

# THE COLLEGE

College

**alghaly**

Data Management Case Study

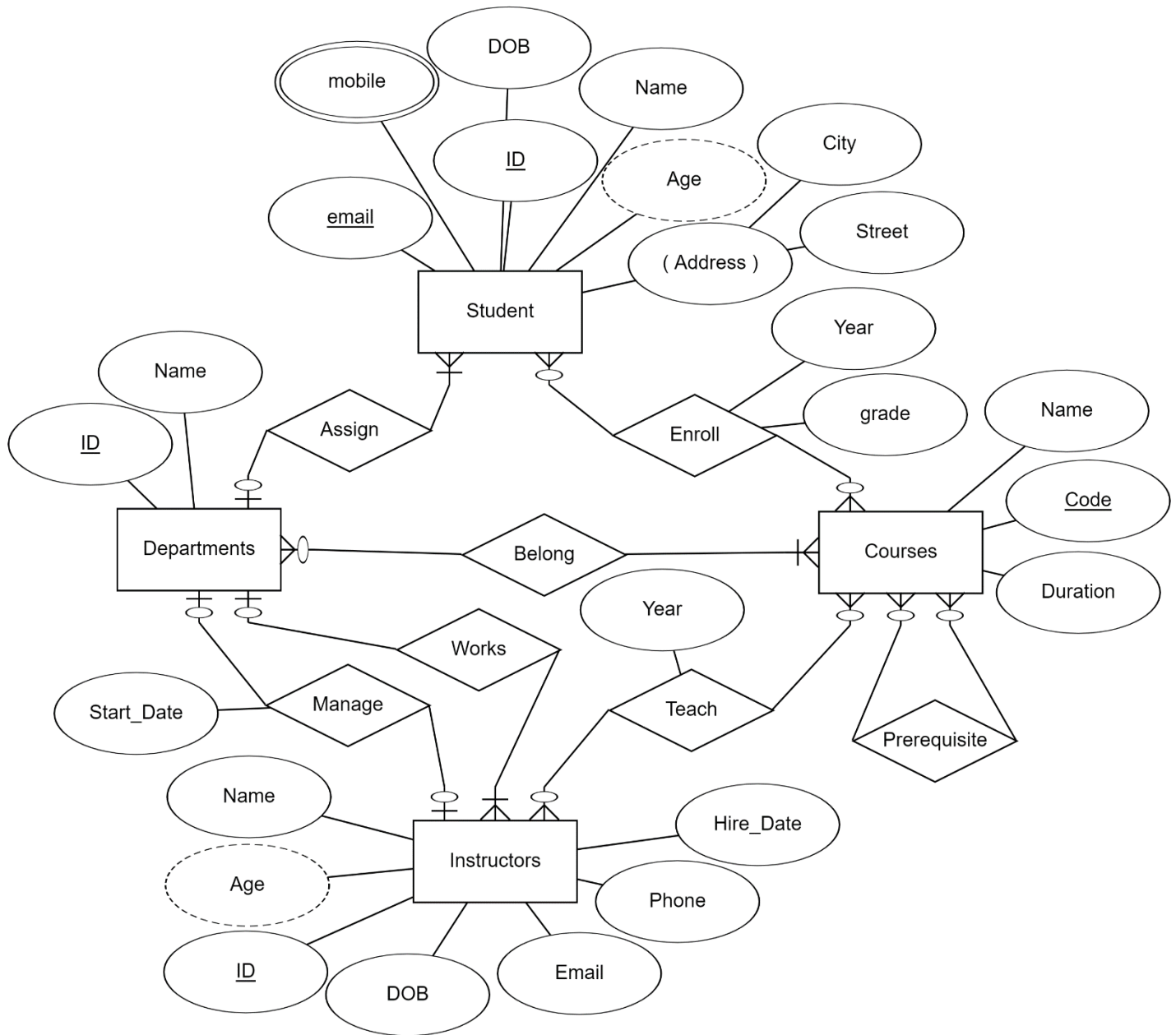
# STEP ONE (DATABASE DESIGN)

## - We will need to keep data for:

- System Users
- User's Transactions
- Students
- Courses
- Departments
- Instructors
- Courses' Prerequisites
- Students' Enrollments
- Students' Grades

- Only privileged employees have access to the application.
- All the transactions made by an employee are stored on a database table.
- A student can enroll in multiple courses, and each course can be taught to many students.
- We may need to store data for students before they apply to any courses; some courses may have 0 enrollments.
- A student is only allowed to enroll in courses for which they have completed all the prerequisites.
- A Student can only enroll in 14-22 credit hours per term (Depending on his GPA).
- The student is assigned to exactly one department and the department can have 0 or more students.
- An instructor can teach many courses and many instructors can teach a course.
- We may need to store data for instructors before they teach any courses; some courses may have 0 instructors.
- An instructor can be hired in exactly one department, but he can teach courses in other departments.
- The department can have many instructors (0 or more), but only one works as its manager.
- A course can belong to any number of departments and the departments can have many courses.
- For us to store the data for a course, the course must belong to a specific department.
- Any course may have many prerequisites and a single course may be a prerequisite for many courses.
- Some courses don't have any prerequisites and some courses are not a prerequisite for any course.

## DB Schema



## STEP TWO (SQL IMPLEMENTATION & DATA POPULATION)

### Table Creation:

- The code for creating the database schema is in a file named **Schema.SQL**.

## Data Population:

- The data is generated using a **python** script.
- The code for generating the database data is in a file named **Populate.PY**.
- The insert statements are in a file named **Populate.SQL**.
- The insert statements for the Enrollments table are in 3 files named **Enrollments.par**, **Enrollments.dat**, and **Enrollments.ctl**.

## Code Sample:

```
236 def populate_enrollments():
237     enrollments = open('Enrollments.SQL', 'w')
238     grades = ['A', 'B', 'C', 'D', 'F', 'A+']
239     current_date = datetime.now()
240     # Construct Insert Statements
241     for i in range(211546):
242         id_ = random.randint(0, 999)
243         code = random.randint(0, 95)
244         year = random.randint(0, 20)
245         year = current_date - timedelta(days=365 * year)
246         year = year.strftime("%Y-%m-%d")
247         grade = random.choice(grades)
248
249         row = f"{grade},{id_},{code},{year}\n"
250         enrollments.write(row)
251
```

## NOW:

- The Students table has 1000 rows.
- The Courses table has 96 rows.
- The Departments table has 15 rows.
- The instructors table has 104 rows.
- The Instructor Courses table has 999 rows.
- The Department Courses table has 225 rows.
- The Prerequisites table has 100 rows.
- The Enrollments table has 188400 rows.
- The Student Mobiles table has 1712 rows.

## STEP THREE (PL/SQL IMPLEMENTATION)

We have the following Database Objects in our database:

The code for creating these objects is in a file named **PL.SQL**.

### TRIGGERS

- **VALIDATE\_ENROLLMENT:**
  - Make sure that the students only enroll into courses satisfying Three conditions:
    - The student has completed all the prerequisites for this course.
    - The student is not already enrolled into this course.
    - The student hasn't attempted the same course twice before, which could happen in two cases:
      - The student has failed to complete the course in the first time, then passed its requirements in second chance.
      - The student has re-enrolled into the same course before as an attempt to get higher grades.
- **STU\_TRG:**
  - Along with (**STD\_SEQ**) it works as for **identity column** STUDENT table.
  - An Identity column in the context of database is:
    - A column that automatically generates and populates a numeric column value each time a new row is inserted into a table.
- **CRS\_TRG**
  - Along with (**COURSES\_SEQ**) it works as for **identity column** COURSES table.
- **INS\_TRG**
  - Along with (**INSTRUCTORS\_SEQ**) it works as for **identity column** INSTRUCTORS table.

### PROCEDURES

- **UPDATE\_STUDENT**
  - Takes any number of parameters besides the student's ID and updates the data for the student in the STUDENT table.

## FUNCTIONS

- CALC\_GPA
  - Takes in a student's ID and calculates/returns his GPA.
- CALC\_EN\_HOURS
  - Takes in a student's ID and calculates/returns this term's credit hours for this student.
- CALC\_HOURS
  - Takes in a student's ID and calculates/returns accumulative credit hours for this student.
- CALC\_CRS\_GPA
  - Calculates the Average GPA for a specific course across all previous enrollments.
- CALC\_CRS\_STDS
  - Calculates the Number of Students currently enrolled into a specific course.

## SEQUENCES

- CDEPARTMENTS\_SEQ
  - Not yet used.
- COURSES\_SEQ
  - Along with (**CRS\_TRG**) it works as for **identity column** COURSES table.
- INSTRUCTORS\_SEQ
  - Along with (**INS\_TRG**) it works as for **identity column** INSTRUCTORS table.
- INS\_COURSES\_SEQ
  - Not yet used.
- STD\_SEQ
  - Along with (**STU\_TRG**) it works as for **identity column** STUDENT table.

## STEP FOUR (AUTOMATION SCRIPT)

### DISK MONITORING

- Bash Script to monitor the Hard Disk usage and send alerts in case a specific threshold is exceeded => in a file named **backup.sh**.
- The **log.log** file contains the disk monitoring and the backup logs.

```
1  #!/bin/bash
2
3  usage=$(df -h | grep 'C:' | awk '{print $6}' | cut -d '%' -f1)
4  if [ $usage -gt 30 ]
5  then
6      echo "$(date)" >> log.log
7      echo "Disk Usage has exceeded limit !!" >> log.log
8  fi
9
10
```

### DATABAS BACKUP

- Perform a full backup of the database => the script is in a file named **backup.sh**.
- The **script.bat** file is used by windows task scheduler to run the bash script.

```
10
11 # Oracle Database Connection Details
12 DB_USER=CS
13 DB_PASSWORD=123
14 DB_SID=XE
15
16 # Date Format for Backup File
17 DATE_FORMAT=$(date +"%Y%m%d_%H%M%S")
18
19 # Export File Name (only the file name, not the full path)
20 EXPORT_FILE="backup_${DATE_FORMAT}.dmp"
21
22 # Oracle Data Pump Export Command
23 expdp ${DB_USER}/${DB_PASSWORD}@${DB_SID}
24 DIRECTORY=DATA_PUMP_DIR DUMPFILE=${EXPORT_FILE} FULL=Y
25
26 # Check if the export was successful
27 if [ $? -eq 0 ]; then
28     echo "Database backup successful. File: ${EXPORT_FILE}"
29 else
30     echo "Error: Database backup failed."
31 fi
32
```

## STEP FIVE (JAVA APPLICATION)

**Now it is time for the fun part (The actual application that the users would use to interact with our SYSTEM)**

In this project we have two folders for the Java application:

- **Java:** Contains the application's folders & files, built using **IntelliJ**.
  - You can just open the project in IntelliJ and run the code.
- **Java Source Code:** Contains the Source code for the java application, so you can use any code editor to build and run the application.
  - **Client:** This folder contains the Classes that we would use across the applications (**DTOs**).
  - **database:** This folder contains the Singleton class used to handle the Database Connection.
  - **gui:** This folder contains the code for all the front-end (**GUI**) classes, it also contains the source code for the application's Back end.
  - **Images:** This folder contains the assets (pictures) used by the application.
  - **Styles:** This folder contains the assets (CSS Code) used by the application.

**We have mainly 14 scenes in our applications:**

Log In Scene	Sign Up Scene
Home Scene	Home Content Subscene
Enrollment Scene	Grading Scene
Courses Scene	Course Profile Scene
Add Course Scene	Notifications Scene
Student Scene	Student Profile Scene
Alter Student Scene	Instructors Scene



## DATA ACCESS LAYER CLASS

Object Initialization => using singleton class assure that we will have at most a single data access layer object (and a single database connection) across the app.

```
10 public class DataAccessLayer {
11     private static DataAccessLayer instance;
12     private Connection connection;
13
14     // Private constructor to prevent instantiation outside the class
15     private DataAccessLayer() {
16         // Initialize the connection here
17         try {
18             DriverManager.registerDriver(new OracleDriver());
19             connection = DriverManager.getConnection(
20                 "jdbc:oracle:thin:@localhost:1521:XE",
21                 "CS", "123");
22         } catch (SQLException e) {
23             e.printStackTrace(); // Handle the exception appropriately
24         }
25     }
26
27     // Method to get the single instance of the class
28     public static synchronized DataAccessLayer getInstance() {
29         if (instance == null) {
30             System.out.println("Data Base Instance Created");
31             instance = new DataAccessLayer();
32         }
33         return instance;
34     }
35
36     // Connect method can now be an instance method
37     public Connection getConnection() {
38         return connection;
39     }
40 }
```

We initialize an object from our class only using the **Static** method **getInstance** that works as the following:

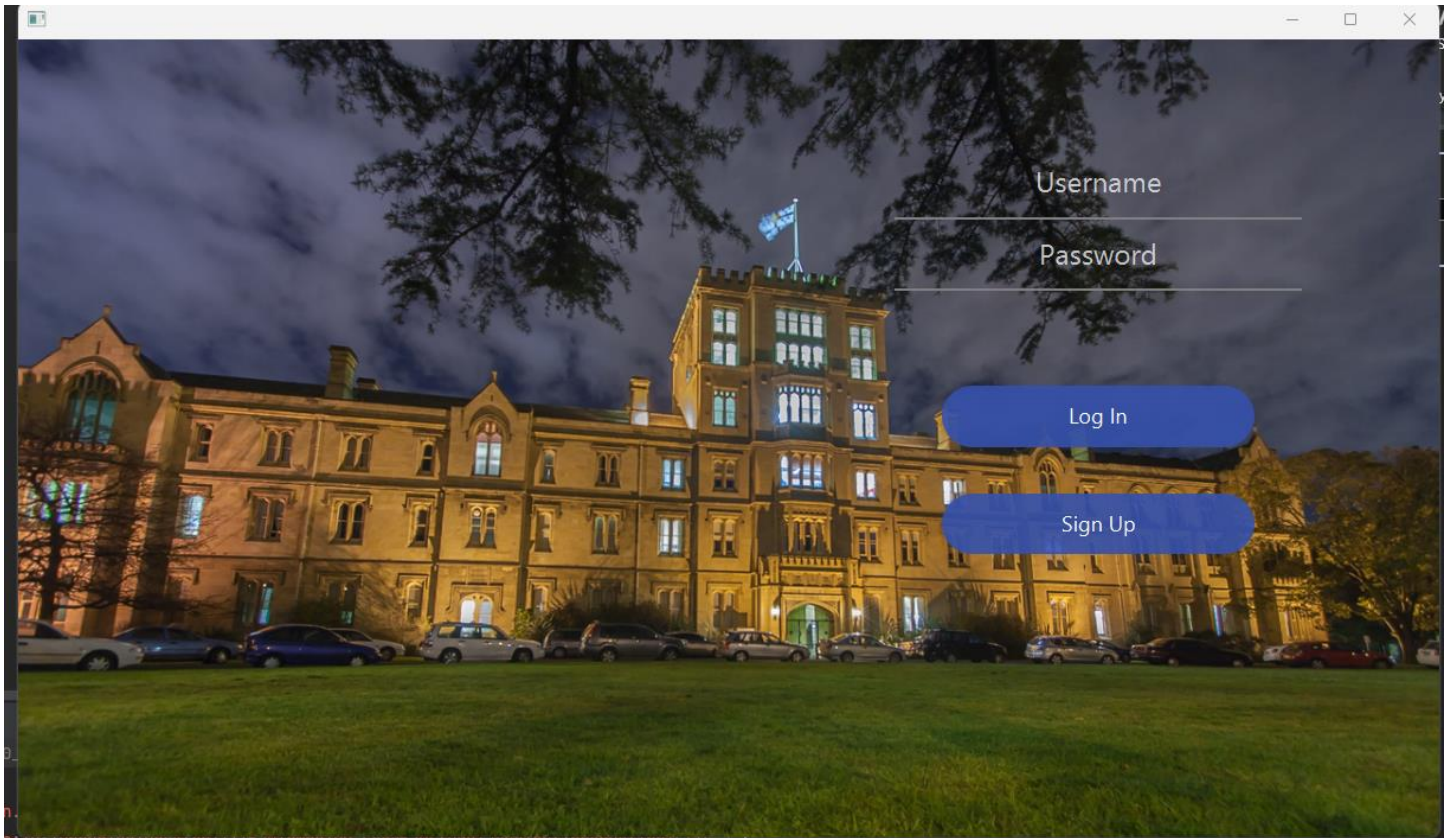
- If the value for the **static** attribute named **instance** of a type **DataAccessLayer** is null, which means that we have not initiated any objects from this class before:
  - o Initiate an object from the **DataAccessLayer** class using its **private** constructor, store it in the instance attribute, and return that object.
- If the value for the **static** attribute named **instance** of a type **DataAccessLayer** is not null which means we have already initiated an object from the class:
  - o Just return the previously initiated objects.

## Data Retrieval

```
41 ▶ public String getPassword(String username) throws SQLException {  
50  
51 ▶ public void addUser(Client client) throws SQLException {  
52 ▶     PreparedStatement stmt = connection.prepareStatement(  
53 ▶         "insert into users values(?, ?, ?, ?)");  
54 ▶     stmt.setString(1, client.getUsername());  
55 ▶     stmt.setString(2, client.getPassword());  
56 ▶     stmt.setString(3, client.getEmail());  
57 ▶     stmt.setString(4, client.getPhone());  
58 ▶     stmt.executeUpdate();  
59  
60  
61 ▶ public ResultSet getStudents() throws SQLException{  
62 ▶     PreparedStatement stmt = connection.prepareStatement(  
63 ▶         "select name, email, id, trunc(months_between(sysdate, dob) /  
64 ▶     return stmt.executeQuery();  
65  
66  
67 ▶ ... public ResultSet getCourseList(int id) throws SQLException{  
99  
100 ▶ public int deleteStudent(int id) throws SQLException{  
101 ▶     PreparedStatement stmt = connection.prepareStatement(  
102 ▶         "update student set status = 'Archived' where id = ?");  
103 ▶     stmt.setInt(1, id);  
104 ▶     return stmt.executeUpdate();  
105  
106  
107 ▶ public ResultSet getDepartments() throws SQLException{  
108 ▶     PreparedStatement stmt = connection.prepareStatement(  
109 ▶         "SELECT D.NAME,\n" +  
110 ▶         "      TRUNC (MONTHS_BETWEEN (SYSDATE, START_DATE) /  
111 ▶         "      D.ID,\n" +  
112 ▶         "      I.NAME  
113 ▶         "      FROM CDEPARTMENTS D, INSTRUCTORS I\n" +  
114 ▶         "      WHERE D.MANAGER_ID = I.ID)";  
115 ▶     return stmt.executeQuery();  
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## Application's Main Scenes

### Log In Page



This window is designed for the system users (The college's staff) to log into their accounts.

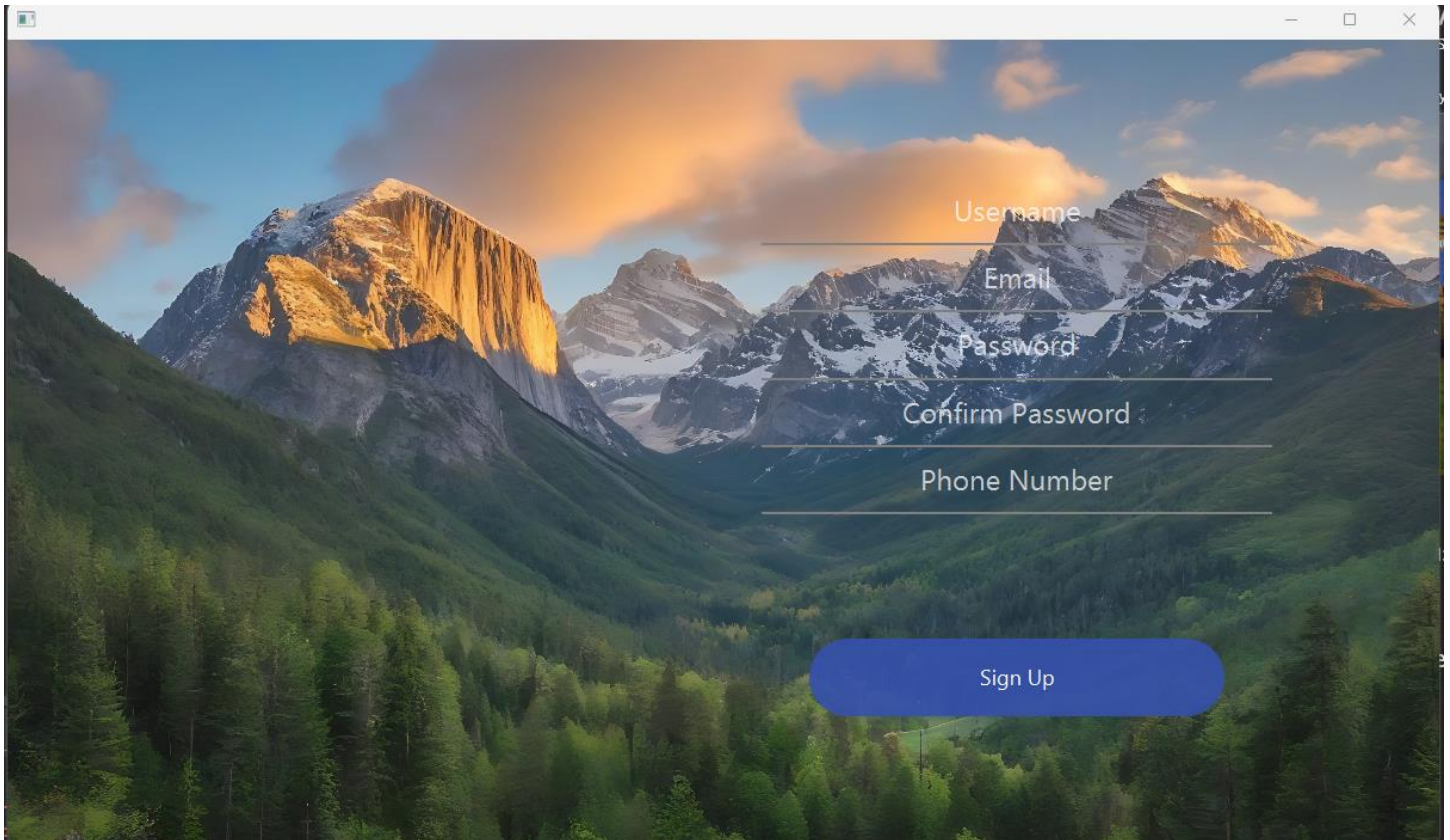
- The username must be unique across all system users.

### Sign Up Page

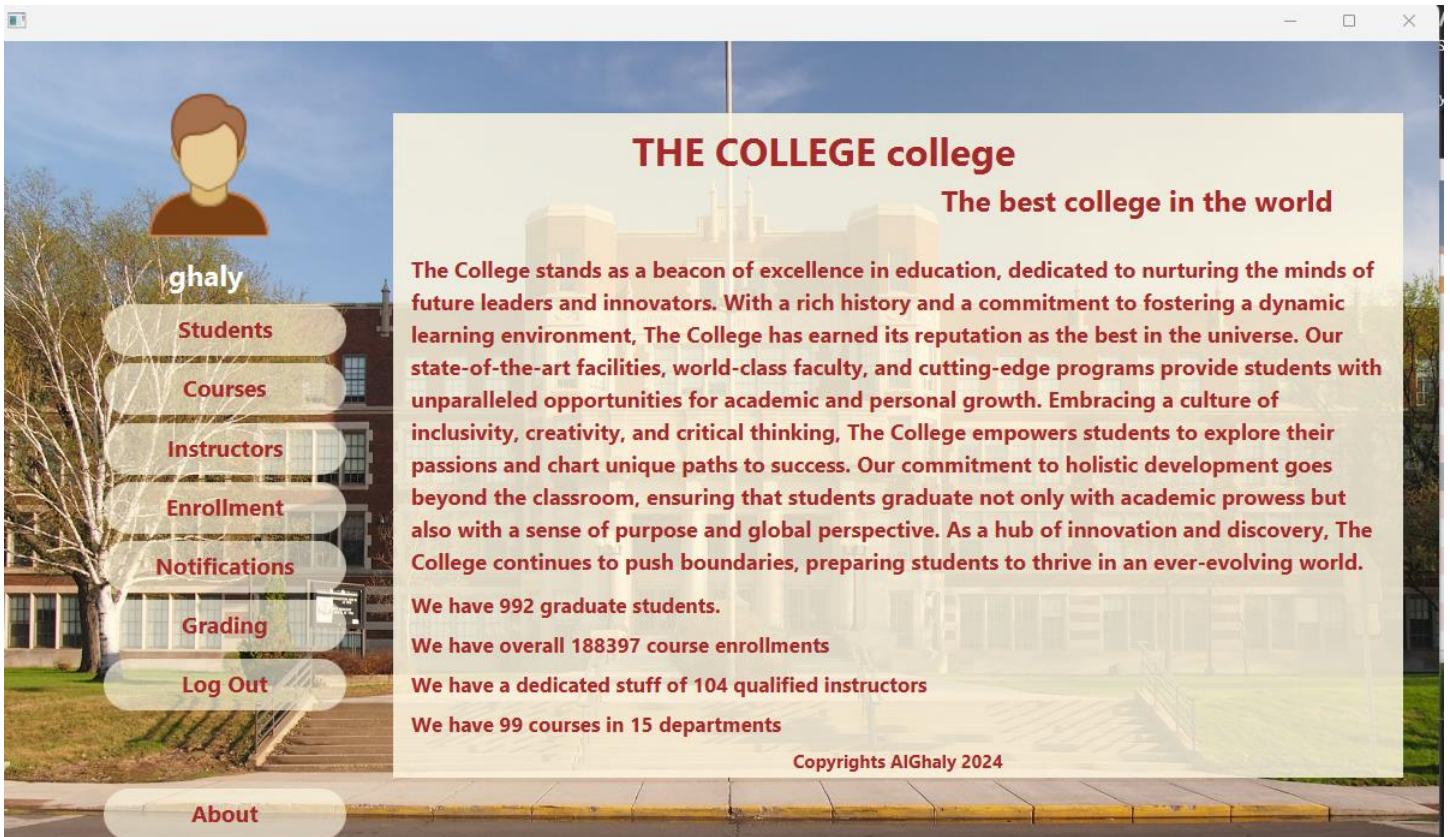
This window is designed for the system users (The college's staff) to create an account.

- The user must enter a valid email address.
- The username must be unique across all system users.
- The password must be a valid password.
- The user must enter a valid mobile number.





## Home Page



This window is the main widow for the application, and it consists of two main parts:

- 1- The navigation bar: the user will use it to navigate through the different pages.
- 2- The Home Content Scene: which contains some information & statistics about the college.

## Enrollment Page

**Students Enrollment**

Name: ghaly      GPA: 0.0      Total Hours: 0  
Semester: First      Year: 2024      Enrolled Hours: 12

gha      Search for a course      Search for an course

Name	Department	GPA
ghaly2	Political Science	0.0
ghaly3	Sociology	0.0
ghaly	Biology	4.0
ghaly	Computer Scie...	0.0

Code	Name	Hours
0	Mathematics	5
1	Chemistry	4
2	Biology	3
3	Physics	3
4	Computer Science	2
5	Environmental Scie...	5
6	Psychology	4
7	Sociology	5

Code	Name	Hours
3	Physics	3
1	Chemistry	4
0	Mathematics	5

**Enroll**

This window is to enroll students into courses.

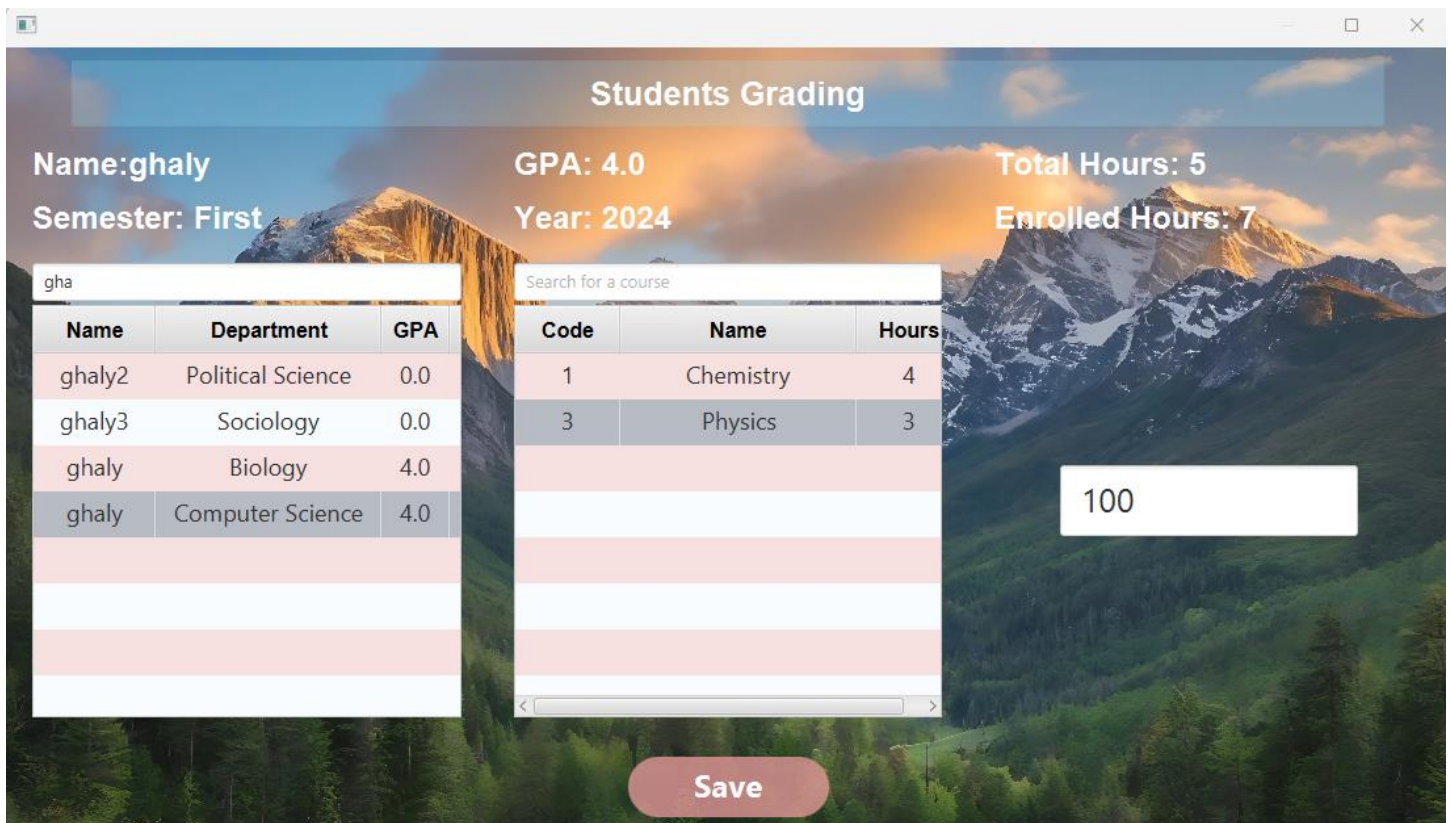
- The user should just choose the student then Choose the course name and click save.
- The student must complete the prerequisite of a course before enrolling into it.
- The student can attempt a course only twice.
- A student is allowed to enroll in a course from any department.



- A student is allowed to enroll into X credit hours depending on their GPA as following:
  - o GPA 3-4: can enroll into up to 22 credit hours.
  - o GPA 2-3: can enroll into up to 18 credit hours.
  - o GPA 0-2: can enroll into up to 14 credit hours.

## Grading Page

This window is designed for the system users to grade the students' enrollments.



The "Students Grading" window features a scenic mountain background. At the top, it displays student information: Name: ghaly, Semester: First, GPA: 4.0, Year: 2024, Total Hours: 5, and Enrolled Hours: 7. Below this, there are two search bars. The left search bar contains the text "gha" and is positioned above a table with columns for Name, Department, and GPA. The right search bar contains the text "Search for a course" and is positioned above a table with columns for Code, Name, and Hours. A "Save" button is located at the bottom center. A text box with the value "100" is visible on the right side of the window.

Name	Department	GPA
ghaly2	Political Science	0.0
ghaly3	Sociology	0.0
ghaly	Biology	4.0
ghaly	Computer Science	4.0

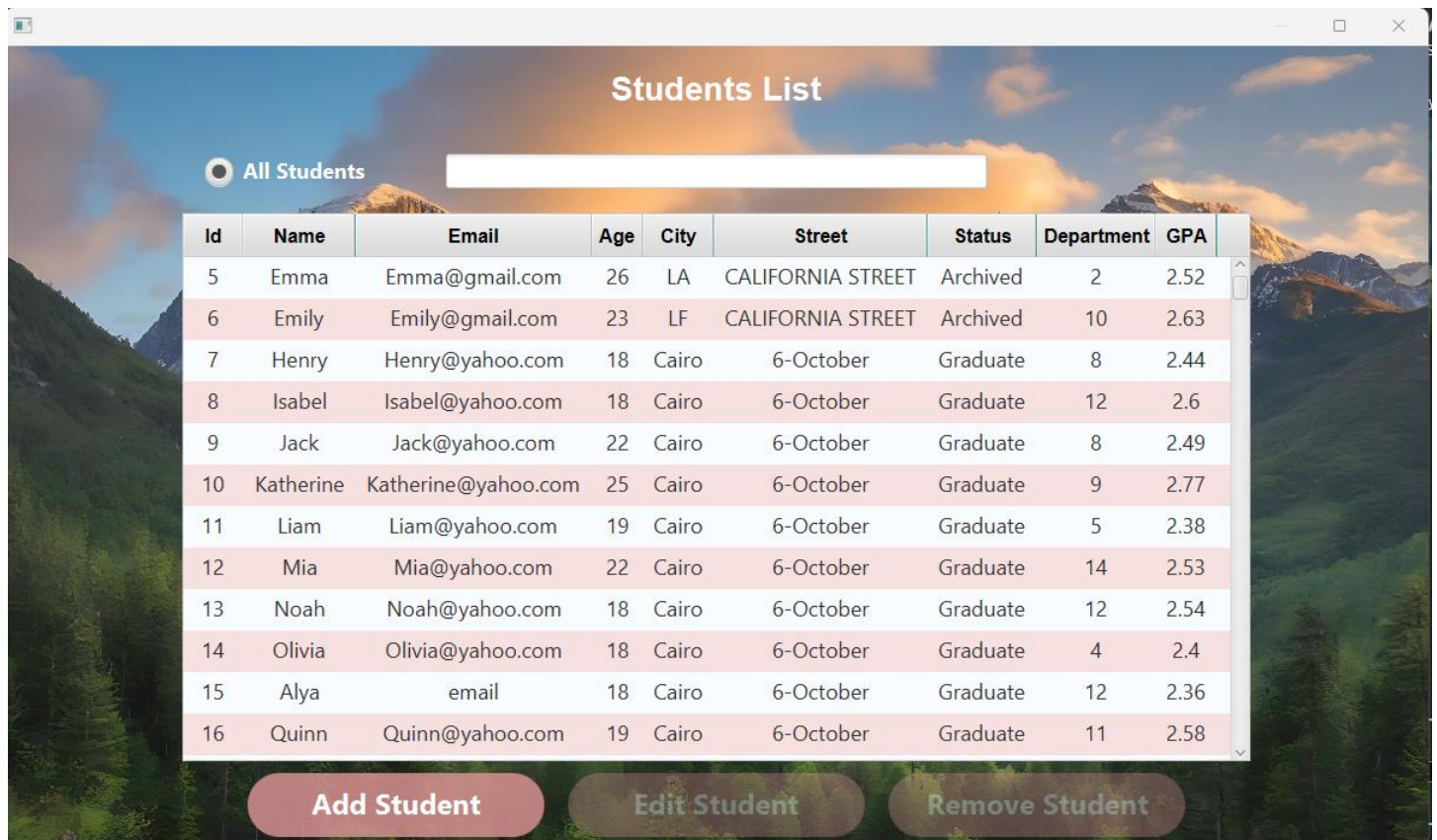
Code	Name	Hours
1	Chemistry	4
3	Physics	3

100

Save

## Students Page

This window is designed for the system users (The college's staff) to show some statistics/data about our students (both active and graduated).



Id	Name	Email	Age	City	Street	Status	Department	GPA
5	Emma	Emma@gmail.com	26	LA	CALIFORNIA STREET	Archived	2	2.52
6	Emily	Emily@gmail.com	23	LF	CALIFORNIA STREET	Archived	10	2.63
7	Henry	Henry@yahoo.com	18	Cairo	6-October	Graduate	8	2.44
8	Isabel	Isabel@yahoo.com	18	Cairo	6-October	Graduate	12	2.6
9	Jack	Jack@yahoo.com	22	Cairo	6-October	Graduate	8	2.49
10	Katherine	Katherine@yahoo.com	25	Cairo	6-October	Graduate	9	2.77
11	Liam	Liam@yahoo.com	19	Cairo	6-October	Graduate	5	2.38
12	Mia	Mia@yahoo.com	22	Cairo	6-October	Graduate	14	2.53
13	Noah	Noah@yahoo.com	18	Cairo	6-October	Graduate	12	2.54
14	Olivia	Olivia@yahoo.com	18	Cairo	6-October	Graduate	4	2.4
15	Alya	email	18	Cairo	6-October	Graduate	12	2.36
16	Quinn	Quinn@yahoo.com	19	Cairo	6-October	Graduate	11	2.58

**Add Student** **Edit Student** **Remove Student**

## Students Profile Page

Double Clicking on a course from the Courses page will open this course's profile window which contains:

- Some statistics about the student.
- Data about the previous enrollments of that student



Emily

Emily@gmail.com

23 Years

LF

GPA: 2.63

Total Hours: 335

Code	Name	Durati...	Hours	Year	Semester	Grade	Gpa	Letter
33	Chinese	64	6	2024	Summer	98	4.0	A+
26	Calculus	58	5	2024	Summer	98	4.0	A+
76	Journalism	54	5	2024	Summer	92	3.6	A
9	Political Science	60	6	2024	Summer	92	3.6	A
79	Meteorology	42	4	2024	Summer	92	3.6	A
44	Finance	51	5	2024	Summer	92	3.6	A
30	French	27	2	2024	Summer	85	3.0	B
37	Arabic	42	4	2024	Summer	75	2.4	C
74	Graphic Design	34	3	2024	Summer	75	2.4	C
56	Biotechnology	33	3	2024	Summer	75	2.4	C
90	Math Education	52	5	2024	Summer	50	0.0	F

Students Alter Page

This window is designed for the system users (The college’s staff) to add a new student into the system or edit the data of a student.

Enter the new data for student : 9

Search for a department

Code	Name	Manager	Age
9	Political Science	Charlie	5
13	Art	Noah	9
10	Economics	Kai	1
7	Sociology	Nora	10
14	Music	William	8
3	Biology	William	2
0	Mathematics	Brooklyn	6
4	Computer Science	Caleb	11
11	English	Caleb	9

Enter The Student's Name

Name

Enter The student's Email

Email

Enter The student's City

City

Enter The student's Street

Street

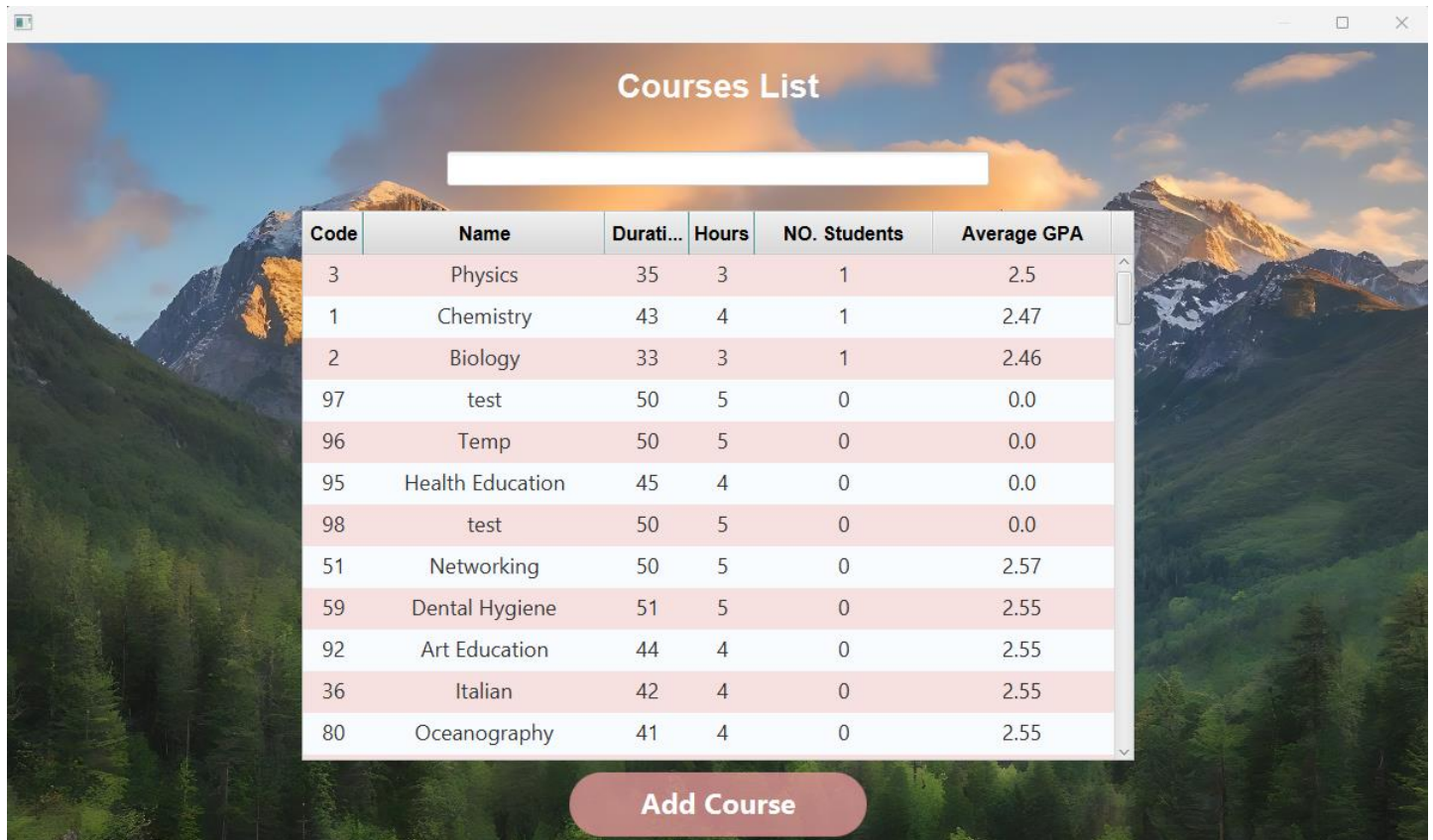
Save



## Courses Page

This window is designed to show some statistics about the courses that our college offer including:

- Course's Duration
- Course's Credit Hours
- Number of Enrolled Students
- Average GPA For previously enrolled students

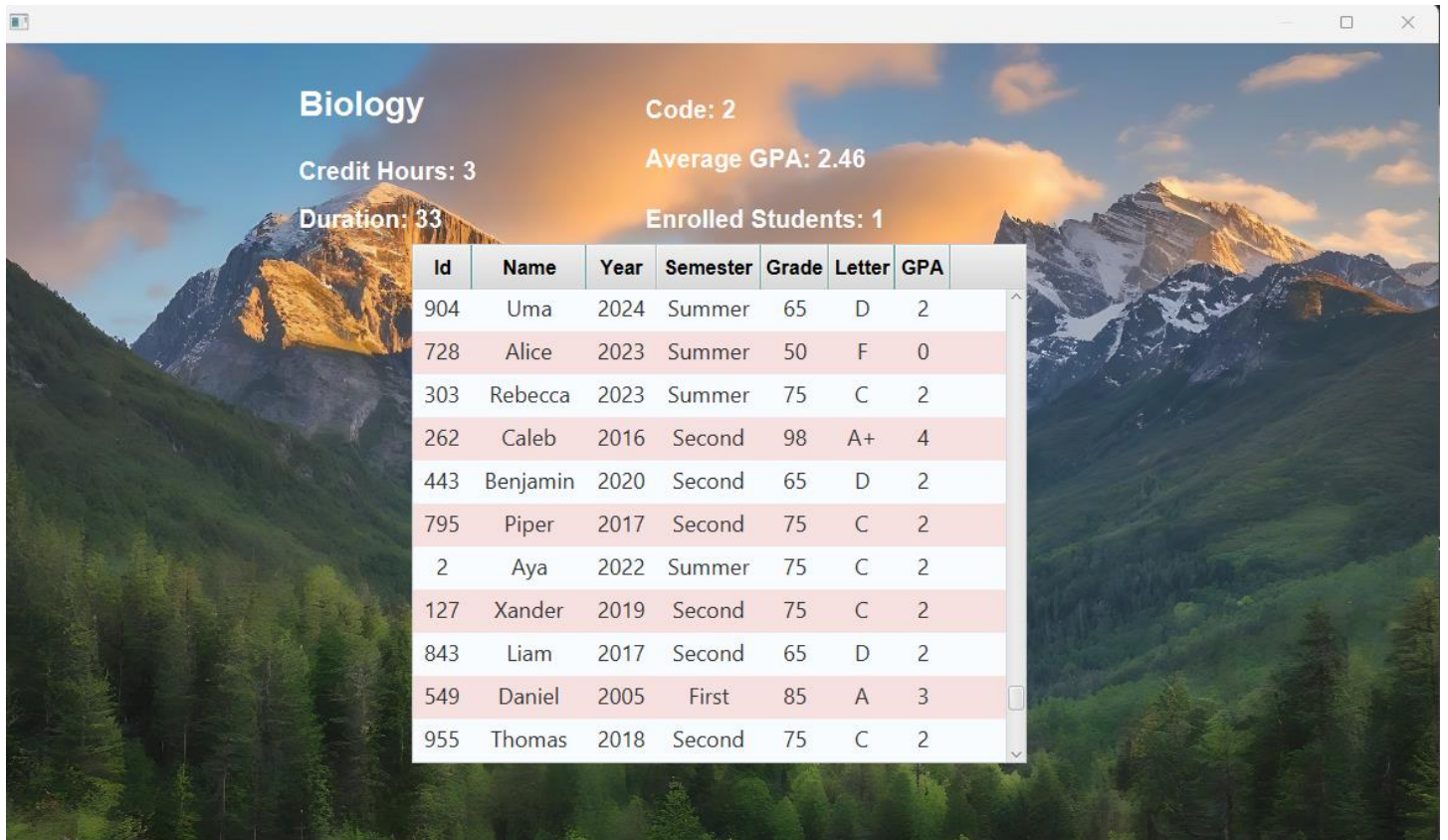


Code	Name	Durati...	Hours	NO. Students	Average GPA
3	Physics	35	3	1	2.5
1	Chemistry	43	4	1	2.47
2	Biology	33	3	1	2.46
97	test	50	5	0	0.0
96	Temp	50	5	0	0.0
95	Health Education	45	4	0	0.0
98	test	50	5	0	0.0
51	Networking	50	5	0	2.57
59	Dental Hygiene	51	5	0	2.55
92	Art Education	44	4	0	2.55
36	Italian	42	4	0	2.55
80	Oceanography	41	4	0	2.55

## Course Profile Page

Double Clicking on a course from the Courses page will open this course's profile window which contains:

- Some statistics about the course.
- Data about the previous enrollments into this course.



Biology							Code: 2	
Credit Hours: 3							Average GPA: 2.46	
Duration: 33							Enrolled Students: 1	
Id	Name	Year	Semester	Grade	Letter	GPA		
904	Uma	2024	Summer	65	D	2		
728	Alice	2023	Summer	50	F	0		
303	Rebecca	2023	Summer	75	C	2		
262	Caleb	2016	Second	98	A+	4		
443	Benjamin	2020	Second	65	D	2		
795	Piper	2017	Second	75	C	2		
2	Aya	2022	Summer	75	C	2		
127	Xander	2019	Second	75	C	2		
843	Liam	2017	Second	65	D	2		
549	Daniel	2005	First	85	A	3		
955	Thomas	2018	Second	75	C	2		

## Add Course Page

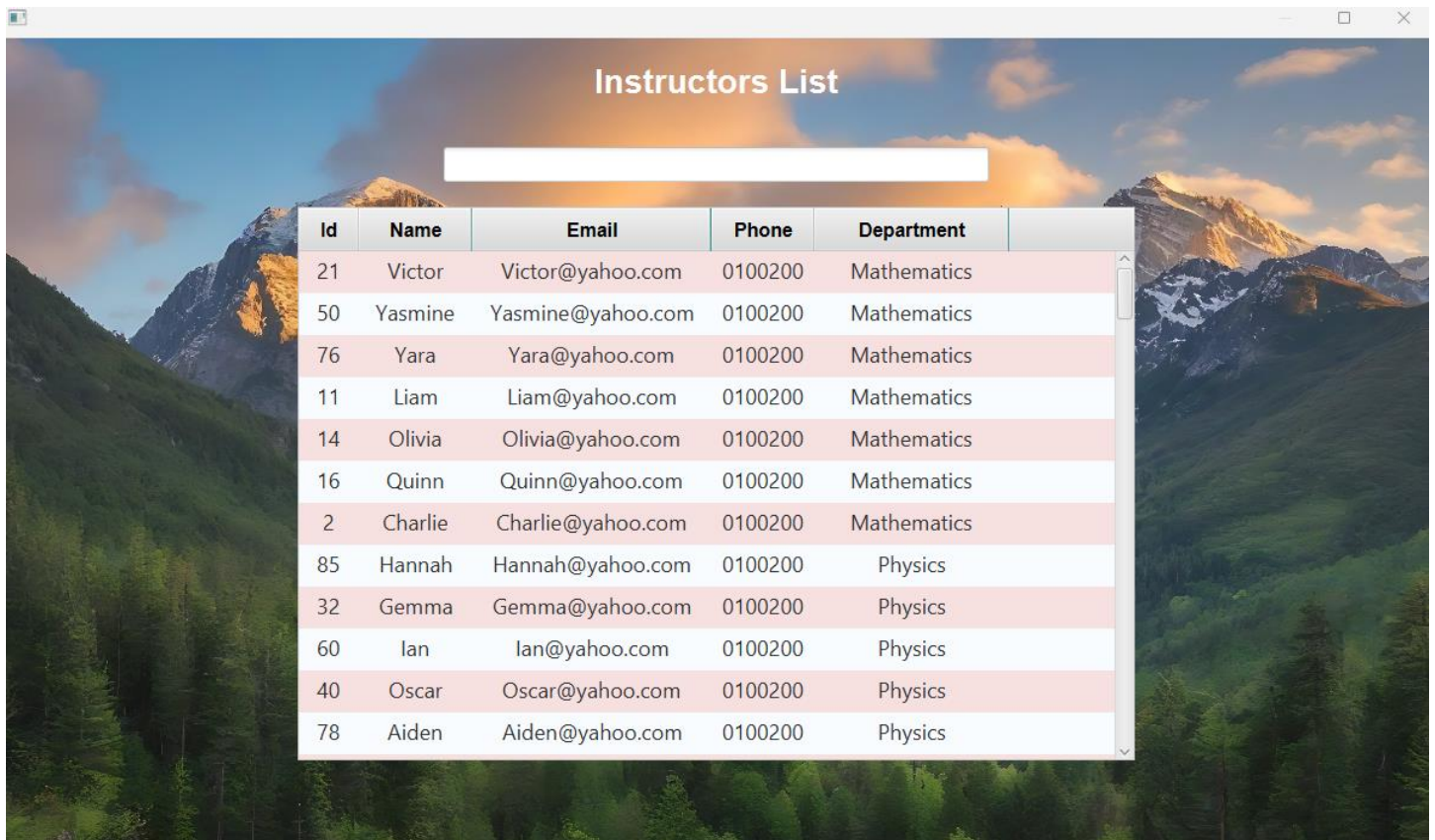
- This window is designed to add new courses into the database.

## About Page

- This window is designed to show some information about the developer &

## Instructors Page

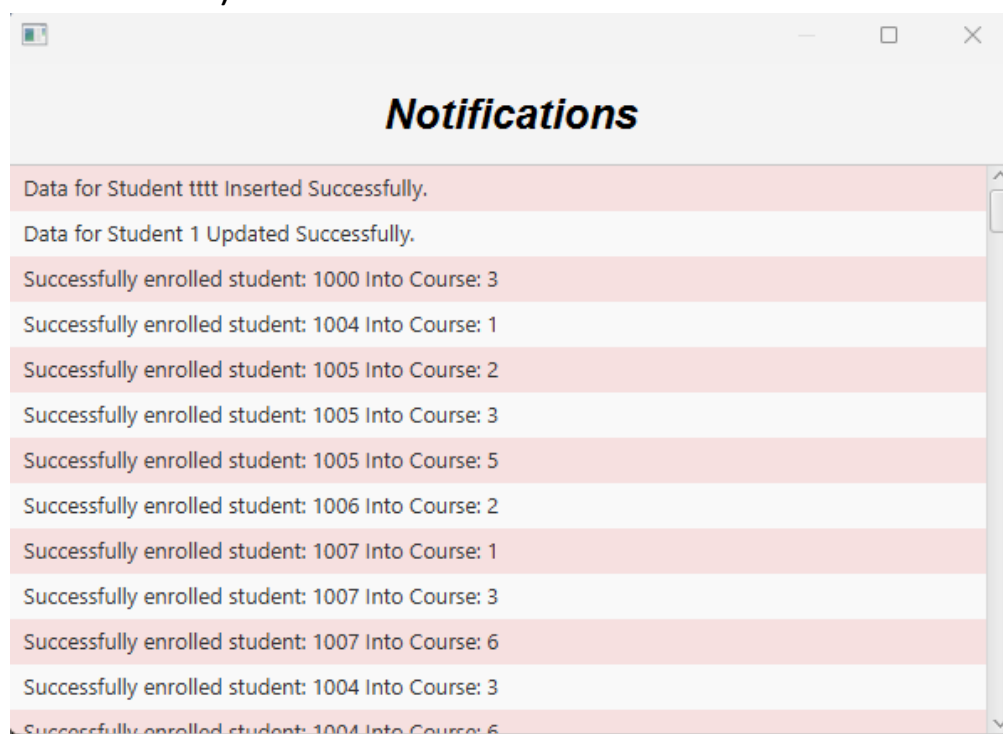
- This window is designed to show some statistics/data about our highly qualified Instructors.



Id	Name	Email	Phone	Department	
21	Victor	Victor@yahoo.com	0100200	Mathematics	
50	Yasmine	Yasmine@yahoo.com	0100200	Mathematics	
76	Yara	Yara@yahoo.com	0100200	Mathematics	
11	Liam	Liam@yahoo.com	0100200	Mathematics	
14	Olivia	Olivia@yahoo.com	0100200	Mathematics	
16	Quinn	Quinn@yahoo.com	0100200	Mathematics	
2	Charlie	Charlie@yahoo.com	0100200	Mathematics	
85	Hannah	Hannah@yahoo.com	0100200	Physics	
32	Gemma	Gemma@yahoo.com	0100200	Physics	
60	Ian	Ian@yahoo.com	0100200	Physics	
40	Oscar	Oscar@yahoo.com	0100200	Physics	
78	Aiden	Aiden@yahoo.com	0100200	Physics	

## Notifications Page

- This window is designed to show the history of transactions done by each user (staff member).



<i><b>Notifications</b></i>
Data for Student tttt Inserted Successfully.
Data for Student 1 Updated Successfully.
Successfully enrolled student: 1000 Into Course: 3
Successfully enrolled student: 1004 Into Course: 1
Successfully enrolled student: 1005 Into Course: 2
Successfully enrolled student: 1005 Into Course: 3
Successfully enrolled student: 1005 Into Course: 5
Successfully enrolled student: 1006 Into Course: 2
Successfully enrolled student: 1007 Into Course: 1
Successfully enrolled student: 1007 Into Course: 3
Successfully enrolled student: 1007 Into Course: 6
Successfully enrolled student: 1004 Into Course: 3
Successfully enrolled student: 1004 Into Course: 6