

# Design Document

Math AF (Advanced Functions)

ICS4U

Version 1.0

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# 1.0 Introduction

The program Math AF is a web based application that is designed to give the teacher of MHF4U aid to student progress throughout the course by giving daily quizzes. The teacher uses this data at anytime throughout the course to get a snapshot of which students are understanding the material and which ones need extra help. They can also, at the end of the quiz, use the total collected data to help give a final mark to the student.

## 2.0 Production

### 2.1 Website Design

The design of the webpage was created during the paper prototype stage of production and all team members had contributed to the structure. Each web page was outlined and predicted features and functionality were shown and displayed.

### 2.2 Application Design

The overall design of navigation and function for users was made along the design of the website itself since it was required that a graphics user interface was to be determined before features could be decided.

### 2.3 Team Roles

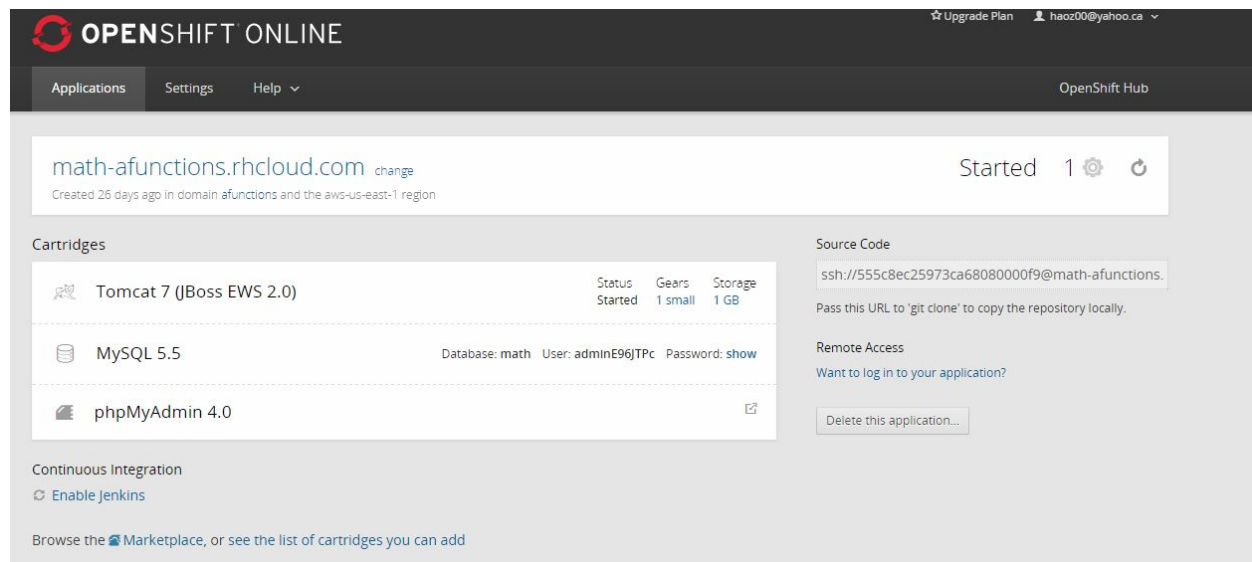
Haoyang Zhu - **Lead programmer and Management:** This role required to program the backend of the application including managing a database and programming corresponding Java Servlets for various web pages. In addition to programming, this role required the practice of making sure the team stayed on track and completed work on due dates.

YiYang Jiang - **Secondary programmer and website designer:** This role required to program the frontend of the coding mainly composed of HTML and CSS with help of the lead programmer for JavaScript and allowing the web pages to be connected with Java Servlets. This role is also response for the implementation of website design and changes throughout the implementation.

## 3.0 Functionality

### 3.1 Openshift by RedHat

The application was hosted for free on Openshift which is a service platform by Redhat. The web domain it was registered as is called math-afunctions.rhcloud.com and has free storage provided by openshift. Along with the application, it includes the following cartridges: Tomcat 7, MySQL 5.5 and phpMyAdmin 4.0. Overall, any coding was done in Eclipse and updates were uploaded to the server.



### 3.2 Java Servlets

All web pages were coded as JSP (Java Servlet Page) as opposed to the standard HTML page so that they could be coupled with the JAVA servlets and become more dynamic than a standard html page. All JSP pages had standard HTML, Javascript and CSS references while still being able to support JAVA code while connecting to the servlet. Each servlet has two important methods called doGet and doPost which are accessed through the servlet URL or an HTML form made in a JSP.

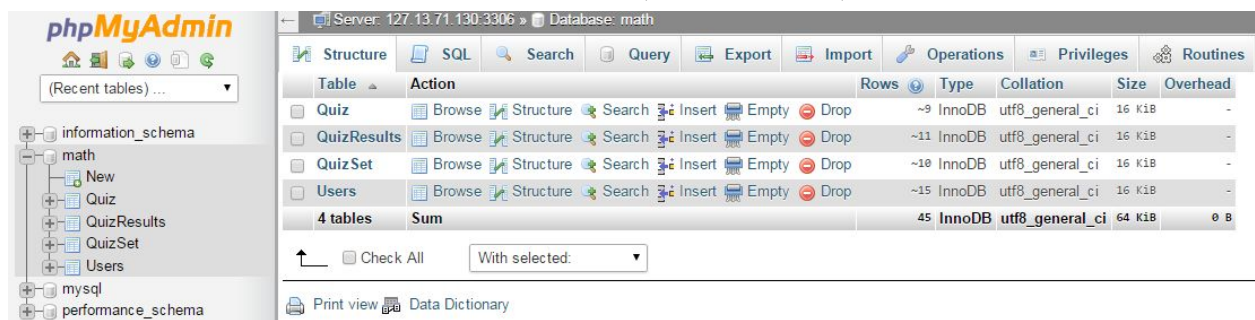
### 3.3 Java HTML Session

To save user data and login information in the browser, Java HTML sessions were used. A session is created when the login servlet is accessed and assigns attributes to the session depending on the usertype that logs in. Throughout the application, the sessions are used to regulate and restrict user access so that student accounts cannot access teacher pages and vice-versa.

### 3.4 MySQL Database and phpMyAdmin

To save user data and information in a permanent location, a MySQL database was used and was accessed through Java code and MySQL commands. The phpMyAdmin cartridge on the application allowed a visual representation of the database and creation of data tables with specific structures was done.

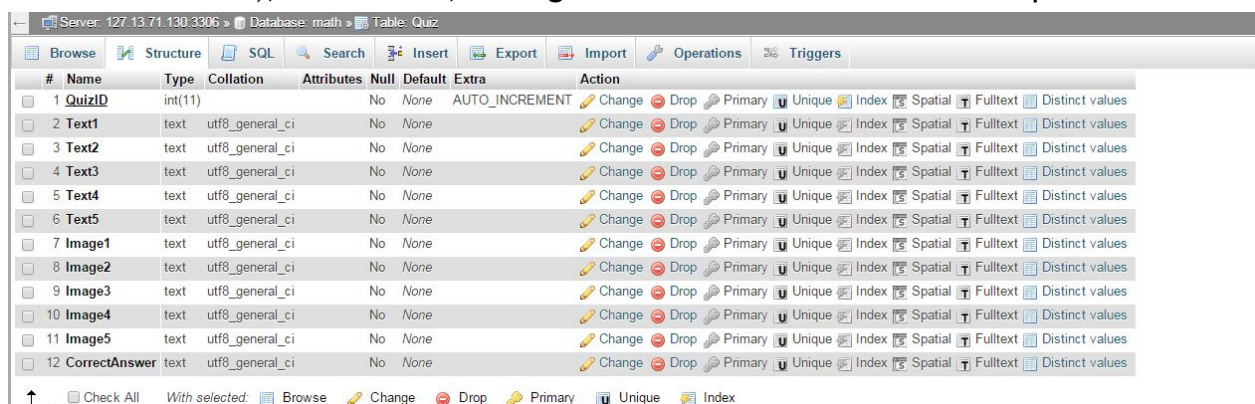
All the data tables: Contains Quiz Questions, Quiz Results, Quiz Set and Users tables



The screenshot shows the phpMyAdmin interface for a MySQL database named 'math'. The left sidebar displays the database structure, including 'information\_schema', 'math', 'mysql', and 'performance\_schema'. The 'math' database is selected, showing four tables: Quiz, QuizResults, QuizSet, and Users. The main panel displays a summary of these tables, including their row counts, types, collations, sizes, and overheads.

Table	Action	Rows	Type	Collation	Size	Overhead
Quiz	Browse Structure Search Insert Empty Drop	~9	InnoDB	utf8_general_ci	16 KiB	-
QuizResults	Browse Structure Search Insert Empty Drop	~11	InnoDB	utf8_general_ci	16 KiB	-
QuizSet	Browse Structure Search Insert Empty Drop	~10	InnoDB	utf8_general_ci	16 KiB	-
Users	Browse Structure Search Insert Empty Drop	~15	InnoDB	utf8_general_ci	16 KiB	-
<b>4 tables</b>	<b>Sum</b>	<b>45</b>	<b>InnoDB</b>	<b>utf8_general_ci</b>	<b>64 KiB</b>	<b>0 B</b>

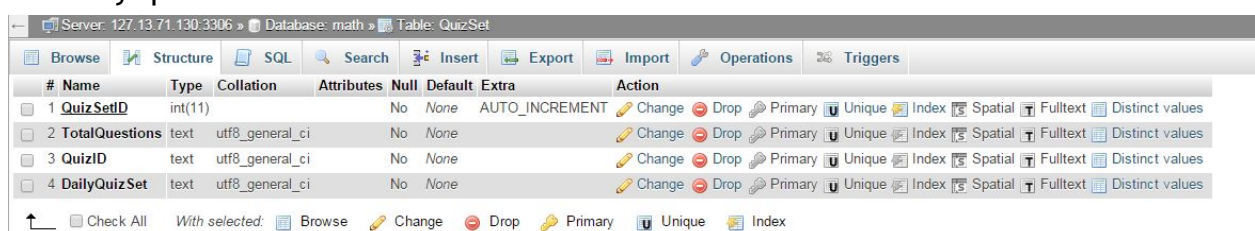
Quiz: The quiz questions table structure which contains an ID (Auto included when a new row is added), 5 text slots, 5 Image url slots and a Correct Answer per row



The screenshot shows the 'Table: Quiz' structure in phpMyAdmin. The table has 12 columns: QuizID (int(11), AUTO\_INCREMENT), Text1, Text2, Text3, Text4, Text5, Image1, Image2, Image3, Image4, Image5, and CorrectAnswer. Each column has a corresponding 'Action' menu with options like Change, Drop, Primary, Unique, Index, Spatial, Fulltext, and Distinct values.

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	QuizID	int(11)			No	None	AUTO_INCREMENT	Change Drop Primary Unique Index Spatial Fulltext Distinct values
2	Text1	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
3	Text2	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
4	Text3	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
5	Text4	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
6	Text5	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
7	Image1	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
8	Image2	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
9	Image3	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
10	Image4	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
11	Image5	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
12	CorrectAnswer	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values

QuizSet: The quiz set table structure which contains an ID (Auto included when a new row is added) and three text slots for total questions, a set of quiz IDs and the ID of the daily quiz set



The screenshot shows the 'Table: QuizSet' structure in phpMyAdmin. The table has 4 columns: QuizSetID (int(11), AUTO\_INCREMENT), TotalQuestions, QuizID, and DailyQuizSet. Each column has a corresponding 'Action' menu with options like Change, Drop, Primary, Unique, Index, Spatial, Fulltext, and Distinct values.

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	QuizSetID	int(11)			No	None	AUTO_INCREMENT	Change Drop Primary Unique Index Spatial Fulltext Distinct values
2	TotalQuestions	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
3	QuizID	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
4	DailyQuizSet	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values

**QuizResults:** The quiz results table structure which contains an ID (Auto included when a new row is added), and text slots for the User's ID, the quiz set ID they have completed, total questions in the set, the number of questions correct and the answers they have gotten right.

Server: 127.13.71.130:3306 » Database: math » Table: QuizResults

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	ResultID	int(11)			No	None	AUTO_INCREMENT	Change Drop Primary Unique Index Spatial Fulltext Distinct values
2	UserID	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
3	QuizSetID	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
4	TotalQuestions	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
5	QuestionsCorrect	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
6	Answers	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values

Check All With selected: Browse Change Drop Primary Unique Index

**Users:** The users table structure which contains a user ID (Auto included when a new row is added), and various text slots for username, password, full name, email, user type (teacher or student) and the classcode.

Server: 127.13.71.130:3306 » Database: math » Table: Users

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	UserID	int(11)			No	None	AUTO_INCREMENT	Change Drop Primary Unique Index Spatial Fulltext Distinct values
2	Username	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
3	Password	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
4	FullName	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
5	Email	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
6	UserType	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values
7	ClassCode	text	utf8_general_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext Distinct values

## 4.0 Navigation and Organization

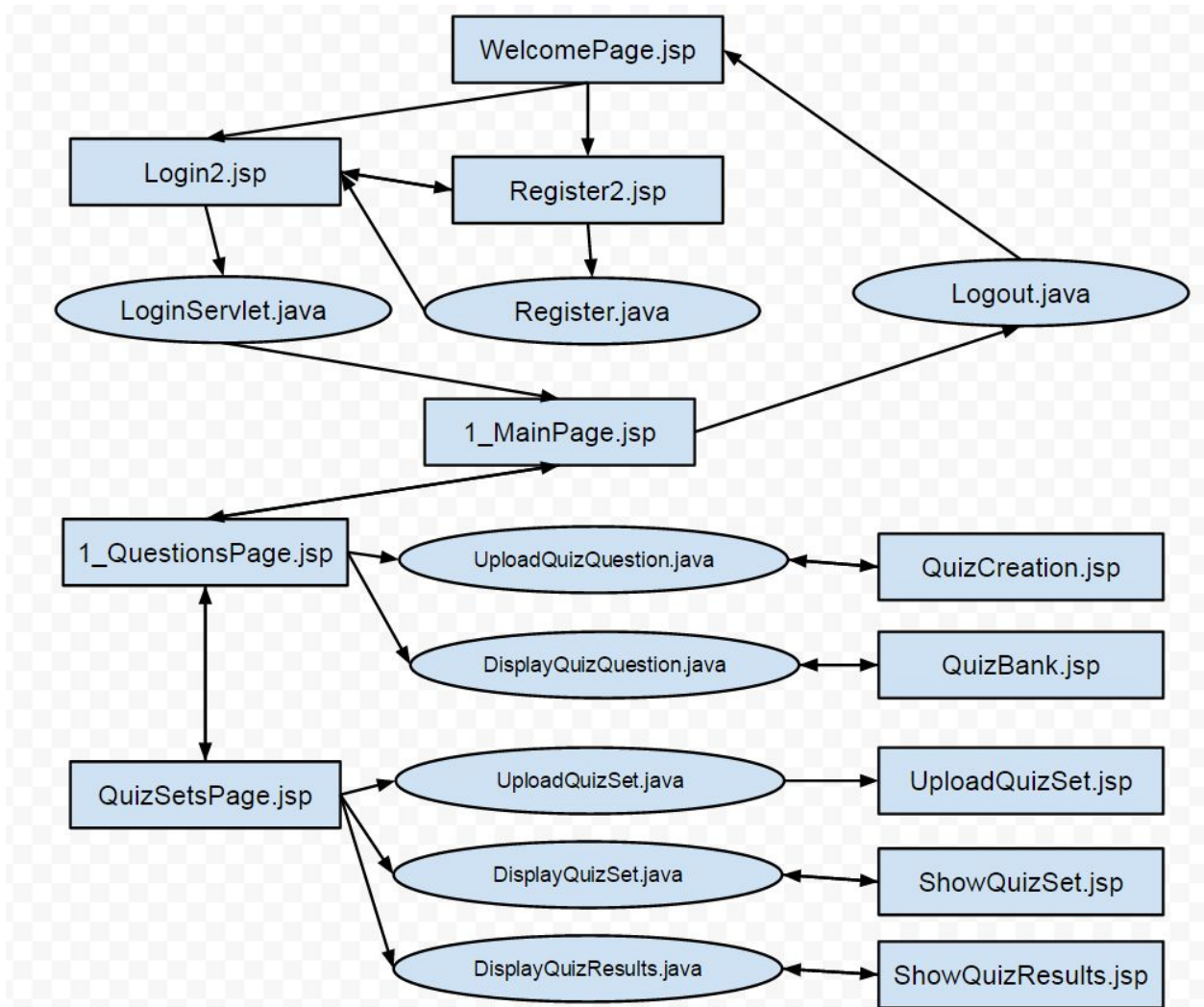
### 4.1 Application Internal Structure

Servlets	Function	Related JSP
DatabaseAccess.java	Contains a list of methods used by other servlets to input or retrieve data from the database.	none
LoginServlet.java Logout.java	Allows user to create a new session, set specific attributes and ends session when logged out. Checks the users info using DatabaseAccess.java and creates session if user data retrieved from the html form is valid.	Login2.jsp
Register.java	Gets user info from a form and checks using DatabaseAccess.java if info is valid and submits if true.	Register2.jsp
UploadQuizQuestion.java	Gets text and image files from an html form and adds to the database using DatabaseAccess.java.	QuizCreation.jsp
DisplayQuizQuestion.java	Retrieves information from DatabaseAccess.java to determine the quiz question to be displayed and redirects to a web page displaying the question.	QuizBank.jsp
UploadQuizSet.java	Retrieves data from DatabaseAccess.java to determine available quiz IDs and sends it to a web page.	UploadQuizSet.jsp
DisplayQuizSet.java	Retrieves info from a parameter to determine the daily quiz set and uses DatabaseAccess.java to get all available quiz sets and information to be sent to a webpage.	ShowQuizSet.jsp

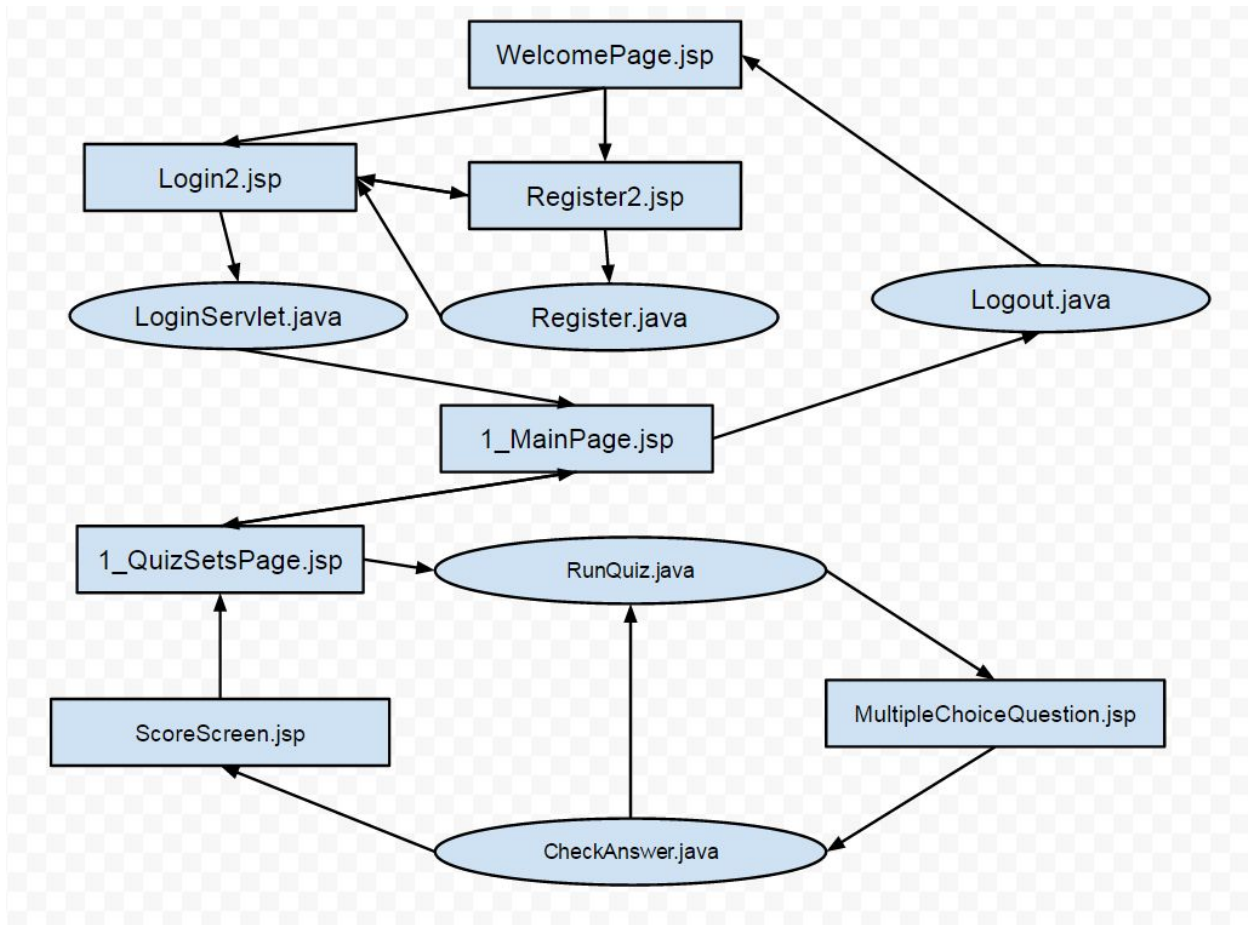
DisplayQuizResults.java	Retrieves info using DatabaseAccess.java and gets a list of quiz set IDs along with information on students which have completed the quizzes. Redirects to a webpage.	ShowQuizResults.jsp
RunQuiz.java CheckAnswer.java	Retrieves info using DatabaseAccess.java and redirects to a webpage where the user can input an answer and accesses CheckAnswer.java which resends to RunQuiz.java until all questions are completed.	MultipleChoiceQuestion.jsp ScoreScreen.jsp



## Website Structure for Teachers



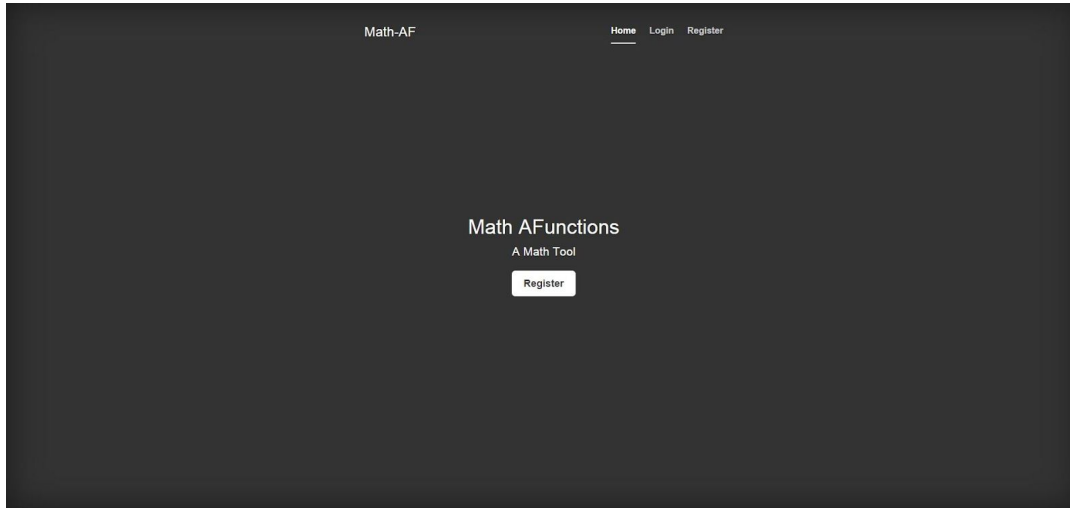
## Website Structure for Students



## 5.0 Menus and Web Pages

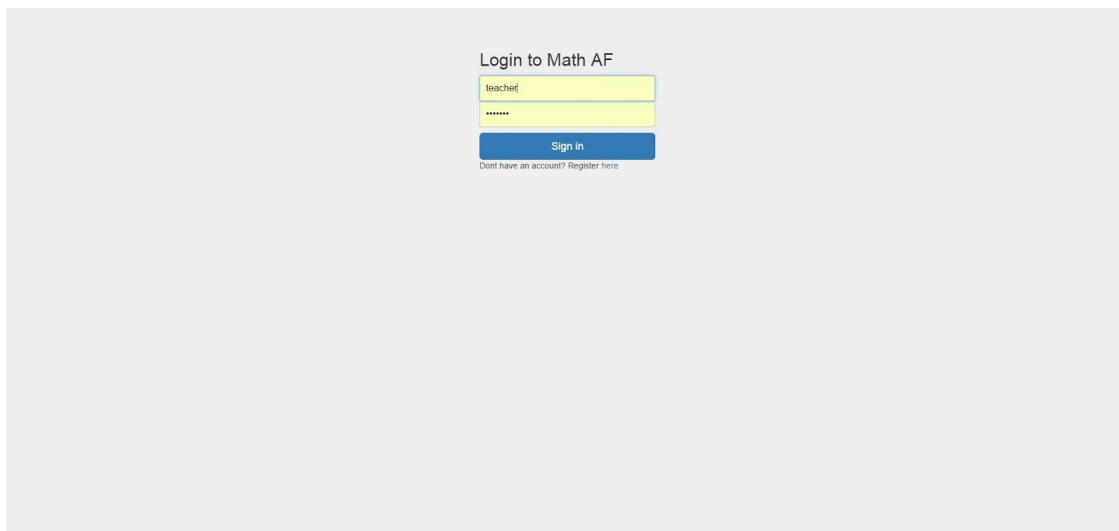
Most of the pages share the same url between student and teacher, however, there are restrictions put onto each pages so that when a user that is a student goes to say the Main Menu, it will redirect them to a student version of that page, and same thing happens with the teacher. There is also a restriction that whenever someone has a copy of the url, and uses that to go to a certain page without logging in, it won't allow them to. Only after the user has logged in can they go to different pages through pasting the url. The styles of the pages also change depending on the functionality of the page. If the pages are made for displaying questions, they all have the same style, if it's used for quiz sets, it also has a particular style

## 5.1 Welcome page



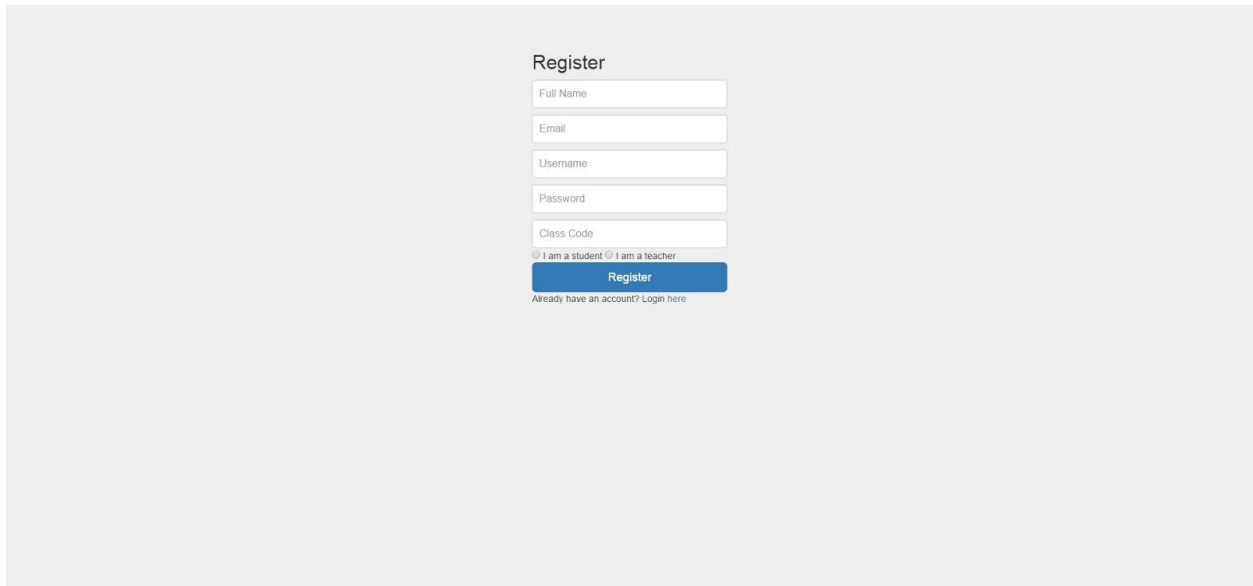
This web page is the first page that the users will see when they use the website. It has a clean and minimalistic view to it, which helps the user easily navigate to where to they want to be. There are two buttons at the top bar for logging in and registering. At the middle of the page, there is the main title of the website and our program. Another registration button is placed there to help the new users to get started.

## 5.2 Login



This is the login screen, it has two spaces for the user to input their username and password. If they do not have an account, there is a button at the end of the signin that redirects them to the register page.

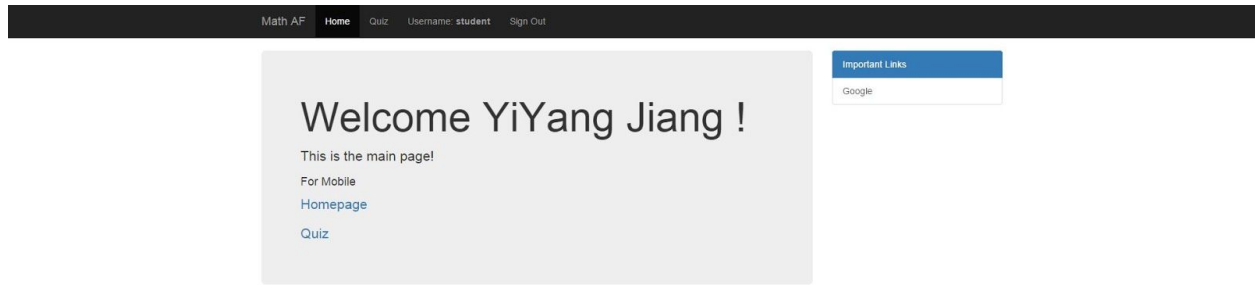
## 5.3 Register

A screenshot of a web registration form titled "Register". The form is centered on a light gray background. It contains five text input fields stacked vertically: "Full Name", "Email", "Username", "Password", and "Class Code". Below these fields are two radio buttons with labels "I am a student" and "I am a teacher". A blue "Register" button is positioned below the radio buttons. At the very bottom, there is a link that says "Already have an account? Login here".

This is the register page, it has 5 spaces for text: full name, email, username, password, and class code. The user can choose what type of an account they sign up with by clicking one of the radio buttons at the bottom. If the user created a teacher account, the user can create any class code. If the user created a student account, the class code has to be the same as their teacher's. At the bottom, it has a option to return to the login screen if the user has already created an account.

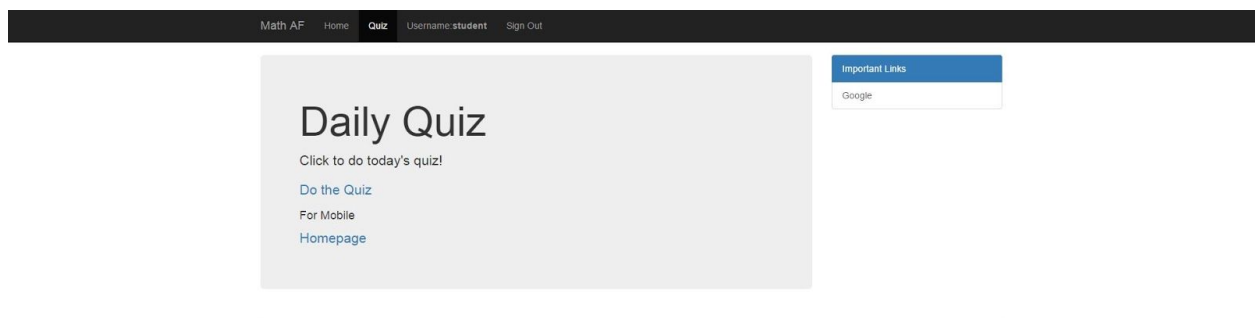
## 5.4 Main Menu

A screenshot of a web application's main menu. At the top is a dark navigation bar with links: "Math AP", "home" (highlighted), "Quiz Questions", "Quiz Sets", "Username: teacher", and "Sign Out". The main content area has a light gray background. On the left, it says "Welcome Ms. D !" followed by "This is the main page!", "For mobile", and links for "Homepage", "Questions", and "Quiz". On the right, there is a blue "Important Links" button above a search bar containing the text "Google".



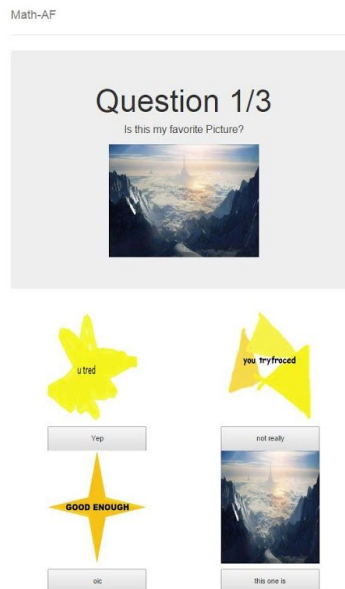
After users login, this is the first page they see. If they logged in with a teacher account, then an image similar to the first image will display. This page contains more buttons in the top navigation bar as teachers have more privileges in the page. (Quiz Questions, and Quiz Sets). For the student, the only option for them is to do the current quiz. So the only other navigation bar button is Quiz. After those buttons is a placement button to state the username of the current user, and the one after that is used to sign out and end the current session. On the right side, there is a list called important links. The teacher may choose to put links to useful websites or to extra practice questions.

## 5.5 Quiz Set Page (Students)



Students will use this page to access their daily quiz. The top navigation bar stays there so the user can still go back to the main menu. The format of this page stays the same as the main menu, and when the student is ready to do the quiz, they can click on the button in the body of the page.

## 5.6 Quiz Questions (Students)



This is the screen the students see when they are doing the quiz. It has the question at the very top, along with the image. The answer texts are clickable and once clicked will direct them to the next question. At the top it says which question it is. In this case, it is the first question out of 3 total questions ( $\frac{1}{3}$ ).

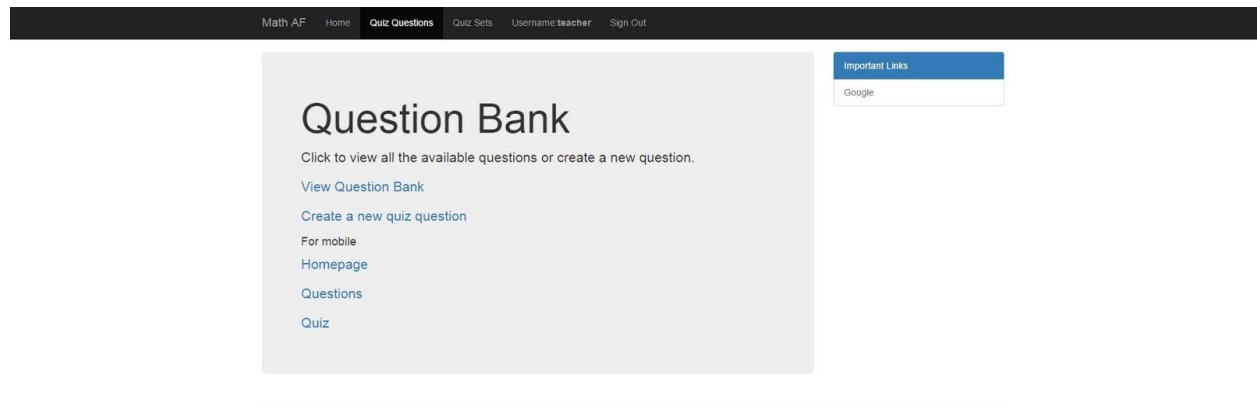
You have completed today's quiz!!

You got 0 questions right out of 3 questions!

[Return to main page](#)

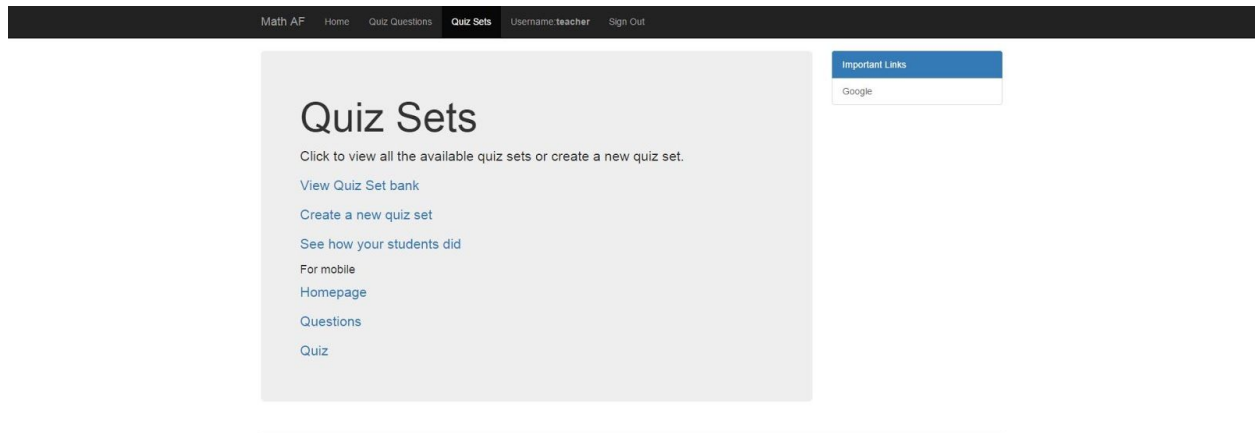
Once the student has finished all the questions in the question set, it leads them to this screen which will tell them how many questions they got right out of the total number of questions. In this case, it is 0/3. At the end, there is a button that directs them back to the home page.

## 5.7 Questions page (Teachers)



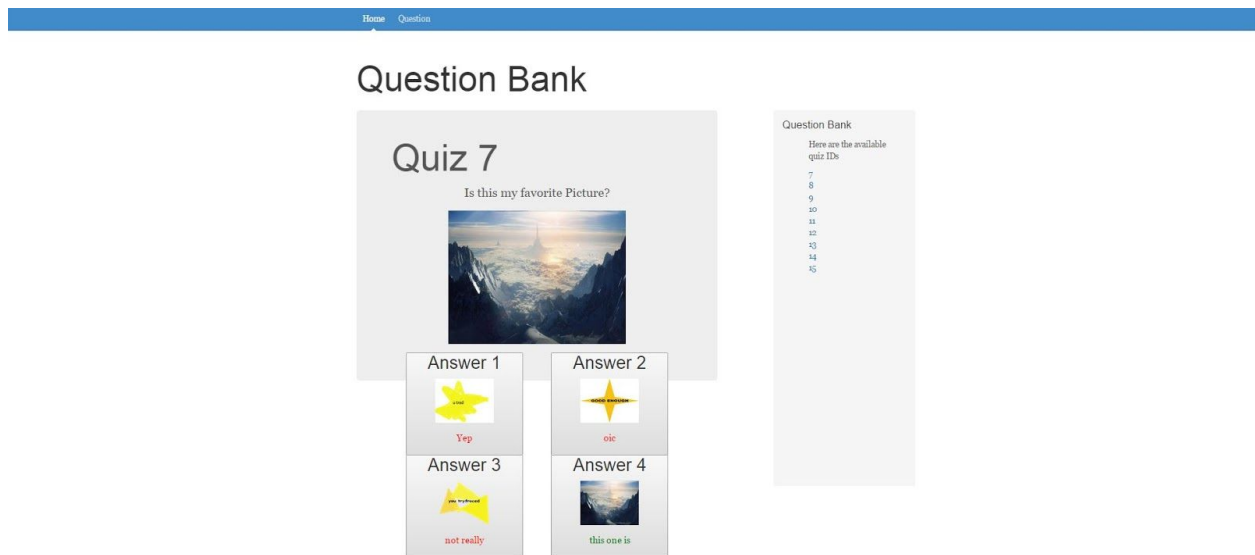
This page is only accessible by a teacher account. When they arrive, there are 2 options in the body of the page: view previous questions and create a new question. It has the same format as Main Menu.

## 5.8 Quiz Set Page (Teachers)



The page is also only accessible to a teacher account. There are 3 options on this page: view previous quizzes, create a new quiz set, and see student scores. The client, Ms.D requested that quizzes should be longer than simply one question, and quiz sets were the solution to that problem. Quiz sets are sets of questions that make up a quiz.

## 5.9 Question Bank (Teachers)



The colour of the top bar changed from black to blue because it goes from a navigation page to a “bank” page. The top bar only contains links to go back to the Questions, as from there, the user can choose further options for navigation. On this page, the right side has a scroll down menu used to all the questions in the database.



There is no scroll bar displayed right now as there are not enough questions to fill up the space. However once there are more questions, the scrollbar will appear. On the left side, the current selected question is being displayed. Currently, it is the question with the ID of 7. It comes with 4 answers, the right answer text is displayed in green while the wrong answers are displayed in red. By clicking on other question numbers on the right hand bar, it will redirect the user to a page similar to this, however the question on the left will be the question that they clicked on. If they clicked on question number 13, question 13 will be expanded to left side.

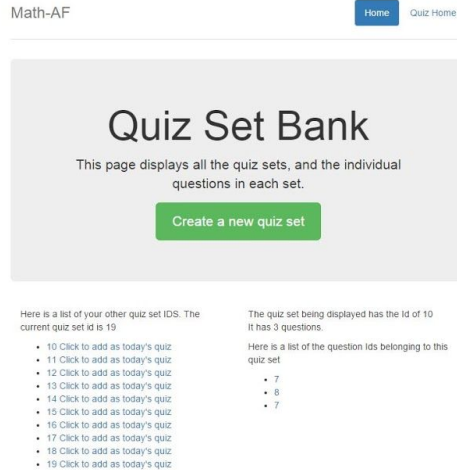
## 5.10 Question Creator (Teachers)

The screenshot shows the 'Question Creator' interface for 'Math-AF'. At the top, there are navigation links: 'Home', 'Quiz Home', and 'Questions Home'. The main heading is 'Question Creator' with the subtext 'Create your question here!'. Below this, there is a form with the following fields and options:

- Question:** A text input field.
- Upload Image:** A button with a file icon.
- Choose File:** A button with a file icon.
- Answer 1:** A text input field.
- Upload Image:** A button with a file icon.
- Choose File:** A button with a file icon.
- Answer 2:** A text input field.
- Upload Image:** A button with a file icon.
- Choose File:** A button with a file icon.
- Answer 3:** A text input field.
- Upload Image:** A button with a file icon.
- Choose File:** A button with a file icon.
- Answer 4:** A text input field.
- Upload Image:** A button with a file icon.
- Choose File:** A button with a file icon.
- Correct Answer:** A dropdown menu with four options: 'Answer 1', 'Answer 2', 'Answer 3', and 'Answer 4'.
- Submit:** A button.

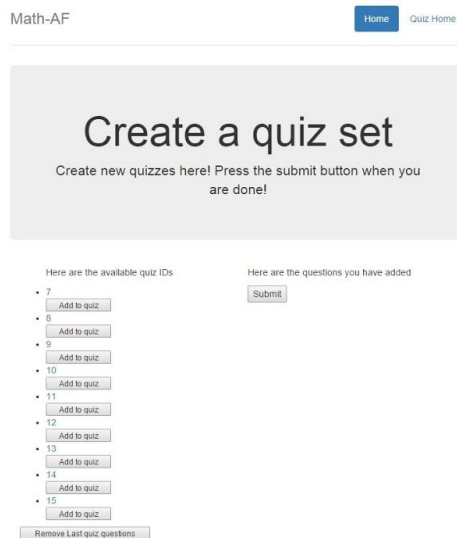
This is the screen teachers will use to create their questions. They will input their question text in the blanks, and if they choose to include images, they can by clicking the choose file button which will upload an image. This image will be displayed under the question it is associated with. At the bottom the teacher can choose which of the 4 answer is the correct one.

## 5.11 Quiz Set Bank (Teachers)



This page is designed for whenever the teacher wants to create a new quiz set, or set a new quiz as the current quiz for students. The page has 2 columns, the one of the left provides a list of all the created quiz sets. By clicking on the number the right column changes to show the questions in that quiz set. By clicking the question number on the right, it directs you back to the question bank displaying that question. If the teacher wants to set this quiz set as the current quiz, they must click on the “Click to add as today’s quiz” button next to the quiz set they want to set. There is also a large green button for the teacher to create a new quiz set.

## 5.12 Add Quiz Set (Teachers)



This page is used to link questions in a particular order to create a quiz set. The page is mainly comprised of two columns. The column on the left is all of the questions available. Like the question bank list, this list is also a scroll list, the scrollbar is not showing as there are not enough questions. By clicking the “add to quiz” button under each question, it will add the question to the new quiz set. The column on the right displays all the questions in this quiz set. By clicking the button at the bottom of the right column, it will remove the last question the user submitted in the quiz set, in case they miss clicked or want to change the order. By clicking the Submit button, it will add the new quiz set to the quiz set bank.

## 5.13 Student Results (Teachers)

Math AF
Home

### Student Scores

This page displays all of your quiz IDs and how your students did on these quizzes

Here is a list of your other quiz set IDs. The daily quiz id is 15. The quizset results being viewed is from quizSet 15

- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19

Here are a list of student results for this quiz

- Name: YiYang Jiang  
Correct Questions: 0/3  
Results: Q1= incorrect Q2= incorrect Q3= incorrect

Whenever the teacher wants to check their student’s results, this page displays all the students scores with all the quiz sets. The list of numbers is a list of quiz set IDs. If the teacher wants to find out the students scores for a particular quiz, the teacher will click on that quiz ID, and under it displays all the student’s results to the quiz. In this case, the student with the name of YiYang Jiang got none of the questions right. And under it will show which question he got right or wrong.

## **6.0 Unimplemented features**

### **6.1 Practice Function**

One of the other main functions we had planned to do was the practice function. In this function, students would have the ability to find questions on certain units they wished to practice and do those questions. This function was later discarded as there was not enough time allocated towards this functionality.

### **6.2 Competitive Function**

Another main function we had planned was the ability for players to compete with each other on quizzes, (similar to quizup). Players would be able to  
However, with the lack of time and lack of programming knowledge, this idea was also scrapped.

### **6.3 Android Application**

After consulting with the client, Ms.D, she made it clear to us that a large number of her students do not have a android smartphone, this would cause the android application to be usable for only around 60% of her class. Because of this, we decided to create a mobile friendly website that can be accessed regardless of what platform. This change also saved the project a lot of time, the majority of which was spent on bug fixes.

### **6.4 Miscellaneous Features**

- Achievements
- Profile Picture
- Forgot password
- Change Password
- Renaming quiz sets and questions
- Student profiles
- Viewing of student profiles
- Class rankings
- Categorized Questions and Quiz Sets
- Completely blue colour scheme

## **7.0 Visual References**

7.1 BootStrap for website templates.

<http://getbootstrap.com/getting-started/>

7.2 Iconj for favicon.

<http://www.iconj.com/>

The html pages were taken from bootstrap.com's free open sourced templates.

The M icon displayed at the next to the title of the page is taken from Iconj.com, a website for animated and picture favicons.