

**Mini Project report on**  
**MLOps based Quiz Performance Improver Application**

**by**

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**Department of Master of Computer Applications**  
**Sardar Patel Institute of Technology**  
**Autonomous Institute Affiliated to Mumbai University**  
**2021-22**

## **CERTIFICATE OF APPROVAL**

**This is to certify that the following students**

**MAHESH KUTTY [2020510040]**

**JAGANNATH PATTA [2020510051]**

**Have satisfactorily carried out work on the project entitled**  
**“ MLOps based Quiz Performance Improver Application”**  
**Towards the fulfillment of a mini project during the year 2021-22.**

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**Project Guide**  
**(Prof. Pallavi Thakur)**

## **PROJECT APPROVAL CERTIFICATE**

**This is to certify that the following students**

**MAHESH KUTTY [2020510040]**

**JAGANNATH PATTA [2020510051]**

**Have successfully completed the Project report on  
“ MLOps based Quiz Performance Improver Application”,  
which is found to be satisfactory and is approved**

**At**

**SARDAR PATEL INSTITUTE OF TECHNOLOGY,  
ANDHERI (W), MUMBAI.**

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**INTERNAL EXAMINER**

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**Head of Department  
(Dr. Pooja Raundale)**

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**EXTERNAL EXAMINER**

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**Principal  
(Dr. B. N. Chaudhari)**

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## **ABSTRACT**

Generic Quiz WebApp for generating and recommending quizzes(set of questions) based on Student's performance in previous quizzes. QuizBuddy is a platform that provides personalized quizzes for the JEE/NEET exam based on student performance and ability. We take forward the initiative of the government of India which is based on a new national education policy. This application helps students better prepare for examinations by providing personalized quizzes and tracking their performance grades. Our model takes care of every data point to better understand student learning patterns get to give a personalized quiz experience. Our Models will be working on the data periodically to recategorize the questions we have and the students performance.

### **Some Major Incorporations:**

1. ML Models for categorizing the Questions periodically.
2. Tried to Combine Machine Learning and Development (MLOps).

### **The system comprises 3 major modules.**

- Admin
  - i. Manage Users ( Student)
  - ii. Manage Class
  - iii. Manage Subjects
  - iv. Manage Chapters
  - v. Manage Questions
- Student
  - i. Register User
  - ii. Attempt Question
  - iii. Attempt Quiz
  - iv. View results
  - v. Show Performance
- System
  - i. Generating Quiz
  - ii. Evaluating Results
  - iii. ML predictions

# **Objectives**

1. Personalized Quiz based on student performance.
2. Easy setup
  - Setting question paper, conducting an exam, grading exam
    - 2.1. BYOD (Bring Your Own Device) model, WiFi infrastructure
      - 2.1.1. Conducting exams made easy
    - 2.2. User-friendly web interface
      - 2.2.1. Setting questions made easy
    - 2.3. Auto-graded objective exams
      - 2.3.1. Correcting exams made easy
3. MLOps
  - 3.1. ML Models for categorizing the Questions periodically.
  - 3.2. ML Models for categorizing the Students periodically.
  - 3.3. Continuous Statistical Analysis of grades.

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# 1. Introduction

## 1.1 Problem Definition

Here are the problems.

- Absence of guided learning platform in the edutech market.
  - Weekly quizzes (that count towards grade) essential
  - Continuous Analysis of grades.
  - Generating quizzes based on the current performance of the student.
  - Questions will be periodically recategorized as the low moderate and hard difficulty types.
- Categorizing every student in a single category.
  - Demotivates Students; because every student has a different learning style and ability.
  - So categorizing them as Fast, Average, and Slow Learners.

## 1.2 Objective and Scope

- An Examination Website.
- Easy setup
  - Setting question paper, conducting exam, grading exam
  - BYOD (Bring Your Own Device) model, WiFi infrastructure
    - Conducting exams made easy
  - User-friendly web interface
    - Setting questions made easy
  - Auto-graded objective exams
    - Correcting exams made easy
- MLOps
  - ML Models for categorizing the Questions periodically.
  - ML Models for categorizing the Students periodically.
  - Continuous Statistical Analysis of grades.

## 1.3 System Requirements

### **1.3.1 Hardware Requirements:**

- Both Desktop and Mobile devices will be compatible for working with WebApp.
- If going for a private server to host:
  - i5 Processor Based Computer or higher
  - Memory: 4 GB RAM
  - Hard Drive: 250 GB
  - Internet Connection

### **1.3.2 Software Requirements:**

- Web Browser to run.
  - Server with Linux operating system
  - Apache for security of the application.
-

## **2. Tools and Techniques**

### **2.1. Tools Used**

- Visual Studio Code Editor
- Sqlite DB Browser
- Draw.io for Uml diagrams
- Gantt Project for gantt chart

### **2.2. Techniques Used**

- Python FastAPI Framework
- React for Frontend
- MYSQL Database
- Javascript and Ajax at some places

### **2.3. Project Management Plan**

#### **2.3.1. Tasks**

The major tasks are:

- Planning
  - Questionnaires
  - Requirements Gathering
- Analysis
  - Study of existing project
  - Technology estimations
- Designing
  - Database design
  - UI design
- Implementation
  - Teacher Module
  - Student Module
  - Admin Module
- Testing & Documentation
  - Manual Integration Testing
  - Documentation

### **3. Project Analysis and Design**

#### **3.1. Methodologies Accepted**

Methodology involves dividing software development work into distinct stages and coming up with tasks or activities aimed at achieving better planning and time management. It is considered a trivial part of the systems development life cycle.

##### **Waterfall Model:**

Waterfall model is preferable for our application as it has provision for changes and the changes can be implemented in the maintenance phase. This is because the waterfall model is simple and easy to understand and use for the developer and the other users. The approach taken was to treat the whole process of modelling software in a sequential order, the outcome or output of the previous step would serve as the input for the next step. This model also allows for early design changes and places emphasis on requirement and design before writing any single line of code which ensures minimal time wastage and effort in design changes. Our project is not very complex and has functionalities which can be considered as basic and hence the waterfall model is the most suitable model. In this system, initially we decided the problem definition. Once the problem definition was done we started with all the requirement specifications for the same. Since we are working on a new technology, we had to give some time to learning ionic. At the same time we started with the planning and design of the system. The architecture was planned while learning ionic. The design and basic schema was also decided while learning Laravel. After all the planning work, we started the implementation where when a few modules were functional we also started with testing. Testing and debugging was done along with the implementation phase. The last phase is just about fixing some small changes or debugging the errors.

#### **3.2. Use case Diagram and Specifications**

<b>UseCase ID :</b>	UC_1
<b>UseCase Name :</b>	ML Based Quiz Application
<b>Created By :</b>	Jagannath Patta and Mahesh Kutty
<b>Date Created :</b>	27 - May - 2022

<b>Actors :</b>	Admin and Student
<b>Description of use cases :</b>	<ul style="list-style-type: none"> <li>● <b>Register / Login</b> : To Access the website every user has to register first and then login.</li> <li>● <b>Manager Users</b> : Admin creates, update and delete Users.</li> <li>● <b>Manage Class</b>: Admin creates every new Class with some details, Updates class, and Delete class.</li> <li>● <b>Manage Subject</b> : Admin creates subject linked to one Class with some details, Update subject, and Delete subject.</li> <li>● <b>Manage Chapter</b> : Admin creates chapter linked to one Subject with some details, Update chapter, and Delete chapter.</li> <li>● <b>Manage Questions</b> : Admin creates questions linked to one Chapter , Edit questions, and Delete questions.</li> <li>● <b>Evaluate Results</b> : The system Calculates marks according to the answers submitted by the students.</li> <li>● <b>Generate Quiz</b> : Students generate quizzes with the current performance level, System sets random questions in that quiz.</li> <li>● <b>Appear Quiz</b> : Students Attempt a quiz in a particular time frame.</li> <li>● <b>Answer Question</b> : Students answer questions in the quiz.</li> <li>● <b>View Result</b> : Students can view results at the end of the quiz.</li> </ul>
<b>Preconditions :</b>	<ul style="list-style-type: none"> <li>● Every user must be registered.</li> <li>● To appear for a quiz student must be enrolled in a course prior and in a quiz in the classroom.</li> </ul>
<b>Postconditions :</b>	<ul style="list-style-type: none"> <li>● If the question is of type long answer then only the evaluation from the teacher end is needed.</li> </ul>
<b>Includes :</b>	<ul style="list-style-type: none"> <li>● Generate Quiz → Includes → Appear Quiz → Includes → Answer Question → Includes → Evaluate Results.</li> </ul>
<b>Assumptions :</b>	NA

**Table 3.1 Use-Case Specifications**

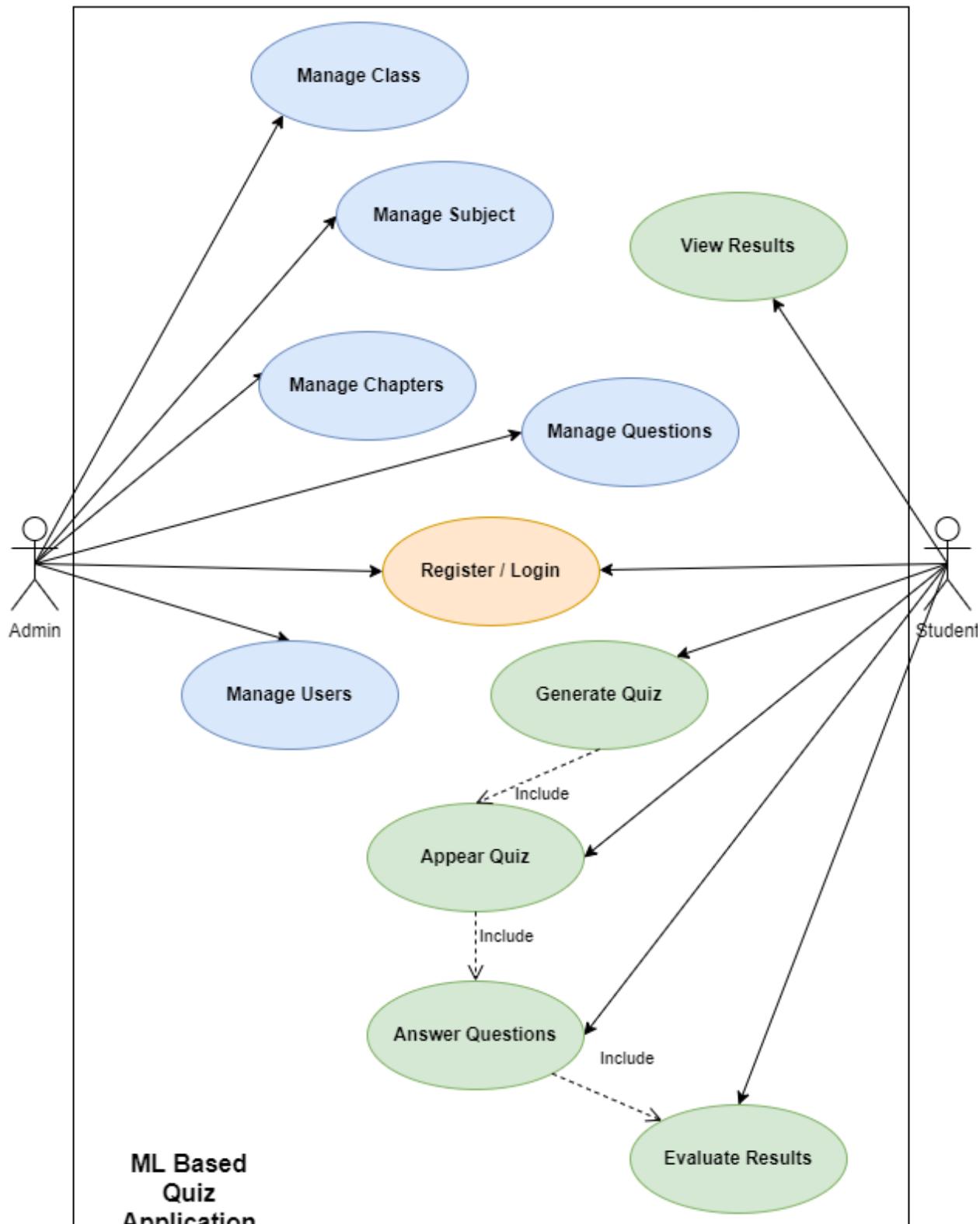


Fig. 3.1 Use Case Diagram

### 3.3. Activity Diagram and Specifications

To identify and implement the activity diagram notations from a given case study.

Step	Admin	System	Student	Business Rules
1	Login		Login	BR_1
2		Validates		BR_2
3	Create Class			BR_3
4	Update Class			BR_4
5	Delete Class			BR_5
6			Search Class	BR_6
7	Enrollment Key			BR_7
8			Enroll Course	BR_8
9		Check Key		BR_9
10	Create Subject / Chapters			BR_10
11	Update Subject / Chapters			BR_11
12	Delete Subject / Chapters			BR_12
13	Create Question			BR_13
14	Update Question			BR_14
15	Delete Question			BR_15
16			Search Quiz	BR_16
17	Enrollment Key			BR_17
18			Enroll Quiz	BR_18
19		Check Key		BR_19
20			Appear Quiz	BR_20

21			Upload Answer	BR_21
22	Evaluate Answers			BR_22
23		Marks Allocation		BR_23
24		Statistical Calculations		BR_24

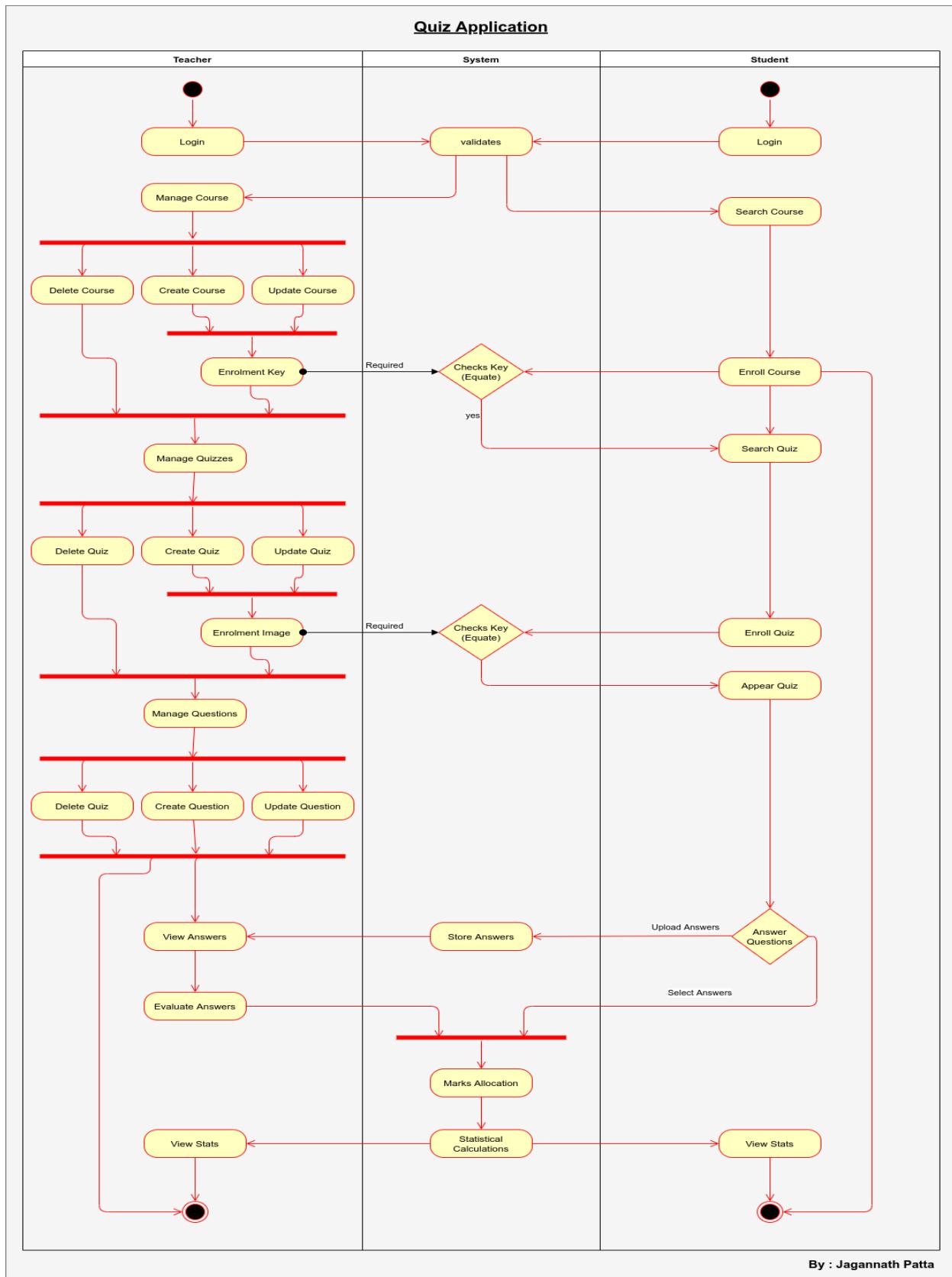
**Table 3.2 Activity diagram Business Rules**

To implement activity diagram specification.

ID	Business Rules	Business Rule Description
BR_1	Login	Mandatory: Username Password
BR_2	Validates	Give Privileges as per role. Based on BR_1
BR_3	Create Class	If BR_2 role is Admin: Class Name Academic Year Course Key
BR_4	Update Class	If BR_2 role is Admin and If BR_3 Class exists: Edits in the Class Details
BR_5	Delete Class	If BR_2 role is Admin and If BR_3 Class exists: Delete the class and its entire Content.
BR_6	Search Class	If BR_2 role is Student: By Class Name
BR_7	Enrollment Key	Key assigned to BR_3 by if BR_2 role is Admin.
BR_8	Enroll Class	if BR_2 role is Student using key of BR_7
BR_9	Check Key	By If keys BR_8 and BR_7 match then the course BR_3 is enrolled.
BR_10	Create Subject / Chapters	If BR_2 role is Admin: Subject Name Reference Course BR_3
BR_11	Update Subject / Chapters	If BR_2 role is Admin and If BR_10 Subject / Chapters exists: Edits in the Subject / Chapters Details

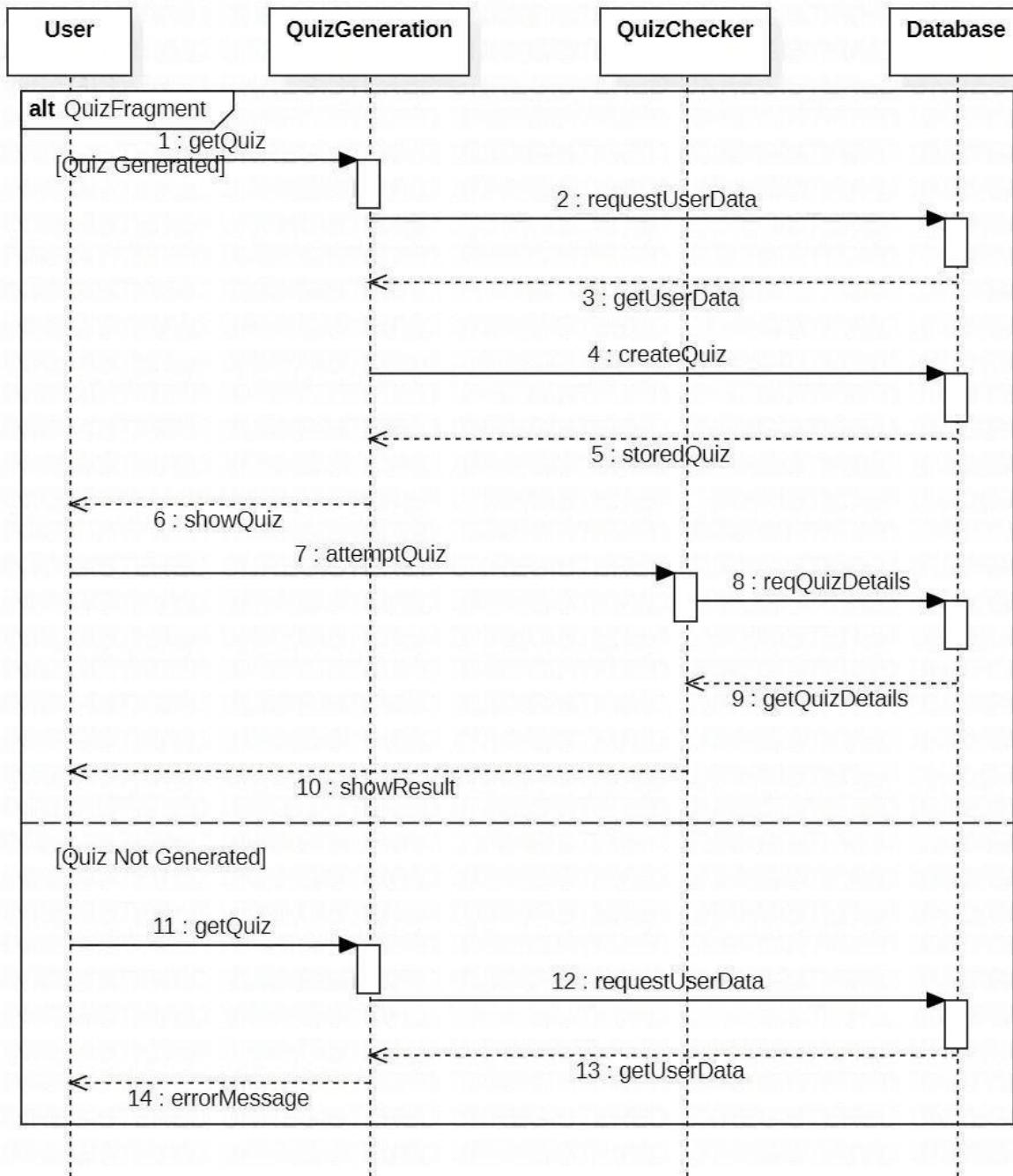
BR_12	Delete Subject / Chapters	If BR_2 role is Admin and If BR_10 Subject / Chapters exists: Delete the Subject / Chapters and its entire Content.
BR_13	Create Question	If BR_2 role is Admin: Reference Course BR_3 Reference Quiz BR_10 Question Text Question type Options Answer Negative Marks Marks
BR_14	Update Question	If BR_2 role is Admin and If BR_13 Question exists: Edits in the Question Details
BR_15	Delete Question	If BR_2 role is Admin and If BR_13 Question exists: Delete the Question and its entire Content.
BR_16	Search Quiz	If BR_2 role is Student: By Quiz Name
BR_17	Enrollment Key	Image Key assigned to BR_10 by if BR_2 role is Teacher.
BR_18	Enroll Quiz	if BR_2 role is Student using key of BR_17
BR_19	Check Key	By If keys BR_18 and BR_17 match then the Quiz BR_10 is enrolled.
BR_20	Appear Quiz	If BR_2 role is Student: Within a valid time period.
BR_21	Upload Answer	By If BR_2 role is Student: Reference Course BR_3 Reference Quiz BR_10 Reference Question BR_13
BR_22	Evaluate Answers	By If BR_2 role is Teacher: Manually corrected.
BR_23	Marks Allocation	By If BR_2 role is Teacher for few questions and for some questions system will.
BR_24	Statistical Calculations	By System

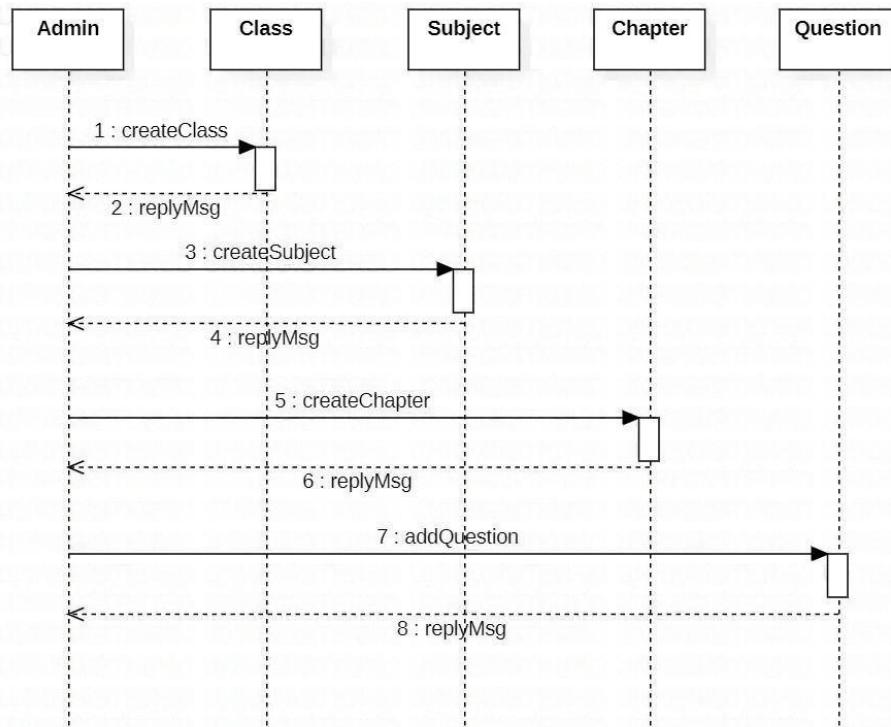
**Table 3.3 Detailed Activity Diagram Business Rules.**



**Fig. 3.2 Activity Diagram**

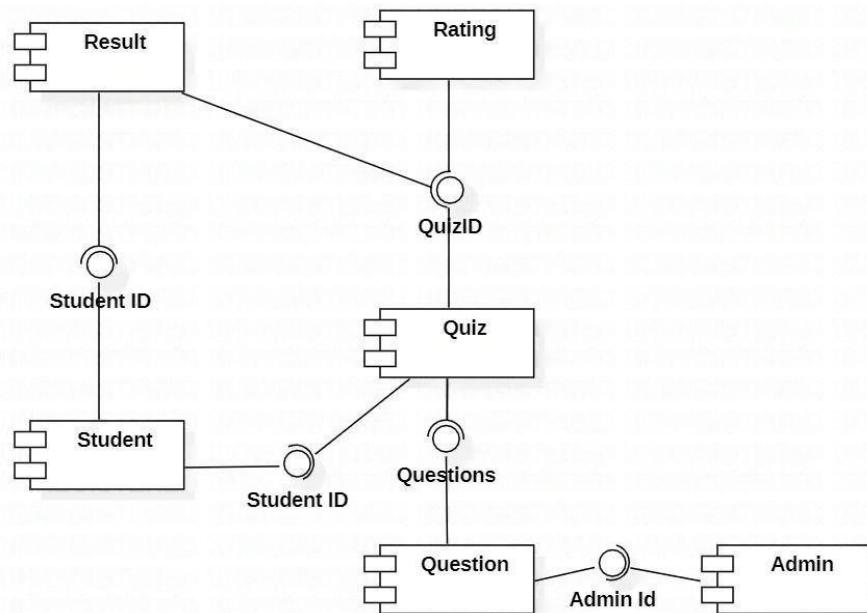
### 3.4. Sequence Diagram



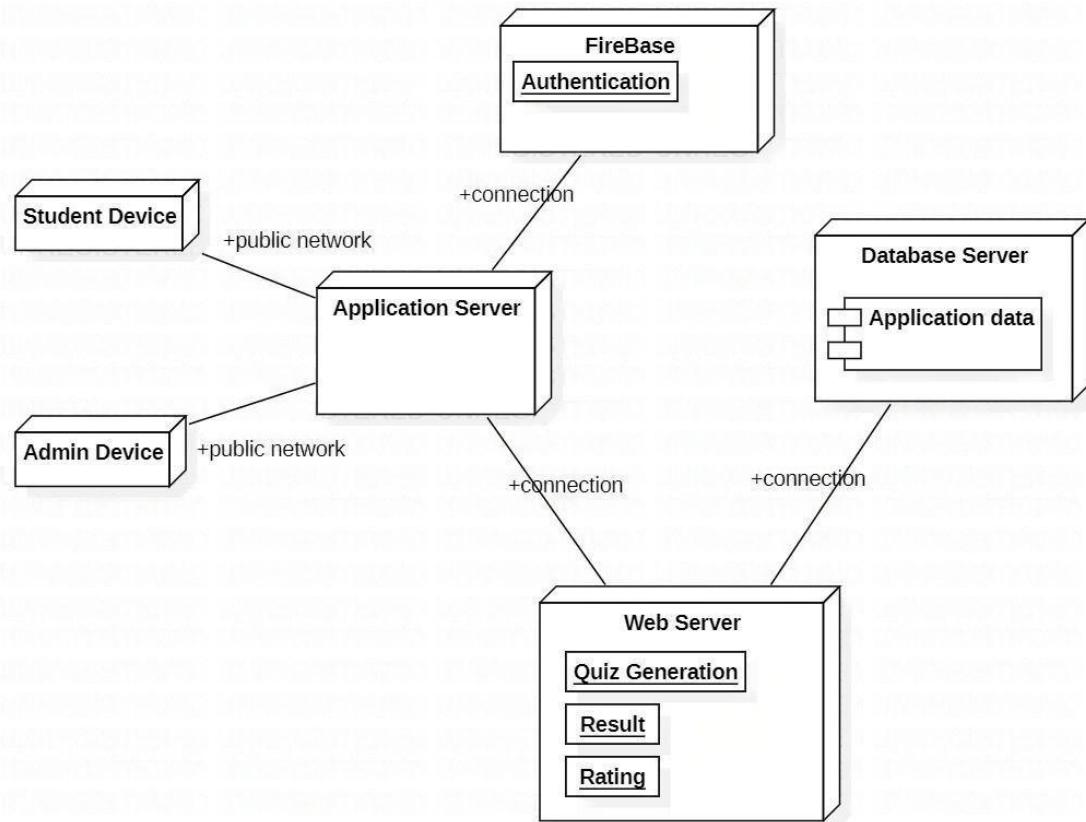


**Fig. 3.3 Sequence Diagram**

### 3.5. Component and Deployment Diagram



**Fig. 3.4 Component Diagram**



**Fig. 3.5 Deployment Diagram**

### 3.6. ER Diagram

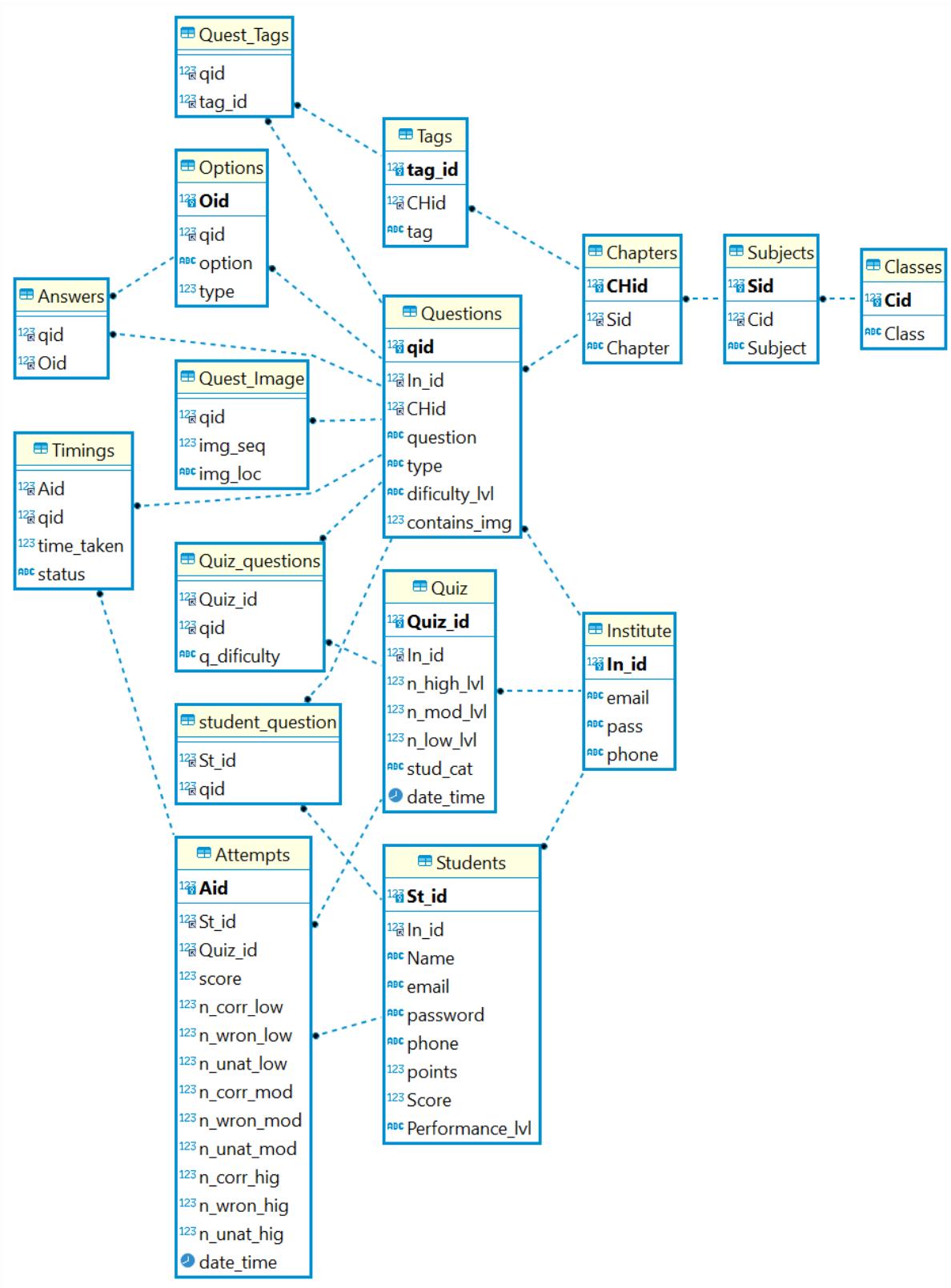
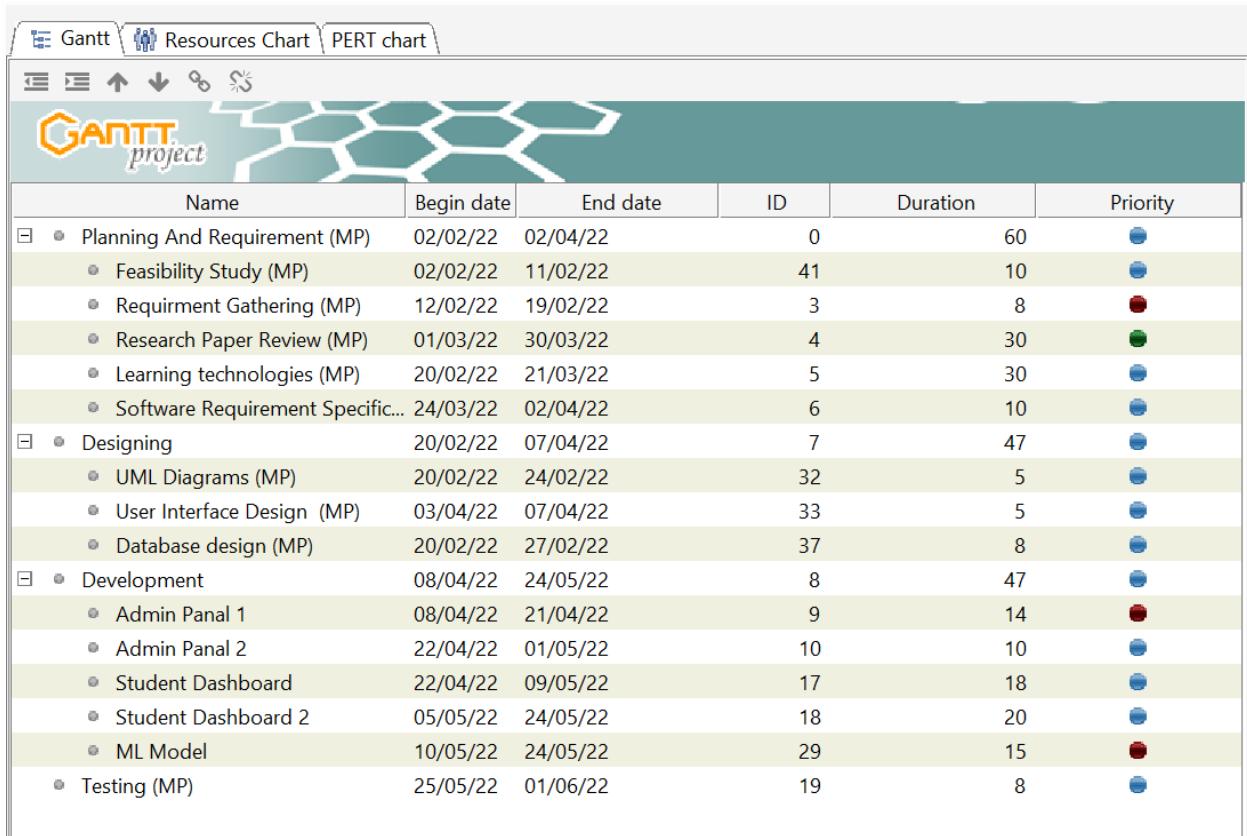


Fig. 3.6 ER Diagram

### 3.7. Gantt Chart



The screenshot shows a Gantt chart application window. At the top, there are three tabs: 'Gantt' (selected), 'Resources Chart', and 'PERT chart'. Below the tabs is a toolbar with icons for zoom, search, and other functions. The main area features a header 'GANTT project' with a stylized hexagonal background. A table lists tasks with columns for Name, Begin date, End date, ID, Duration, and Priority. Tasks are grouped under categories like Planning And Requirement, Designing, Development, and Testing. Some tasks have sub-tasks listed under them.

Name	Begin date	End date	ID	Duration	Priority
Planning And Requirement (MP)	02/02/22	02/04/22	0	60	●
Feasibility Study (MP)	02/02/22	11/02/22	41	10	●
Requirement Gathering (MP)	12/02/22	19/02/22	3	8	●
Research Paper Review (MP)	01/03/22	30/03/22	4	30	●
Learning technologies (MP)	20/02/22	21/03/22	5	30	●
Software Requirement Specific...	24/03/22	02/04/22	6	10	●
Designing	20/02/22	07/04/22	7	47	●
UML Diagrams (MP)	20/02/22	24/02/22	32	5	●
User Interface Design (MP)	03/04/22	07/04/22	33	5	●
Database design (MP)	20/02/22	27/02/22	37	8	●
Development	08/04/22	24/05/22	8	47	●
Admin Panel 1	08/04/22	21/04/22	9	14	●
Admin Panel 2	22/04/22	01/05/22	10	10	●
Student Dashboard	22/04/22	09/05/22	17	18	●
Student Dashboard 2	05/05/22	24/05/22	18	20	●
ML Model	10/05/22	24/05/22	29	15	●
Testing (MP)	25/05/22	01/06/22	19	8	●

Fig 3.7 Analyze Tasks and Sub Tasks.

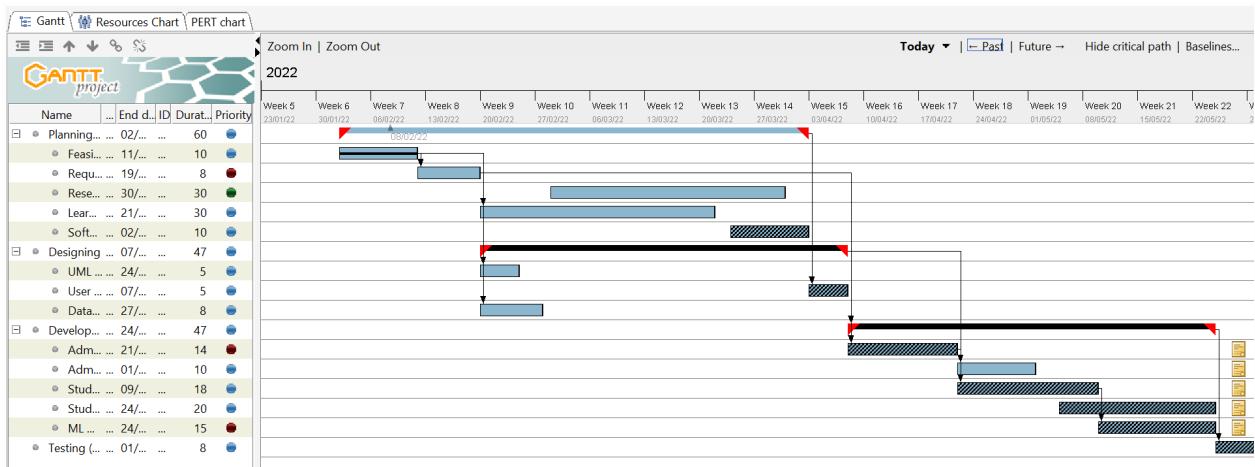


Fig 3.8 Gantt chart with critical Path.

### 3.8. Pert Chart

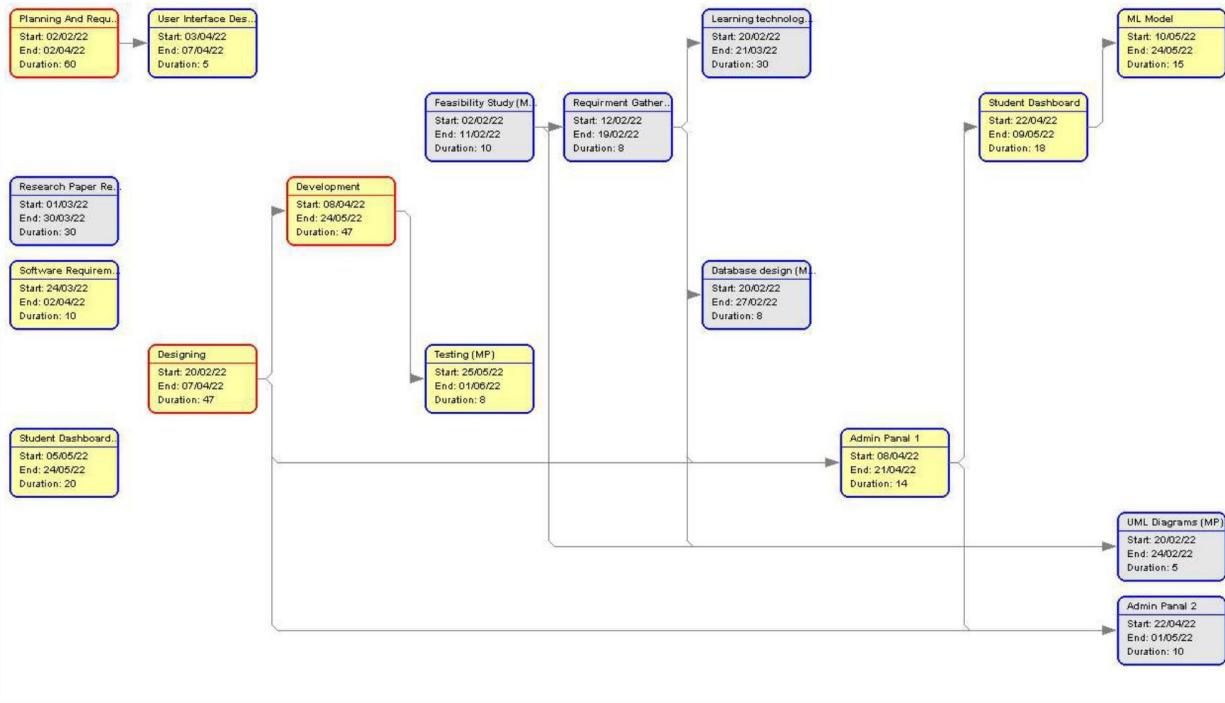
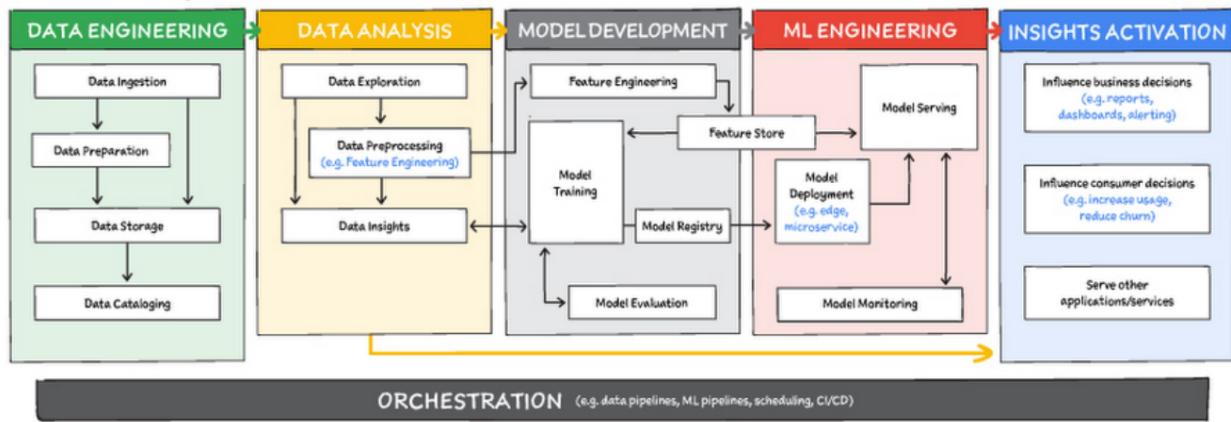


Fig 3.9 PERT chart



## 4. Project Implementation and testing

### 4.1. Snapshots of the WebApp

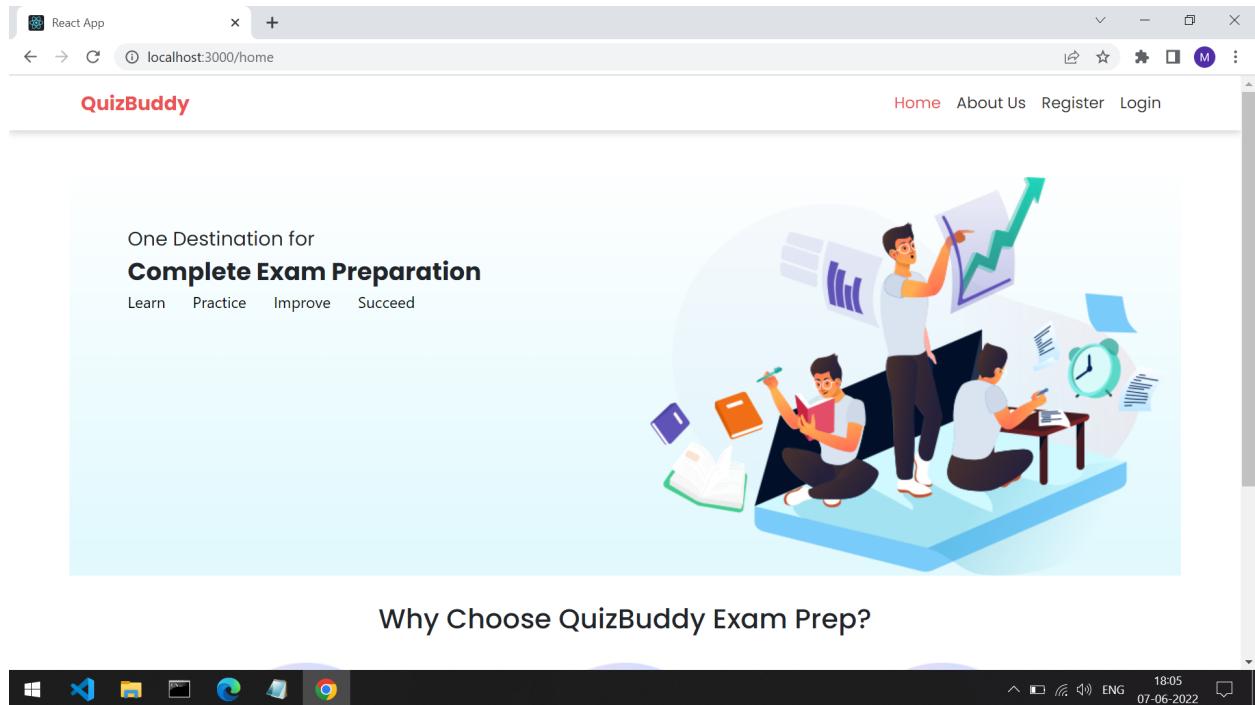


Fig 4.1 Home Page

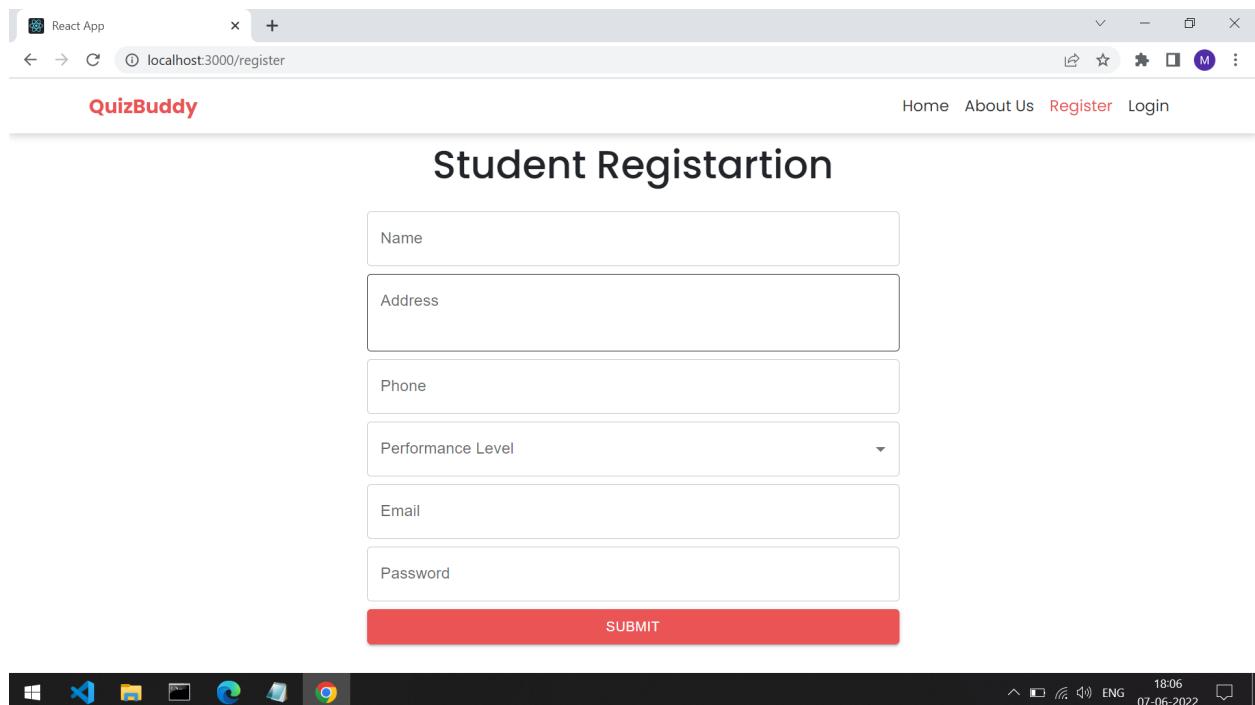
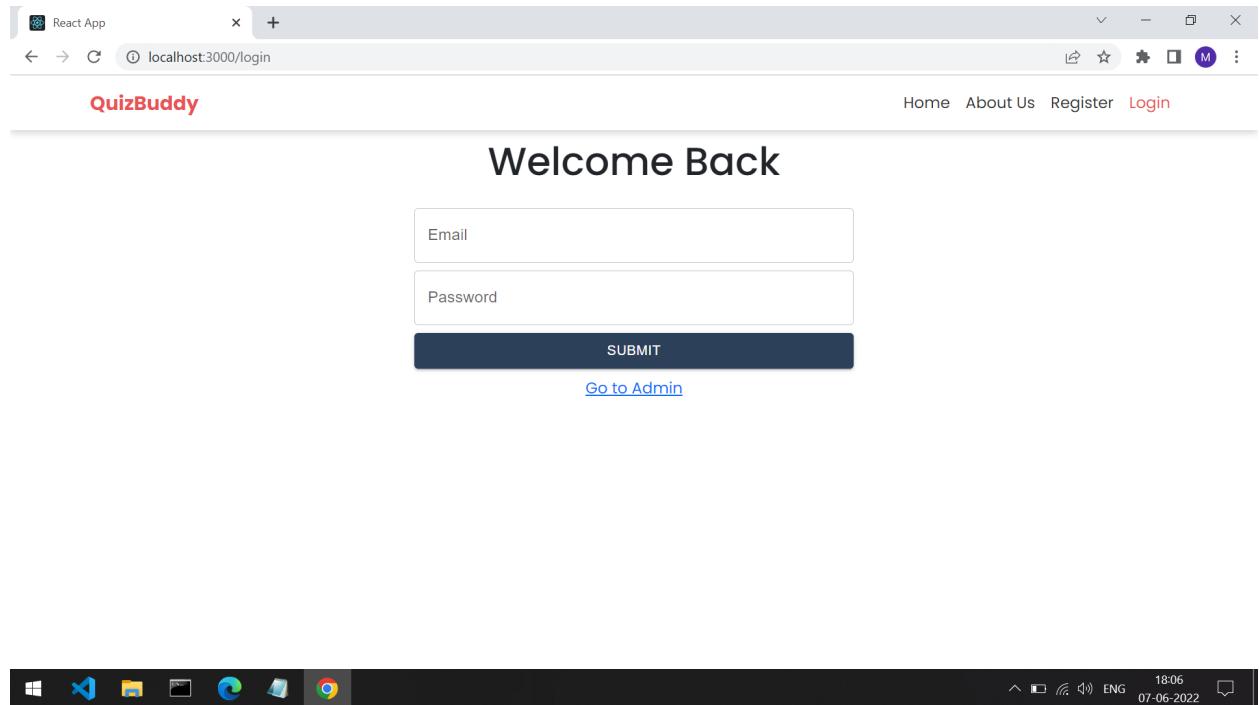


Fig 4.2 Registration Page



**Fig 4.3 Login Page**

#### 4.1.1 Admin Module

The screenshot shows a web browser window titled "React App" with the URL "localhost:3000/admin/classes". The page has a sidebar with "Admin" navigation items: Home, Classes (which is selected and highlighted in pink), Subjects, Chapters, and Questions. The main content area is titled "Classess" and displays a table of classes. The table has columns for "Sr no.", "Class", and "Action". The data in the table is as follows:

Sr no.	Class	Action
1	11th Science	
2	12th science	
3	11th commerce	
4	12 arts	

The system tray at the bottom shows standard icons and a timestamp of 18:07 on 07-06-2022.

**Fig 4.4 Admin Dashboard Page**

The screenshot shows a web application interface titled 'React App' running on 'localhost:3000/admin/classes'. The left sidebar, titled 'Admin', contains navigation links: 'Home', 'Classes' (which is highlighted in pink), 'Subjects', 'Chapters', and 'Questions'. The main content area is titled 'Classess' and displays a table of classes. The table has columns: 'Sr no.', 'Class', and 'Action'. The data in the table is as follows:

Sr no.	Class	Action
1	11th Science	
2	12th science	
3	11th commerce	
4	12 arts	

The status bar at the bottom shows system icons and the date/time: '18:07 07-06-2022'.

**Fig 4.5 Classes Page ‘List of classes created by Admin.’**

The screenshot shows a web application interface titled 'React App' running on 'localhost:3000/admin/subjects'. The left sidebar, titled 'Admin', contains navigation links: 'Home', 'Classes', 'Subjects' (which is highlighted in pink), 'Chapters', and 'Questions'. The main content area is titled 'Subjects' and displays a table of subjects. The table has columns: 'Sr no.', 'Class', 'Subjects', and 'Action'. The data in the table is as follows:

Sr no.	Class	Subjects	Action
1	11th Science	maths	

The status bar at the bottom shows system icons and the date/time: '18:09 07-06-2022'.

**Fig 4.6 Subject Page ‘List of subjects created by admin.’**

The screenshot shows a web application interface for managing chapters. On the left, a dark sidebar menu lists 'Home', 'Classes', 'Subjects', 'Chapters' (which is highlighted in pink), and 'Questions'. The main content area is titled 'Chapters' and displays a table with 10 rows of data. The columns are 'Sr no.', 'Class', 'Subjects', and 'Chapters'. The data is as follows:

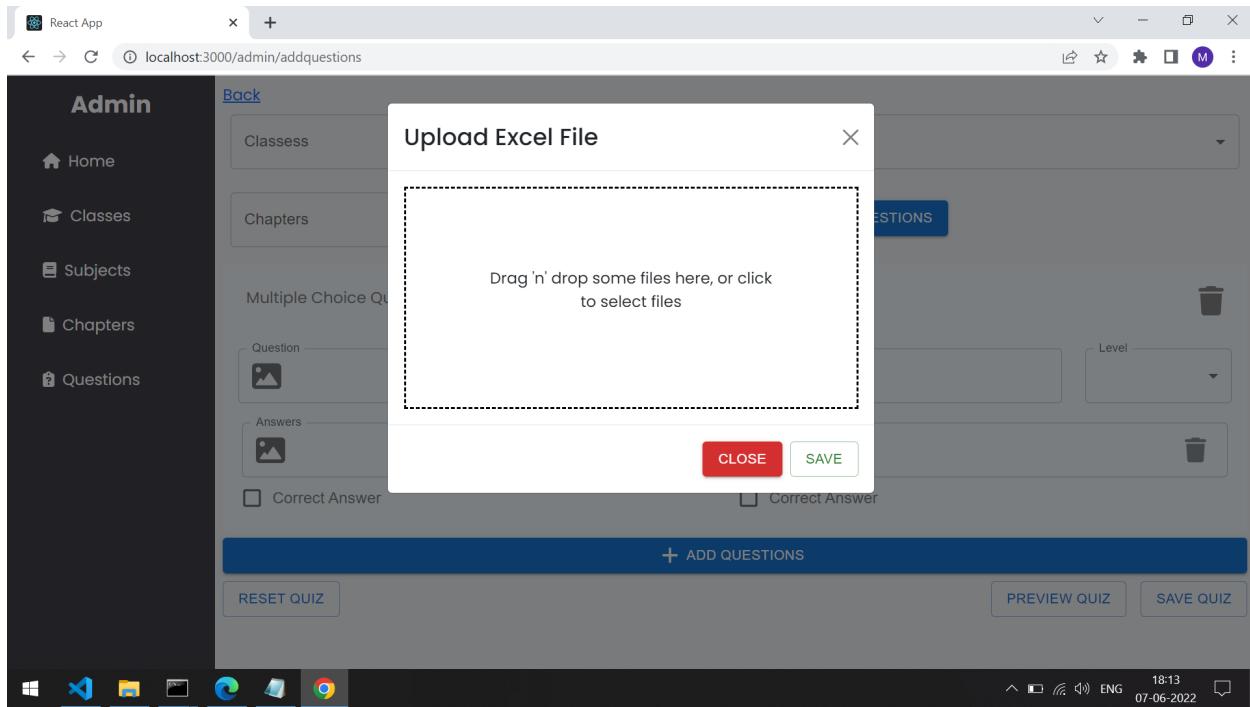
Sr no.	Class	Subjects	Chapters
1	11th Science	maths	calculus
2	11th Science	maths	Sets, Relations and Functions
3	11th Science	maths	Complex Numbers
4	11th Science	maths	Equations and Inequalities
5	11th Science	maths	Sequences and Series
6	11th Science	maths	Permutations and Combinations
7	11th Science	maths	Matrices and Determinants
8	11th Science	maths	Trigonometric Identities and Equations
9	11th Science	maths	Inverse Trigonometric Functions
10	11th Science	maths	Limits, Continuity and Differentiability

Fig 4.7 Chapters Page ‘List of subjects created by admin.’

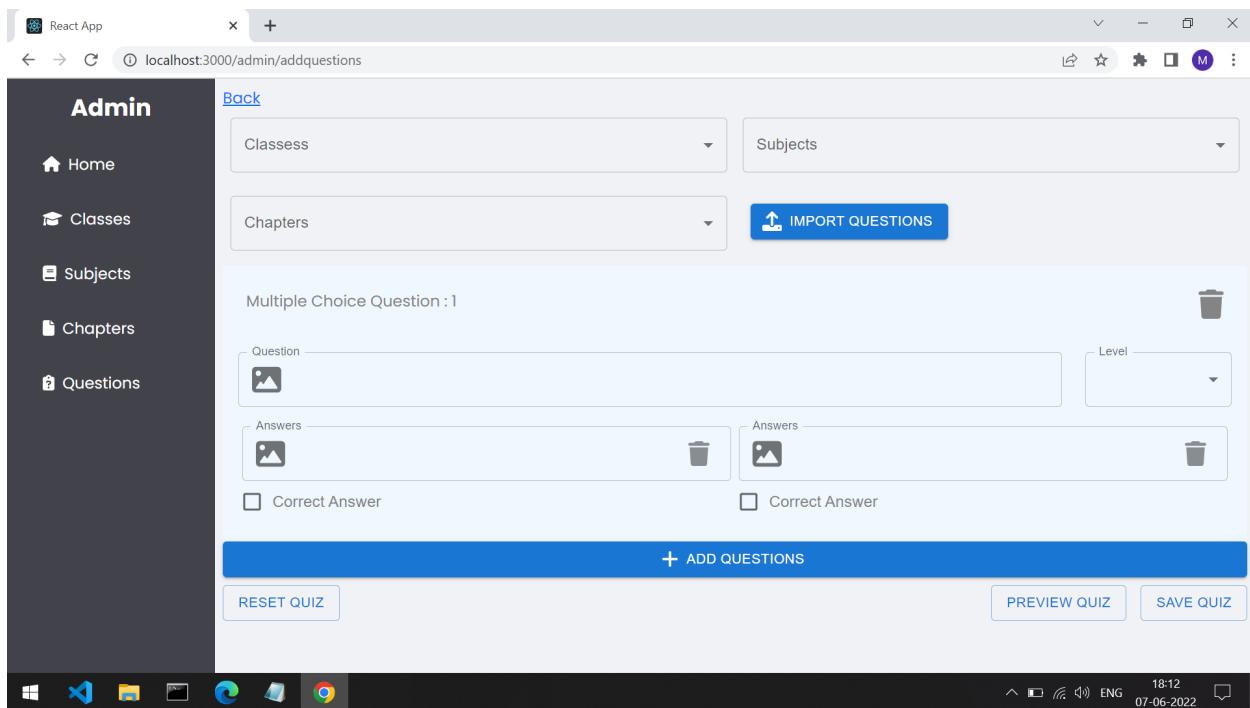
The screenshot shows a web application interface for managing questions. On the left, a dark sidebar menu lists 'Home', 'Classes', 'Subjects', 'Chapters', and 'Questions' (which is highlighted in pink). The main content area is titled 'Questions' and displays a table with 5 rows of data. The columns are 'Sr no.', 'Name', 'Class', 'Subject', 'Difficulty', and 'Action'. The data is as follows:

Sr no.	Name	Class	Subject	Difficulty	Action
1	If $X = \{4n - 3n - 1 : n \in \mathbb{N}\}$ and $Y = \{g(n-1) : n \in \mathbb{N}\}$ , where $\mathbb{N}$ is the set of natural numbers, then $X \cup Y$ is equal to	11th Science	maths	Medium	
2	The total number of subsets of a finite set A has 56 more elements than the total number of subsets of another finite set B. What is the number of elements in the set A?	11th Science	maths	Easy	
3	The set $A = \{x : 1 \leq x + 3 \leq 7\}$ is equal to the set	11th Science	maths	Easy	
4	The number of students who take both the subjects Mathematics and Chemistry is 30. This represents 10% of the enrolment in Mathematics and 12% of the enrolment in Chemistry. How many students take atleast one of these two subjects?	11th Science	maths	Medium	
5	There is a group of 265 persons who like either singing or dancing or painting. In this group, 200 like singing, 110 like dancing and 55 like painting. If 60 persons like both singing and dancing, 30 like both singing and painting and 10 like all three activities, then the number of persons who like only dancing and	11th Science	maths	Medium	

Fig 4.8 Questions Page ‘List of questions added by Admin.’



**Fig 4.9 Upload excel file for questions**



**Fig 4.10 Add Question Page**

## 4.1.2 Student Module

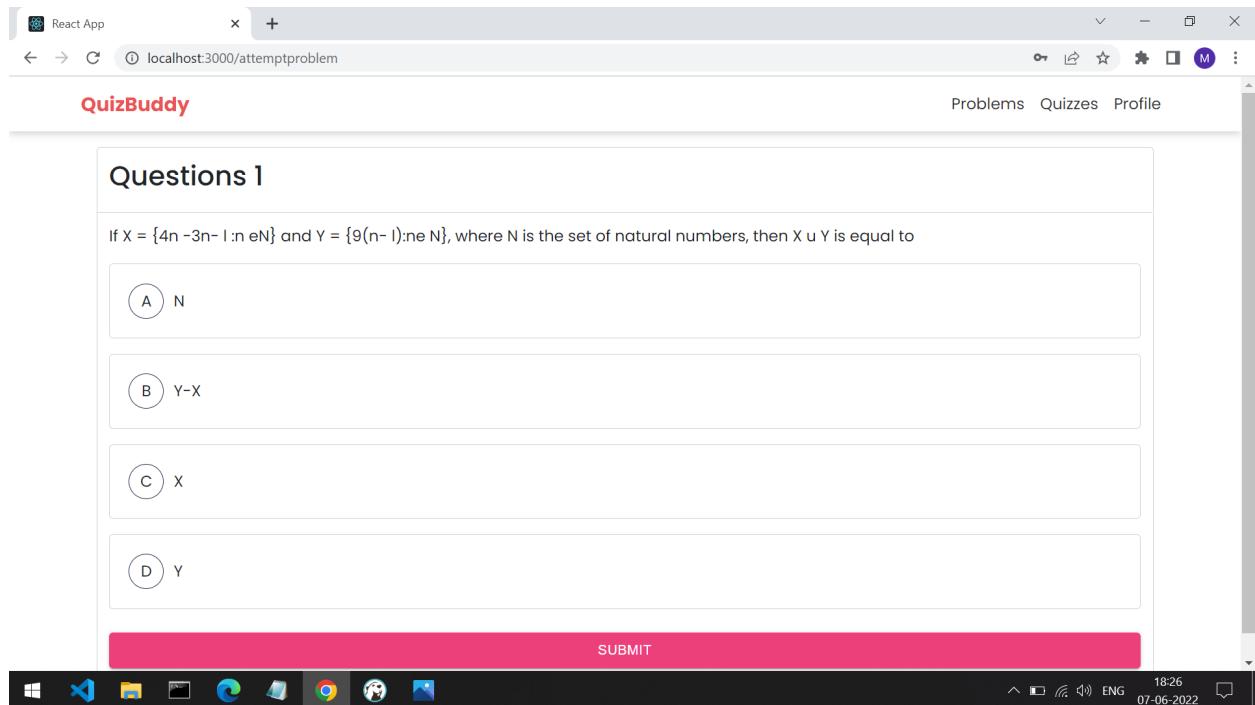
The screenshot shows a web browser window titled "QuizBuddy" with the URL "localhost:3000/problems". The page has a header with "Problems", "Quizzes", and "Profile" links. Below the header is a "Filter by" section with dropdown menus for "Classes", "Subjects", "Chapters", and "Difficulty". The main content area displays a table with four rows of math problems. Each row includes the problem number, name, class, subject, and difficulty level.

Sr no.	Name	Class	Subject	Difficulty
1	If $X = \{4n - 3n - 1 : n \in N\}$ and $Y = \{9(n - 1) : n \in N\}$ , where $N$ is the set of natural numbers, then $X \cup Y$ is equal to	11th Science	maths	Medium
2	The total number of subsets of a finite set A has 56 more elements than the total number of subsets of another finite set B. What is the number of elements in the set A?	11th Science	maths	Easy
3	The set $A = \{x : 1 \leq x + 3 \leq 7\}$ is equal to the set	11th Science	maths	Easy
4	The number of students who take both the subjects Mathematics and Chemistry is 30. This represents 10% of the enrolment in Mathematics and 12% of the enrolment in Chemistry. How many students take atleast one of these two subjects?	11th Science	maths	Medium

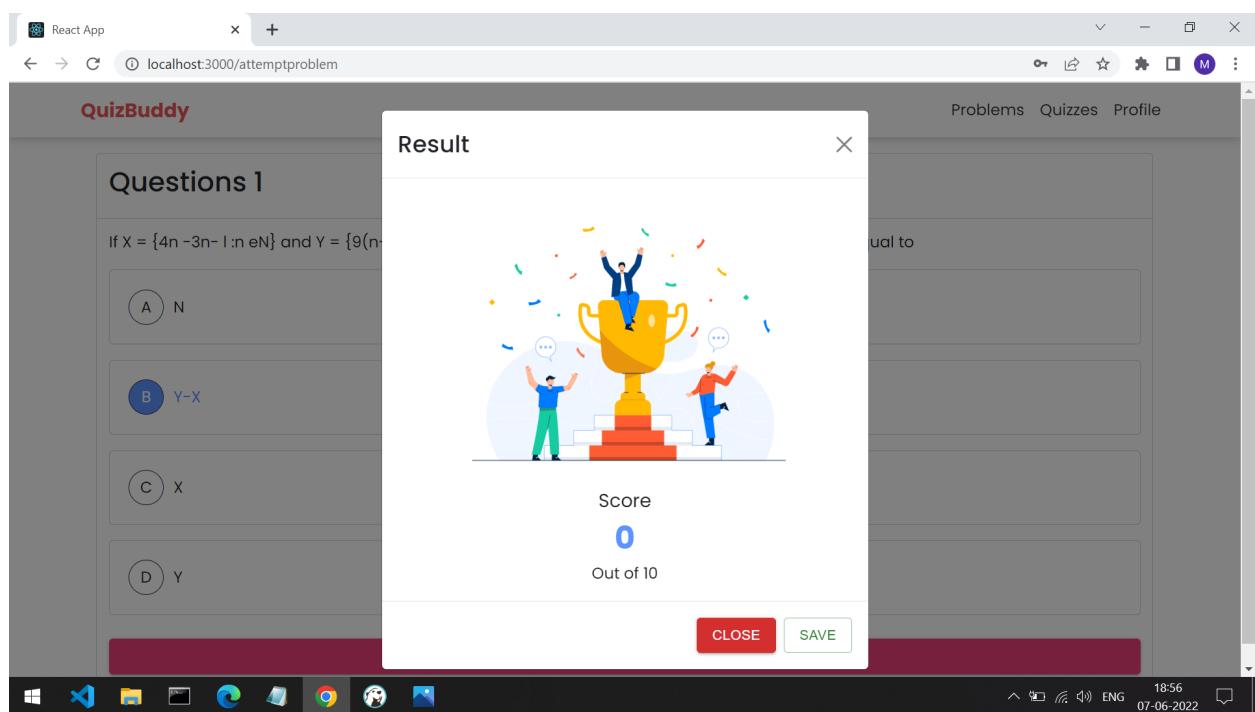
**Fig 4.11 Student Dashboard Page**

This screenshot is identical to Fig 4.11, showing the QuizBuddy Student Dashboard Page with a list of math problems. The browser window title is "localhost:3000/problems" and the URL bar shows "localhost:3000/problems". The page layout and data in the table are the same as in the previous screenshot.

**Fig 4.12 Question Page ‘List of Problems to Attempt .’**



**Fig 4.13 Question Page ‘Question details with options’**



**Fig 4.14 Question Page ‘Result of single problem’**

The screenshot shows a web browser window titled 'React App' with the URL 'localhost:3000/dashboard'. The page is titled 'QuizBuddy' and features a banner for 'JEE/NEET Quiz: Start Free Quizzes for JEE/NEET & other state CET exams 2022. Practice free online maths, chemistry, biology with multiple choice answers.' Below the banner, there is a 'Filter By' section for 'Class' with dropdowns for '11th Science', '12th science', '11th commerce', and '12 arts', and a red 'APPLY' button. To the right, a box titled 'Your personalized mock test' displays a clock icon, the text 'Personalized Quiz', and statistics: 'Time: 30', 'Difficulty: Medium', and 'Question: 20'. A red 'START QUIZ' button is at the bottom. The taskbar at the bottom shows various application icons.

**Fig 4.15 Quizzes Page ‘List of all the quizzes based on filter.’**

The screenshot shows a web browser window titled 'React App' with the URL 'localhost:3000/attemptquiz/5'. The page title is 'All quiz'. At the top, there is a header bar with a timer showing 'Time Left - 029 : 58 mins'. The main content area is divided into two sections: 'Questions 1' on the left and 'Questions Analysis' on the right. 'Questions 1' contains four multiple-choice questions with options A, B, C, and D. 'Questions Analysis' shows a grid of 20 numbered circles (1-20) with circle 1 highlighted in blue. A red 'SUBMIT QUIZ' button is at the bottom. Navigation buttons 'PREV' and 'NEXT' are at the bottom of the main content area. The taskbar at the bottom shows various application icons.

**Fig 4.16 Quiz Attempt Page**

The screenshot shows a web browser window titled "React App" with the URL "localhost:3000/quizresult/8". The page is titled "QuizBuddy" and has tabs for "Problems", "Quizzes", and "Profile". The main content area is titled "Questions 1" and contains a math problem: "If z is a complex number such that  $z = -z$ , then". Below the question are four options:

- A z is purely real
- B z is purely imaginary
- C z is any complex number
- D real part of z is same as its imaginary part

Option B is highlighted with a green circle. To the right, there is a large empty box for drawing and a score summary: "Score 10 Out of 100". The browser's taskbar at the bottom shows various icons and the date/time "07-06-2022 19:00".

**Fig 4.17 Quiz Result Page**

The screenshot shows a web browser window titled "React App" with the URL "localhost:3000/profile". The page is titled "QuizBuddy" and has tabs for "Problems", "Quizzes", and "Profile". The main content area features a user profile picture and the name "Mahesh". Below the profile, there is a section titled "About Me" with fields for Email, Score, Mobile no., and Performance Level. There is also a section titled "Attempted Quiz" with cards for "Quiz 1" and "Quiz 2". The browser's taskbar at the bottom shows various icons and the date/time "07-06-2022 19:03".

**Fig 4.18 Student Profile Page**

## 4.2. Test cases and Report

Test Id	Test Name	Test Description	Expected Output	Actual Output	Result
TC01	Student and Admin Login Credentials	Login with Valid Username invalid password	Login Unsuccessful, please enter correct credentials	Login Unsuccessful, please enter correct credentials	PASS
TC02		Login with invalid Username Valid password	Login Unsuccessful, please enter correct credentials	Login Unsuccessful	PASS
TC03		Login with Valid Username and valid password	Login Successful	Login Successful	PASS
TC04	Student Registration	Registration with all valid data	Your registration is submitted for approval. You get mail as registration is confirmed.	Your registration is submitted for approval. You get mail as registration is confirmed.	PASS
TC05		Registration with invalid or Unique phone no	Not valid phone no	Not valid phone no	PASS
TC06		Registration with invalid email	Not valid email	Not valid phone no	PASS
TC07	Create Class	Class creation with a valid enrollment key and Name	Class creation successfully	Class Created	PASS
TC08		Class creation with a valid Name but not Enrollment Key	Class creation successfully	Class Created	PASS
TC09		Class creation with an existing course Name	The Class Already Exists.	Class Cannot be created, class already exists.	PASS

TC10	Create Subject / Chapter	Subject / Chapter creation with a valid enrollment key and Details	Subject / Chapter creation successfully	Subject / Chapter Created	PASS
TC11		Subject / Chapter creation with an existing Subject / Chapter Name	The Subject / Chapter Already Exists.	Subject / Chapter Cannot be created, Subject / Chapter already exists.	PASS

**Table 4.1 White Box testing**

## 5. ML implementation in Project

- Generating Dataset for Questions Classification

```
from numpy.ma.core import mean
import numpy as np
import pandas as pd
from scipy.stats import truncnorm

def get_truncated_normal(mean=0, sd=1, low=0, upp=10):
    return truncnorm(
        (low - mean) / sd, (upp - mean) / sd, loc=mean, scale=sd)
```

1. Independent Columns for Question Classification.

```
question_cols = ['Median_time_FastLearners', 'N_Correctly_Answered_FastLearners', 'N_Wrongly_Answered_FastLearners', 'N_UnAttempted_FastLearners',
                 'Median_time_AvgLearners', 'N_Correctly_Answered_AvgLearners', 'N_Wrongly_Answered_AvgLearners', 'N_UnAttempted_AvgLearners',
                 'Median_time_SlowLearners', 'N_Correctly_Answered_SlowLearners', 'N_Wrongly_Answered_SlowLearners', 'N_UnAttempted_SlowLearners']
```

2. Question of Dificulty Level : Low

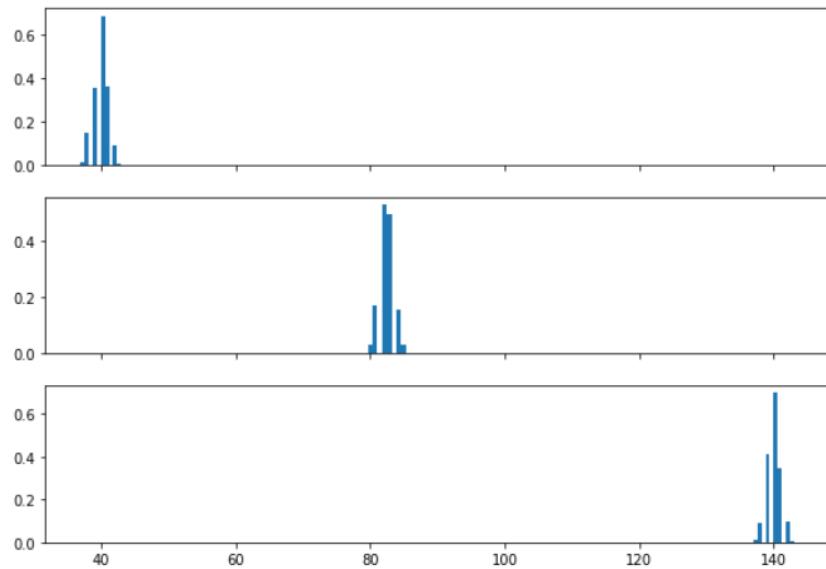
```
question_cols_paras = {'Median_time_FastLearners':(20,60), 'N_Correctly_Answered_FastLearners':(240,290), 'N_Wrongly_Answered_FastLearners':(10,60), 'N_UnAttempted_FastLearners':(50,100),
                       'Median_time_AvgLearners':(45,120), 'N_Correctly_Answered_AvgLearners':(200,260), 'N_Wrongly_Answered_AvgLearners':(40,100), 'N_UnAttempted_AvgLearners':(80,160),
                       'Median_time_SlowLearners':(100,180), 'N_Correctly_Answered_SlowLearners':(180,240), 'N_Wrongly_Answered_SlowLearners':(60,150), 'N_UnAttempted_SlowLearners':(60,100)}
```

3. Generating Dataset

```
low_q_data = pd.DataFrame()
for col in question_cols:
    mean = ( low_question_cols_paras[col][0] + low_question_cols_paras[col][1] ) / 2
    X = get_truncated_normal(mean = mean, sd=1, low = low_question_cols_paras[col][0] , upp = low_question_cols_paras[col][1])
    X = X.rvs(300).round().astype(int)
    low_q_data[col] = X
low_q_data['target'] = [1]*300
```

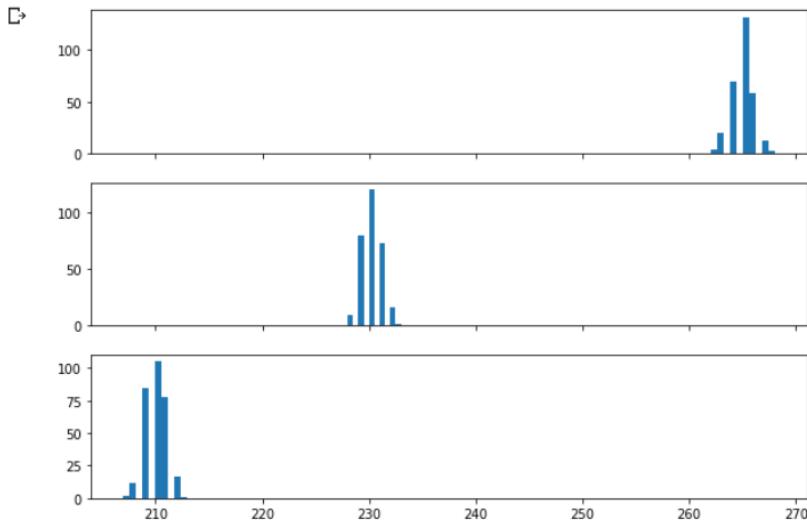
Median Time Taken by all kind of learners for Low difficulty questions.

```
fig, ax = plt.subplots(3, figsize=(10,7), sharex=True)
i=0
for col in ['Median_time_FastLearners','Median_time_AvgLearners','Median_time_SlowLearners']:
    ax[i].hist( low_q_data[col] , density=True, stacked=True)
    i = i+1
plt.show()
```



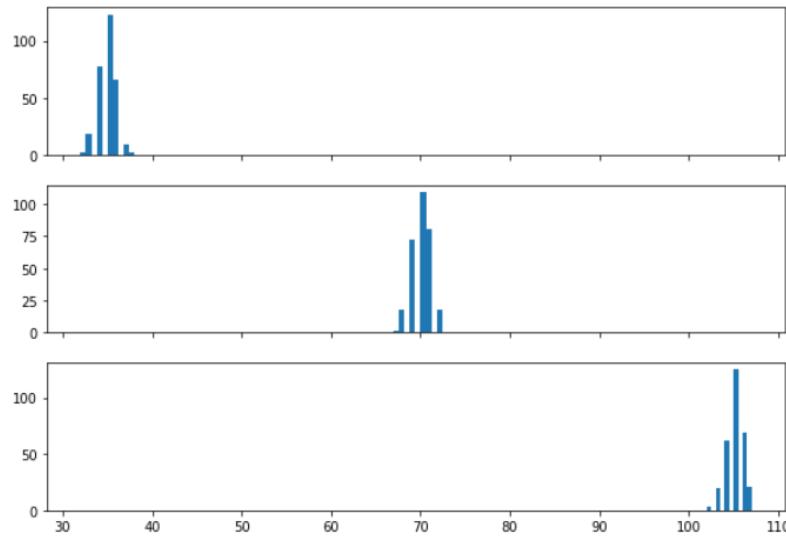
Low difficulty questions answered correctly N times by all Kind of Learners.

```
fig, ax = plt.subplots(3, figsize=(10,7), sharex=True)
i=0
for col in ['N_Correctly_Answered_FastLearners','N_Correctly_Answered_AvgLearners','N_Correctly_Answered_SlowLearners']:
    ax[i].hist( low_q_data[col] , density=False, stacked=False)
    i = i+1
plt.show()
```



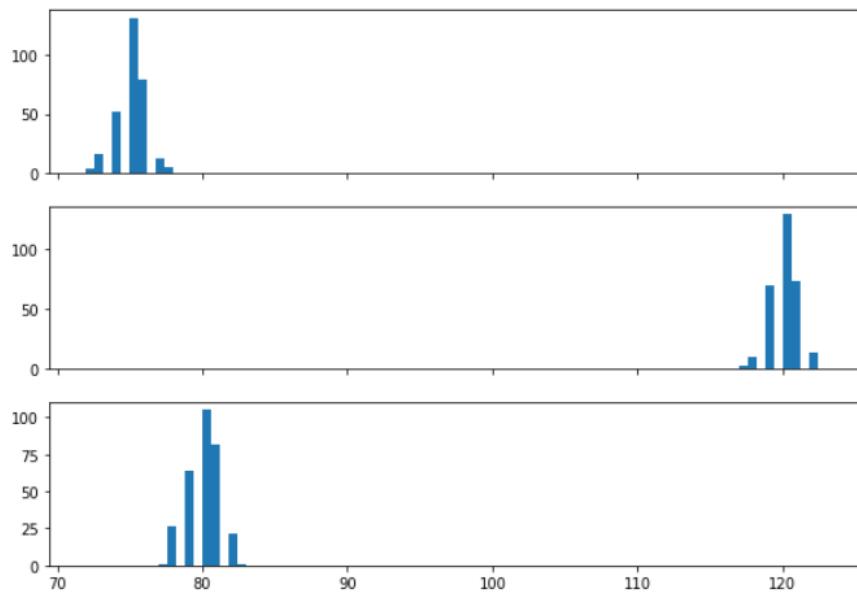
Low difficulty questions answered Wrongly N times by all Kind of Learners.

```
[ ] fig, ax = plt.subplots(3, figsize=(10,7), sharex=True)
i=0
for col in ['N_Wrongly_Answered_FastLearners', 'N_Wrongly_Answered_AvgLearners', 'N_Wrongly_Answered_SlowLearners']:
    ax[i].hist( low_q_data[col] , density=False, stacked=True)
    i = i+1
plt.show()
```



Low difficulty questions UnAttempted N times by all Kind of Learners.

```
[ ] fig, ax = plt.subplots(3, figsize=(10,7), sharex=True)
i=0
for col in ['N_UnAttempted_FastLearners', 'N_UnAttempted_AvgLearners', 'N_UnAttempted_SlowLearners']:
    ax[i].hist( low_q_data[col] , density=False, stacked=True)
    i = i+1
plt.show()
```



- Question Model Building

## 1. Importing Libraries And Load Data

```
[ ] import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn import metrics

data = pd.read_csv("QuestionsDataSet.csv")
data.rename( columns={'Unnamed: 0':'Question_No'}, inplace=True )
data.sample(10)
```

## 2. Data Preprocessing

After the data is loaded, our next step is to separate the features and label them as features and target respectively.

```
[ ] feature_cols = ['Median_time_FastLearners','N_Correctly_Answered_FastLearners','N_Wrongly_Answered_FastLearners','N_UnAttempted_FastLearners',
                   'Median_time_AvgLearners','N_Correctly_Answered_AvgLearners','N_Wrongly_Answered_AvgLearners','N_UnAttempted_AvgLearners',
                   'Median_time_SlowLearners','N_Correctly_Answered_SlowLearners','N_Wrongly_Answered_SlowLearners','N_UnAttempted_SlowLearners']
X = data[feature_cols]
y = data['target']
```

## 3. Data Split

Splitting of data into training & testing sets in the ratio of 70:30.

```
[ ] from sklearn.model_selection import train_test_split

x_train , x_test , y_train , y_test = train_test_split( X , y , test_size=0.2 ,random_state = 4)
print('x_train.shape : ' , x_train.shape)
print('x_test.shape : ' , x_test.shape)
print('y_train.shape : ' , y_train.shape)
print('y_test.shape : ' , y_test.shape)

x_train.shape : (720, 12)
x_test.shape : (180, 12)
y_train.shape : (720,)
y_test.shape : (180,)
```

## Decision tree

### 4. Performing The decision tree analysis using scikit learn

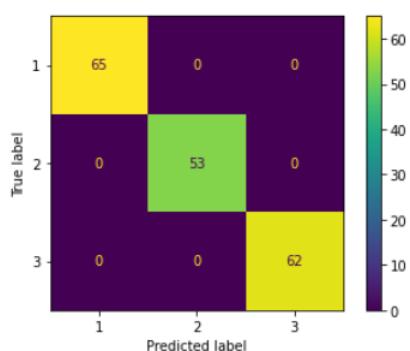
- Create Decision Tree classifier object
- Train Decision Tree Classifier
- Predict the response for test dataset

```
[ ] # Create Decision Tree classifier object  
dt_clf = DecisionTreeClassifier()  
  
# Train Decision Tree Classifier  
dt_clf = dt_clf.fit( x_train , y_train )  
  
# Predict the response for test dataset  
y_pred = dt_clf.predict( x_test )
```

```
[ ] y_pred
```

5. We should estimate how accurately the classifier predicts the outcome. The accuracy is computed by comparing actual test set values and predicted values.

```
[ ] import matplotlib.pyplot as plt  
from sklearn.metrics import confusion_matrix , ConfusionMatrixDisplay  
cm = confusion_matrix(y_test, y_pred , labels=dt_clf.classes_)  
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels = dt_clf.classes_ )  
disp.plot( values_format='d' )  
plt.show()
```



```
from sklearn.metrics import accuracy_score  
accuracy = accuracy_score( y_test , y_pred )  
accuracy_per = 100 * accuracy  
print('Accuracy : ', accuracy)  
print('Accuracy Percent : ' , accuracy_per , '%')
```

```
Accuracy : 1.0  
Accuracy Percent : 100.0 %
```

```

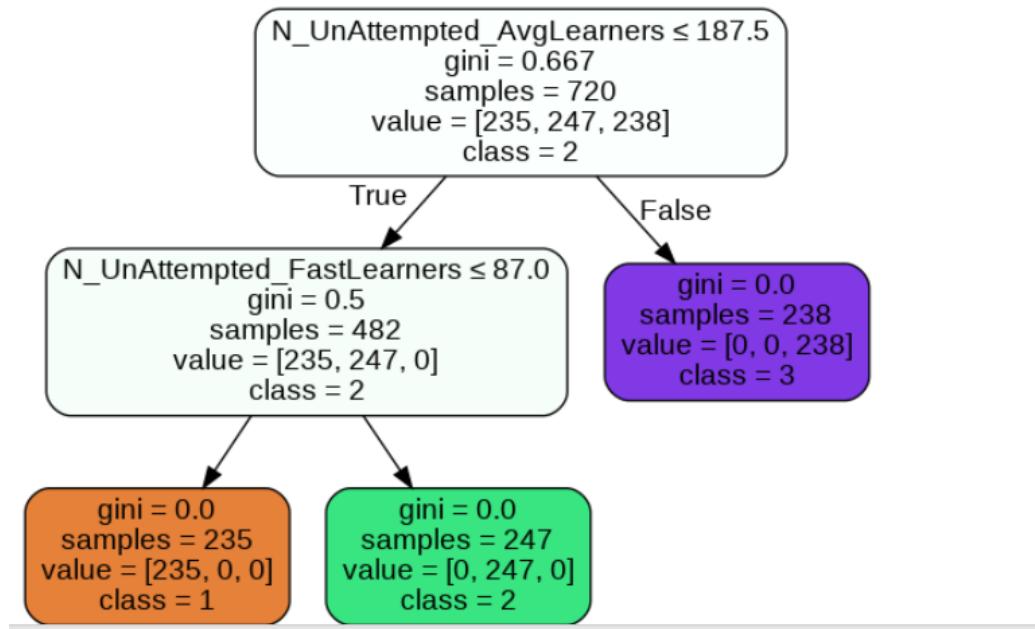
from sklearn import tree
import graphviz

dot_data = tree.export_graphviz( dt_clf , out_file=None , feature_names= feature_cols ,
                                class_names = ['1' , '2' , '3'] , filled = True ,
                                rounded = True , special_characters = True)

graph = graphviz.Source(dot_data)
png_bytes = graph.pipe(format='png')
with open('dtree_pipe.png','wb') as f:
    f.write(png_bytes)

from IPython.display import Image
Image(png_bytes)

```



## 6. Project Installation

### Steps to install front end app:

Prerequisite: Node JS (Latest Version), Git (Latest Version)

- To install applications, we need the latest version of node js and git.
- Git clone the source code from the git repository :

```
$ git clone https://github.com/maheshkutty/quizbuddy
```

- Get inside project directory quizbuddy
- Install dependencies by typing following command:

```
$ npm install
```

- To start server type following command:

```
$ npm start
```

### Steps to install back end web app on local server:

Prerequisite: Python (Latest Version), Git (Latest Version)

- The server should have python3 and git pre-installed.
- Git clone the source code from the git repository.
  - >> git clone <https://github.com/Jagannathpatta/Quiz-Application.git>
- Get inside the project directory.
  - >> cd Quiz-Application
- Create a virtual environment to install required packages.
  - >> python3 -m venv Applibs
- Activate the virtual environment “Applibs”.
  - >>source /Applibs/bin/activate
- Now Install the required packages using requirements.txt file.
  - >> pip install -r requirements.txt
- Finally, run the app.py file to get running the application on localhost.
  - >> python app.py

## **7. Future Enhancements**

- Admin will be able to add short answer and long answer types of questions as well.
- Students will be able to upload pdf files as their long answer submissions.
- Admin will correct long answers and assign marks.
- More detailed stats regarding attendance.
- More privileges for Admin users.

## **8. Limitations**

- Updation feature is not implemented yet.
- Admin is Solely responsible for CRUD of all the questions in the database.
- Models will work properly once a large amount of data is curated by our system.
- If students cheat while attempting a quiz, it leads to the wrong prediction of student performance.

## **9. Conclusion**

We got inspiration from websites that conduct quizzes for competitive exams like SSC, UPSC etc. There is no website available that provides customized quizzes based on student performance. We built an application using react and fast API which uses the ML Technologies to generate a quiz for JEE/Neet exam. Students can track their progress and how they perform on quizzes. Students get flexibility to attempt any quiz and any time. Applications provide customized experience to the students that help them to be more productive and confident about these types of competitive exams. We also contributed to new government policies for education. A little contribution toward saving the environment by reducing the use of papers for conduction of quiz.

## 10. Bibliography

Following is the list of websites which were used while researching for this project and developing it:

- <https://flask.palletsprojects.com/en/2.0.x/>
- <https://bootswatch.com/flatly/>
- <https://www.sqlitetutorial.net/>
- For deployment on AWS  
[https://www.youtube.com/playlist?list=PL5KTLzN85O4KTCYzsWZPTP0BfRj6I\\_yUP](https://www.youtube.com/playlist?list=PL5KTLzN85O4KTCYzsWZPTP0BfRj6I_yUP)
- [Getting Started on Heroku with Node.js | Heroku Dev Center](#)
- [Modern React with Redux Training Course | Udemy](#)
- [Deploy Fully Managed MySQL in the Cloud \(clever-cloud.com\)](#)