CIS - 25 MIDTERM: Student Gradebook

By: Minh Le

Project Description:

My midterm project involved making a student gradebook system with C++ that managed student, teacher, and course information. I stored data such as student information, course IDs, assignment points, and grades with data types and arrays/vectors. I wrote file input/output to write to .txt files for teachers when they wanted to generate report cards. I used a binary search to find students or courses by their IDs for efficiency and applied pointers for dynamic data. Via functions, constructors, and control structures such as loops and conditionals, I supported numerous operations, such as adding students, updating grade points, calculating GPAs, and printing neatly formatted report cards. Encapsulation was achieved by using access modifiers and also through a console interface for user interaction, thereby enabling teachers or administrators to manage academic records smoothly. Though I couldn't cover all possible edge cases nor set proper teacher-student security protocols, I attempted to make a very easy-to-use interface.

List of Concepts Used:

- **Data types and data sizes**
- **File types (e.g., .txt for data input/output)**
- **Use of pointers**
- **Arrays**
- **Binary search algorithm (or another search algorithm)**
- **Use of strings**
- **File I/O (reading from and writing to files)**
- **Four classes with meaningful interaction**
- Loops (for, while)
- Conditional statements (if, else)
- Functions / Methods
- Constructors and Destructors
- Header Files
- Encapsulation (private, public)
- Passing arguments by reference or by value
- Dynamic memory allocation
- Vectors
- File stream error checking

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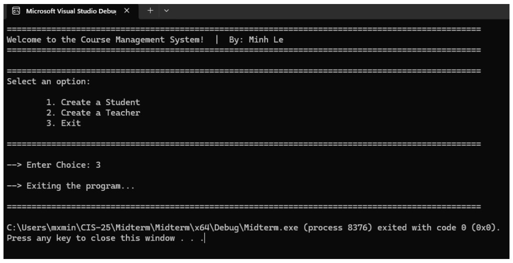
Screenshots of Program:

<table>
<tr><th>Explanation</th><th>Screenshots</th></tr>
<tr><td>The user is prompted to select an option and hits “Exit”.</td><td>


<pre>
==
Welcome to the Course Management System! | By: Minh Le
==

==
Select an option:

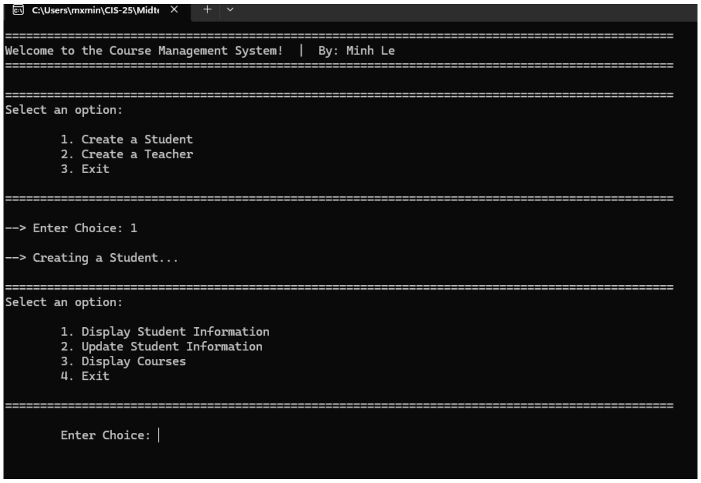
        1. Create a Student
        2. Create a Teacher
        3. Exit

==

--> Enter Choice: 3

--> Exiting the program...

==

C:\Users\mxmin\CIS-25\Midterm\Midterm\x64\Debug\Midterm.exe (process 8376) exited with code 0 (0x0).
Press any key to close this window . . .
</pre>
</td></tr>
<tr><td>The user is prompted to select an option and hits “Create a Student”. Same will happen when creating a Teacher, except additional information will be present since Teacher’s have more access.</td><td>


<pre>
==
Welcome to the Course Management System! | By: Minh Le
==

==
Select an option:

        1. Create a Student
        2. Create a Teacher
        3. Exit

==

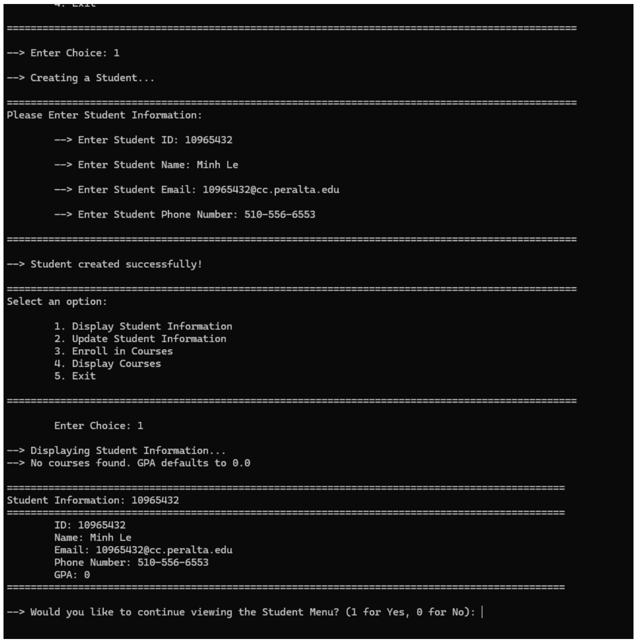
--> Enter Choice: 1

--> Creating a Student...

==
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Display Courses
        4. Exit

==

        Enter Choice:
</pre>
</td></tr>
<tr><td>The user created a Student and has inputted some Student Information. All of this is accessible and stored for future use.</td><td>

<pre>
        4. Exit

==

--> Enter Choice: 1

--> Creating a Student...

==
Please Enter Student Information:

        --> Enter Student ID: 10965432

        --> Enter Student Name: Minh Le

        --> Enter Student Email: 10965432@cc.peralta.edu

        --> Enter Student Phone Number: 510-556-6553

==

--> Student created successfully!

==
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Enroll in Courses
        4. Display Courses
        5. Exit

==

        Enter Choice: 1

--> Displaying Student Information...
--> No courses found. GPA defaults to 0.0

===
Student Information: 10965432
===
        ID: 10965432
        Name: Minh Le
        Email: 10965432@cc.peralta.edu
        Phone Number: 510-556-6553
        GPA: 0
===

--> Would you like to continue viewing the Student Menu? (1 for Yes, 0 for No):
</pre>
</td></tr>
</table>

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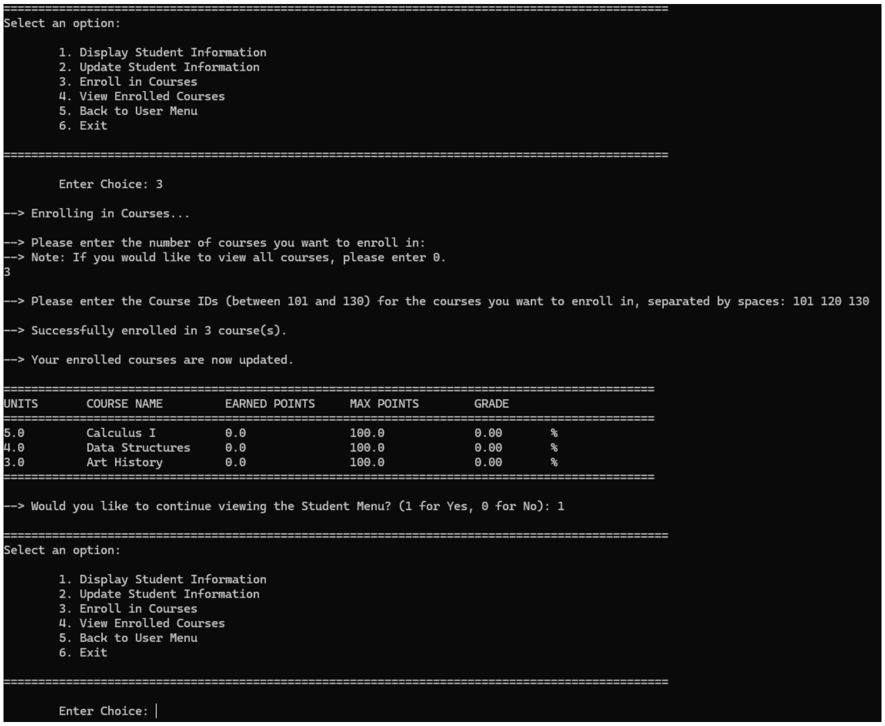
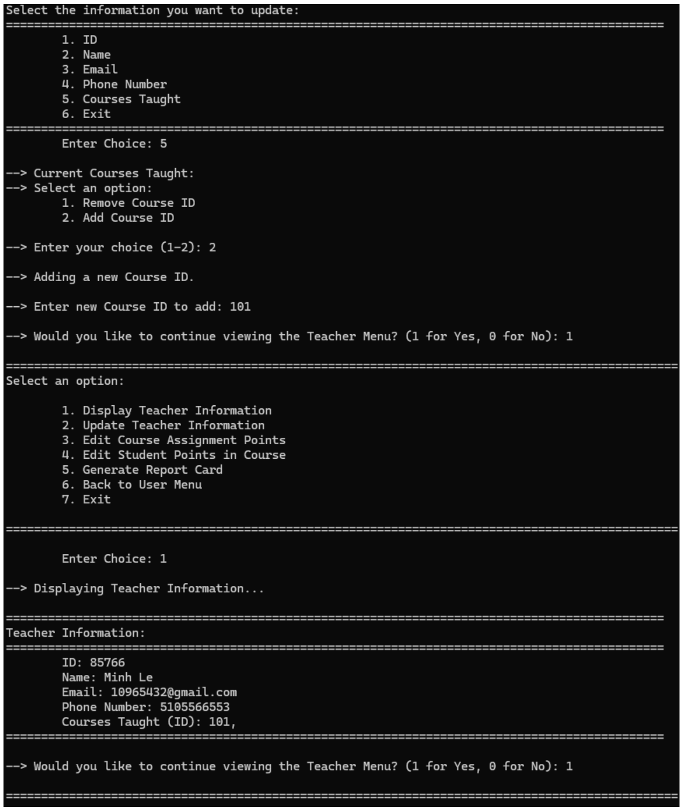
User Creating A Student and Enrolling them into courses.



```
===============================================================================================
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Enroll in Courses
        4. View Enrolled Courses
        5. Back to User Menu
        6. Exit

===============================================================================================

        Enter Choice: 3

--> Enrolling in Courses...

--> Please enter the number of courses you want to enroll in:
--> Note: If you would like to view all courses, please enter 0.
3

--> Please enter the Course IDs (between 101 and 130) for the courses you want to enroll in, separated by spaces: 101 120 130

--> Successfully enrolled in 3 course(s).

--> Your enrolled courses are now updated.

=============================================================================================
UNITS       COURSE NAME         EARNED POINTS     MAX POINTS        GRADE
=============================================================================================
5.0         Calculus I          0.0               100.0             0.00       %
4.0         Data Structures     0.0               100.0             0.00       %
3.0         Art History         0.0               100.0             0.00       %
=============================================================================================

--> Would you like to continue viewing the Student Menu? (1 for Yes, 0 for No): 1

===============================================================================================
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Enroll in Courses
        4. View Enrolled Courses
        5. Back to User Menu
        6. Exit

===============================================================================================

        Enter Choice: |
```

User Created a Teacher and is updating teacher Information including courses they teach.



```
Select the information you want to update:
==============================================================================================
        1. ID
        2. Name
        3. Email
        4. Phone Number
        5. Courses Taught
        6. Exit
==============================================================================================
        Enter Choice: 5

--> Current Courses Taught:
--> Select an option:
        1. Remove Course ID
        2. Add Course ID

--> Enter your choice (1-2): 2

--> Adding a new Course ID.

--> Enter new Course ID to add: 101

--> Would you like to continue viewing the Teacher Menu? (1 for Yes, 0 for No): 1

================================================================================================
Select an option:

        1. Display Teacher Information
        2. Update Teacher Information
        3. Edit Course Assignment Points
        4. Edit Student Points in Course
        5. Generate Report Card
        6. Back to User Menu
        7. Exit

================================================================================================

        Enter Choice: 1

--> Displaying Teacher Information...

==============================================================================================
Teacher Information:
==============================================================================================
        ID: 85766
        Name: Minh Le
        Email: 10965432@gmail.com
        Phone Number: 5105566553
        Courses Taught (ID): 101,
==============================================================================================

--> Would you like to continue viewing the Teacher Menu? (1 for Yes, 0 for No): 1

================================================================================================
```

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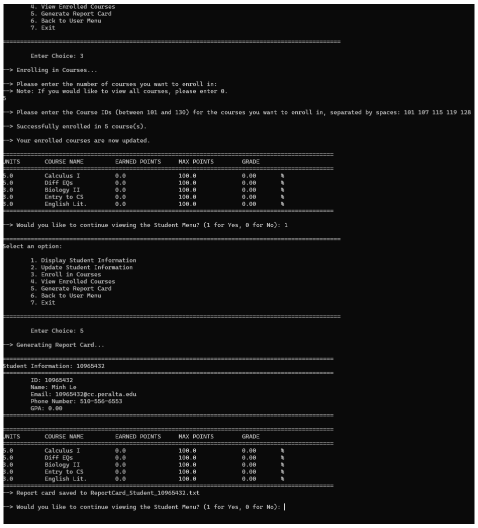
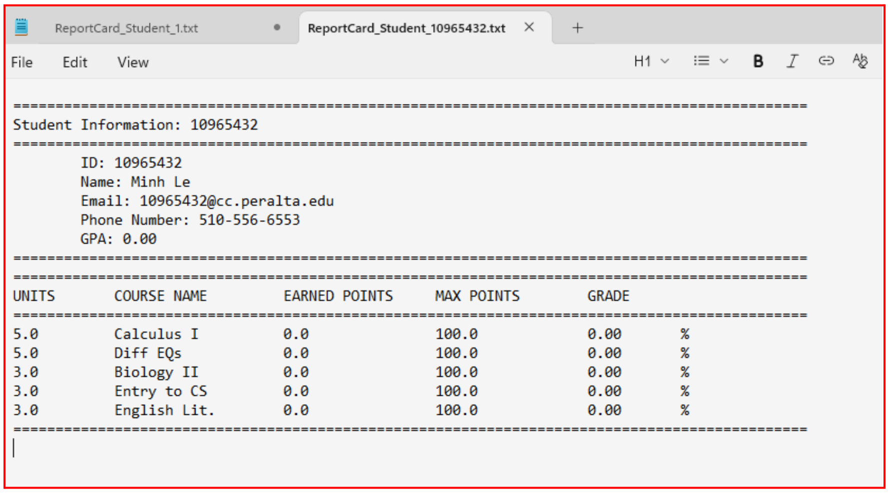
The user enrolls into courses and then the program generates a report card (.txt) because the user selects that option.



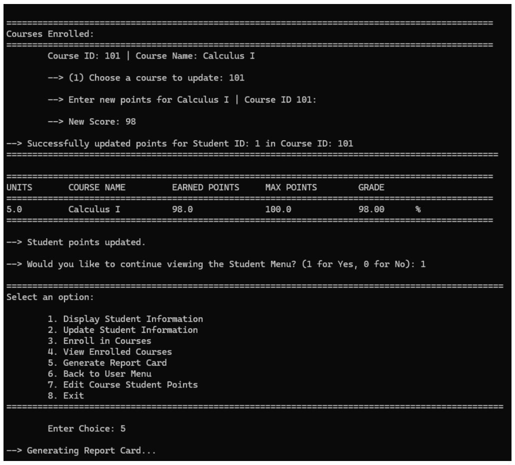
```
        4. View Enrolled Courses
        5. Generate Report Card
        6. Back to User Menu
        7. Exit

==========================================================================================

        Enter Choice: 3

--> Enrolling in Courses...

--> Please enter the number of courses you want to enroll in:
--> Note: If you would like to view all courses, please enter 0.
5

--> Please enter the Course IDs (between 101 and 130) for the courses you want to enroll in, separated by spaces: 101 107 115 119 128

--> Successfully enrolled in 5 course(s).

--> Your enrolled courses are now updated.

========================================================================================
UNITS       COURSE NAME         EARNED POINTS     MAX POINTS        GRADE
========================================================================================
5.0         Calculus I          0.0               100.0             0.00        %
5.0         Diff EQs            0.0               100.0             0.00        %
3.0         Biology II          0.0               100.0             0.00        %
3.0         Entry to CS         0.0               100.0             0.00        %
3.0         English Lit.        0.0               100.0             0.00        %
========================================================================================

--> Would you like to continue viewing the Student Menu? (1 for Yes, 0 for No): 1

==========================================================================================
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Enroll in Courses
        4. View Enrolled Courses
        5. Generate Report Card
        6. Back to User Menu
        7. Exit

==========================================================================================

        Enter Choice: 5

--> Generating Report Card...

========================================================================================
Student Information: 10965432
========================================================================================
        ID: 10965432
        Name: Minh Le
        Email: 10965432@cc.peralta.edu
        Phone Number: 510-556-6553
        GPA: 0.00
========================================================================================

========================================================================================
UNITS       COURSE NAME         EARNED POINTS     MAX POINTS        GRADE
========================================================================================
5.0         Calculus I          0.0               100.0             0.00        %
5.0         Diff EQs            0.0               100.0             0.00        %
3.0         Biology II          0.0               100.0             0.00        %
3.0         Entry to CS         0.0               100.0             0.00        %
3.0         English Lit.        0.0               100.0             0.00        %
========================================================================================
--> Report card saved to ReportCard_Student_10965432.txt

--> Would you like to continue viewing the Student Menu? (1 for Yes, 0 for No): |
```



```
========================================================================================
Student Information: 10965432
========================================================================================
        ID: 10965432
        Name: Minh Le
        Email: 10965432@cc.peralta.edu
        Phone Number: 510-556-6553
        GPA: 0.00
========================================================================================
========================================================================================
UNITS       COURSE NAME         EARNED POINTS     MAX POINTS        GRADE
========================================================================================
5.0         Calculus I          0.0               100.0             0.00        %
5.0         Diff EQs            0.0               100.0             0.00        %
3.0         Biology II          0.0               100.0             0.00        %
3.0         Entry to CS         0.0               100.0             0.00        %
3.0         English Lit.        0.0               100.0             0.00        %
========================================================================================
|
```

ABOVE IS THE .TXT FILE

Students adjust grades for a specific course. This also changes their GPA and related information.



```
==========================================================================================
Courses Enrolled:
==========================================================================================
        Course ID: 101 | Course Name: Calculus I

        --> (1) Choose a course to update: 101

        --> Enter new points for Calculus I | Course ID 101:

        --> New Score: 98

--> Successfully updated points for Student ID: 1 in Course ID: 101
===========================================================================================

==========================================================================================
UNITS       COURSE NAME         EARNED POINTS     MAX POINTS        GRADE
==========================================================================================
5.0         Calculus I          98.0              100.0             98.00       %
==========================================================================================

--> Student points updated.

--> Would you like to continue viewing the Student Menu? (1 for Yes, 0 for No): 1

============================================================================================
Select an option:

        1. Display Student Information
        2. Update Student Information
        3. Enroll in Courses
        4. View Enrolled Courses
        5. Generate Report Card
        6. Back to User Menu
        7. Edit Course Student Points
        8. Exit
============================================================================================

        Enter Choice: 5

--> Generating Report Card...
```

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Challenges Faced:

I struggled to make class methods communicate with one another properly and to have control over how data was being stored across instances, especially to ensure that changes to objects were propagating through the entire program correctly. It was hard to keep track of where and when data was being created or updated. To allow for this, I had to use vectors to store lists of objects dynamically and ensure I worked with pointers and references (&) carefully to make sure I was accessing and modifying the right instances without creating copies accidentally. This was trial-and-error but ultimately meant that I had data consistently throughout the program. Another issue I had to deal with was deciding when to pass pointers, full class objects, or pass by reference as function parameters.

At first, I was unable to determine which method would be most efficient or appropriate in a given situation. Passing entire classes sometimes necessitated redundant copying of data, slowing down efficiency, while pointers and references required careful use to avoid issues such as dangling pointers or unintended changes. Learning how to use each appropriately took time and practice but was crucial in creating clean, efficient, and error-free code. Apart from that, it was frustrating to deal with and keep track of my many methods and classes. I had to organize my code diligently in order to keep things neat and maintainable. It was time-consuming and took practice to understand how to apply each parameter-passing technique and how to have my code organized, but it paid off in making clean, effective, and error-free programs.

In the end, I was unable to fix bugs relating to teachers generating and managing groups of students. This all stemmed from how students were stored after creation. I was also unable to handle all possible edgecases (all stemming from user input problems). I will continue to try and improve my data management skills.