depression/pages/coping-with-exam-stress.aspx> [Accessed 03 Feb. 2016].

1. Respondus.com. (2016). Respondus. [online]

Available at: <https://www.respondus.com/> [Accessed 03 Feb. 2016].

1. Version 4.0, R. (2016). Instructor Quick Start Guide. [online] Respondus® Version 4.0. Available at: <https://www.respondus.com/downloads/RespondusQuickStartGuide.pdf> [Accessed 03 Feb. 2016].
2. Features, R. (2016). Respondus 4.0: Exam Authoring Tool. [online] Respondus.com. Available at: <https://www.respondus.com/products/respondus/#1> [Accessed 03 Feb. 2016].
3. Browser, L. (2016). LockDown Browser. [online] Respondus.com. Available at: <https://www.respondus.com/products/lockdown-browser/> [Accessed 03 Feb. 2016].
4. Monitor, R. (2016). Respondus Monitor. [online] Respondus.com. Available at: <http://www.respondus.com/products/monitor/> [Accessed 03 Feb. 2016].
5. Respondus, S. (2016). StudyMate: Learning Activities and Games. [online] Respondus.com. Available at: http://www.respondus.com/products/studymate/ [Accessed 03 Feb. 2016].
6. Moodle, A. (2016). About Moodle - MoodleDocs. [online] Docs.moodle.org. Available at: <https://docs.moodle.org/30/en/About_Moodle> [Accessed 03 Feb. 2016].
7. Moodle, L. (2016). Quizzes in Moodle. [online] Lti.lse.ac.uk. Available at: <http://lti.lse.ac.uk/moodle/quizzes.php> [Accessed 03 Feb. 2016].
8. Quiz Practices, E. (2016). Effective quiz practices - MoodleDocs. [online] Docs.moodle.org. Available at: <https://docs.moodle.org/30/en/Effective_quiz_practices#Quiz_strategies> [Accessed 03 Feb. 2016].
9. Reports, Q. (2016). Quiz reports - MoodleDocs. [online] Docs.moodle.org. Available at: <https://docs.moodle.org/23/en/Quiz_reports> [Accessed 03 Feb. 2016].
10. Conductexam.com. (2016). Integrated online platform to conduct exams. [online] Available at: <http://www.conductexam.com/Online-Exam-System-About-Us> [Accessed 03 Feb. 2016].
11. Overview, S. (2016). Online Exam Software,Free Test Maker,Quiz Maker. [online] Speedexam.net. Available at: <http://speedexam.net/exam-management-overview.html> [Accessed 03 Feb. 2016].
12. Proprofs.com. (2016). ProProfs Quiz Maker - Create Online Quizzes, Online Testing, Exams.. [online] Available at: <http://www.proprofs.com/quiz-school/> [Accessed 03 Feb. 2016].
13. Gale, T. (2016). Graphic Presentation – FREE Graphic Presentation information | Encyclopedia.com: Find Graphic Presentation research. [online] Encyclopedia.com. Available at: <http://www.encyclopedia.com/doc/1G2-3045000481.html> [Accessed 03 Feb. 2016].
14. Africa Geography Blog. (2016). [Blog] ADVANTAGES AND DISADVANTAGES OF BAR GRAPH. Available at: <http://geographymaterials.blogspot.co.uk/2015/08/advantages-and-disadvantages-of-bar.html> [Accessed 03 Feb. 2016].
15. Geographyfieldwork.com. (2016). Data Presentation: Pie Charts. [online] Available at: <http://geographyfieldwork.com/DataPresentationPieCharts.htm> [Accessed 03 Feb. 2016].
16. Betterevaluation.org. (2016). Line Graph | Better Evaluation. [online] Available at: <http://betterevaluation.org/evaluation-options/LineGraph> [Accessed 03 Feb. 2016].
17. Codeigniter.com. (2016). *CodeIgniter Web Framework*. [online] Available at: <https://www.codeigniter.com/> [Accessed 03 Feb. 2016].
18. Paragoncorporation.com. (2016). Separation of Business Logic from Presentation Logic in Web Applications (ASP.NET and PHP). [online] Available at: <http://www.paragoncorporation.com/ArticleDetail.aspx?ArticleID=21> [Accessed 03 Feb. 2016].
19. EllisLab, I. (2016). CodeIgniter / EllisLab. [online] Ellislab.com. Available at: <https://ellislab.com/codeigniter> [Accessed 03 Feb. 2016].
20. Directory Structure, P. (2016). [online] 3.bp.blogspot.com. Available at: <http://3.bp.blogspot.com/-Dhk-FfFBzP0/UC_MOCsPK0I/AAAAAAAAABw/o_P4T69G7xE/s1600/codeigniter_directory.png> [Accessed 03 Feb. 2016].
21. Bautista, N. (2010). 10 Compelling Reasons to Use Zend Framework. [online] Code Envato Tuts+. Available at: <http://code.tutsplus.com/tutorials/10-compelling-reasons-to-use-zend-framework--net-12214> [Accessed 03 Feb. 2016].
22. Kromkamp, B. (2016). [online] Quesucede.com. Available at: <http://www.quesucede.com/public/resources/zend-framework/images/zend_directory_structure.png> [Accessed 03 Feb. 2016].
23. W3school.com. (2016), Bootstrap Get Started. [online] Available at: <http://www.w3school.com/bootstrap/bootstrap_get_started.asp> [Accessed 03 Feb. 2016].

### **Books**

# **Appendix A – Existing Products Features**

### **Respondus**

# **Appendix B -**