CS201 – Spring 2022-2023 - Sabancı University

Homework #7: Library System with Class

Due June 4 -, Wednesday, 23:00 (Sharp Deadline)

Introduction

In this assignment, you will enhance the library management program you previously developed. Instead of using a struct to represent a book, you will now use a class. The class will have member variables to store book data and member functions to manipulate this data. You will also add two new member functions.

The main functionalities remain the same: adding books to the library, searching for a book by author, searching for a book by title and displaying the books sorted by the author's last name. If multiple books have the same author, they will be sorted by their titles. You will implement the insertion sort algorithm to sort the books, the binary search algorithm to search for a book by the author, and the linear search algorithm to search by title.

The goal of this homework is to help you understand how classes work in C++ and how they provide more functionality and control compared to structs.

Your homework will be automatically graded using SUCourse, so it is very important to satisfy the exact same outputs given in the example test cases of SUCourse. Please submit your assignment by writing your main source (cpp) file content into the Answer field. You can utilize the **Check** button under the code editor at SUCourse to check whether your implementation is working in the expected way. After you check your solution code, you will see your grade with the example test cases used; however your homework will then be graded with **different** test cases.

To submit your homework, you must hit the **"Finish attempt…"** and **"Submit all and finish"** buttons. **Just a reminder of a character ↩ which refers to a newline in your expected output.**

VERY IMPORTANT!

Your programs will be compiled, executed and evaluated automatically; therefore, you should definitely follow the rules for prompts, inputs and outputs. See **Sample Runs** section for some examples.

Order of inputs and outputs must be in the abovementioned format.
Prompts before inputs and outputs must be **exactly the same** with examples.

Following these rules is crucial for grading, otherwise our software will not be able to process your outputs and you will lose some grades in the best scenario.

Inputs

Inputs remain the same as previous assignment as following;

There are various inputs in this program, including book details, menu choices, and search queries. The primary inputs are the book's title, author, and publication year. You can assume that the book's title and author will be strings containing letters, digits, and spaces. The publication year will be an integer input. The user can add books one at a time using the "Add books" menu option.

Another input is the menu choice, which is an integer ranging from 1 to 5, representing the available menu options. The user can enter menu choices until they enter "5" to quit the program.

The search query is a string input representing the title of the book the user wants to search for.

Input Checks

Input checks remain the same as previous assignment;

The rules for input checks are as follows:

For book details and search query, you can assume that the user enters these inputs correctly, and you do not have to check them.

Book details:

Title: Must be a string containing only letters, digits, and spaces.

Author: Must be a string containing only letters, digits, and spaces.

Publication Year: Must be a valid integer.

Search query:

Must be a string containing only letters, digits, and spaces. Cannot be empty.

You can assume that the menu choice is an integer, but you should check it for the range.

Menu choice: Must be an integer ranging from 1 to 5.

In case of an invalid input, the program should ask for input again until a correct input is entered. Use loops and conditional statements to ensure input validity.

Processing, Program Flow, and Output

Your program should start with an introductory explanation and a prompt for the input. After initializing the library system with a predefined set of books, the program will display a menu with four options:

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
```

The user can enter their choice as an integer.

You will be provided with a predefined set of books, which you should use to initialize your library within your code. To accomplish this, you should create instances of the Book class for each book, using the provided title, author, and publication year as arguments for the **constructor**. Here are the predefined set of books:

"The Great Gatsby" by "F Scott Fitzgerald" published in 1925
"Moby Dick" by "Herman Melville" published in 1851
"To Kill a Mockingbird" by "Harper Lee" published in 1960
"Pride and Prejudice" by "Jane Austen" published in 1813
"Burmese Days" by "George Orwell" published in 1934
"Brave New World" by "Aldous Huxley" published in 1932
"Animal Farm" by "George Orwell" published in 1945

Ensure to add these books to your library system which is your vector.

For the book details, instead of creating a struct, you'll use the class constructor to create a book. The class will have getters and setters for each member variable, which you'll use to access and modify the book data.

If the user chooses to add a book, the program should prompt for the book's title, author, and publication year. After the user enters the details, the program should add the book to the library and re-sort the library using the class's member functions.

The other functionalities remain the same as the previous assignment; however, you must now implement these functionalities through class member functions within the Book class.

If the user chooses to search for a book by an author, the program should prompt for the author's full name. The search should be based on the author's last name and be case-insensitive. If any books are found by the specified author, the program should display the details of each book, including its title, author, publication year and position. If no books are found by the specified author, the program should display an appropriate message.

If the user chooses to search for a book by title, the program should prompt for the book's title. The search should be case-insensitive and based on the provided title. If any books with the specified title are found, the program should display the details of each book, including its title, author, publication year, and position in the sorted list. If no books are found with the specified title, the program should display an appropriate message.

If the user chooses to display books, the program should display the entire library sorted by the author's last name as case-insensitive. The output should include the book's title, author, and publication year.

If the user chooses to quit, the program should display a farewell message and terminate.

Your program should continuously display the menu and prompt for input until the user chooses to quit.

In object-oriented programming, classes have members which can be either variables (attributes) or functions (methods). Members of a class can be used to manipulate the objects of that class. These members can be public (accessible from anywhere), private (accessible only from within the class), or protected (accessible from the class and its derived classes).

The **getAuthorLastName()** and **display(int i)** functions are newly introduced member functions in the Book class.

The getAuthorLastName() function is used to extract and return the last name of the author of a particular book. This function is important for the functionality that allows for searching a book by author's last name and sorting books by the author's last name. The function doesn't take any arguments and returns a string representing the author's last name.

The display(int i) function is used to display the details of a particular book. This function takes an integer argument i, which represents the position of the book in the sorted book list, and doesn't return anything. When called, it displays the book details in the following format:

i+1. Title, Author, Publication Year

These two functions help encapsulate the logic for displaying and retrieving information about a book within the Book class itself, promoting better data encapsulation and making the code easier to manage and understand.

Class Details

class Book {

public:

Book(); : This is the default constructor. It is a special member function that is automatically called when an object of the Book class is created. This constructor will initialize the member variables to default values, for instance, an empty string for title and author, and zero for publicationYear.

Book(const string& title, const string& author, int publicationYear); : This is a parameterized constructor. It is used when you want to create a Book object and initialize the member variables at the same time.

string getTitle() const; : This is a getter method for the title member variable. It does not modify any values and returns the current title of the Book object.

string getAuthor() const; : This is a getter method for the author member variable. It returns the current author of the Book object.

int getPublicationYear() const; : This is a getter method for the publicationYear member variable. It returns the current publicationYear of the Book object.

void setTitle(const string& book_title); : This is a setter method for the title member variable. It sets the title of the Book object to the value provided in the argument.

void setAuthor(const string& book_author); : This is a setter method for the author member variable. It sets the author of the Book object to the value provided in the argument.

void setPublicationYear(int book_publicationYear); : This is a setter method for the publicationYear member variable. It sets the publicationYear of the Book object to the value provided in the argument.

string getAuthorLastName() const; // New function : This is a getter method that returns the last name of the author of the book.

void display() const; // New function : This method displays the details of the Book object.

Inside the method, we use the cout statement to print out the details of the book, including its title, author, and publication year. Each piece of information is separated by a comma for readability.

private:

string title; : This is a string private member variable that stores the title of the book. As a private member, it is accessible only within the methods of the Book class.

string author; : This is a string private member variable that holds the name of the author of the book. Like title, this is also a private member and can only be accessed or modified within the Book class methods.

int publicationYear; : This is an int private member variable that stores the publication year of the book. It is also a private member, so it is accessible only within the Book class methods.

};

IMPORTANT!

If your code does not compile, you will get **zero**. Please be careful about this and double check your code before submission.

No abrupt program termination please!

You may want to stop the execution of the program at a specific place (before the end) in the program. Although there are ways of doing this in C++, it is not a good programming practice to abruptly stop the execution in the middle of the program. Therefore, your program flow should continue until the end of the main function and finish there.

Sample Runs

Below, we provide some sample runs of the program that you will develop. The *italic* and **bold** phrases are inputs taken from the user. You have to display the required information in the same order and with the same words and characters as below.

Sample Run 1

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 4
Sorted books by author's last name:
1. Pride and Prejudice, Jane Austen, 1813
2. The Great Gatsby, F Scott Fitzgerald, 1925
3. Brave New World, Aldous Huxley, 1932
4. To Kill a Mockingbird, Harper Lee, 1960
5. Moby Dick, Herman Melville, 1851
6. Animal Farm, George Orwell, 1945
7. Burmese Days, George Orwell, 1934

Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
```

```
5. Quit
Enter your choice: 5
Goodbye!
```

Sample Run 2

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 1
Enter the new book details:
Enter book's title: The Hunger Games
Enter book's author: suzanne collins
Enter book's publication year: 2008
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 4
Sorted books by author's last name:
1. Pride and Prejudice, Jane Austen, 1813
2. The Hunger Games, suzanne collins, 2008
3. The Great Gatsby, F Scott Fitzgerald, 1925
4. Brave New World, Aldous Huxley, 1932
5. To Kill a Mockingbird, Harper Lee, 1960
6. Moby Dick, Herman Melville, 1851
7. Animal Farm, George Orwell, 1945
8. Burmese Days, George Orwell, 1934

Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 1
Enter the new book details:
Enter book's title: The Moonstone
Enter book's author: Wilkie Collins
Enter book's publication year: 1868
```

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 4
Sorted books by author's last name:
1. Pride and Prejudice, Jane Austen, 1813
2. The Hunger Games, suzanne collins, 2008
3. The Moonstone, Wilkie Collins, 1868
4. The Great Gatsby, F Scott Fitzgerald, 1925
5. Brave New World, Aldous Huxley, 1932
6. To Kill a Mockingbird, Harper Lee, 1960
7. Moby Dick, Herman Melville, 1851
8. Animal Farm, George Orwell, 1945
9. Burmese Days, George Orwell, 1934

Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 5
Goodbye!
```

Sample Run 3

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 2
Enter the author of the book you want to search for: George Orwell
Books by Orwell:
Title: Animal Farm, Publication Year: 1945, Position: 6
Title: Burmese Days, Publication Year: 1934, Position: 7
Library System Menu:
1. Add books
```

```
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 2
Enter the author of the book you want to search for: Murat Mentes
No books were found.
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 5
Goodbye!
```

Sample Run 4

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 6
Invalid choice, please try again.
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 5
Goodbye!
```

Sample Run 5

```
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 3
Enter the title of the book you want to search for: animal farm
Books matching the title "animal farm":
Title: Animal Farm, Author: George Orwell, Publication Year: 1945, Position: 6
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 1
Enter the new book details:
Enter book's title: Harry Potter and the Prisoner of Azkaban
Enter book's author: j k rowling
Enter book's publication year: 1999
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 3
Enter the title of the book you want to search for: Harry Potter and the Prisoner of Azkaban
Books matching the title "Harry Potter and the Prisoner of Azkaban":
Title: Harry Potter and the Prisoner of Azkaban, Author: j k rowling, Publication Year: 1999, Position: 8
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 4
Sorted books by author's last name:
1. Pride and Prejudice, Jane Austen, 1813
2. The Great Gatsby, F Scott Fitzgerald, 1925
3. Brave New World, Aldous Huxley, 1932
4. To Kill a Mockingbird, Harper Lee, 1960
5. Moby Dick, Herman Melville, 1851
6. Animal Farm, George Orwell, 1945
7. Burmese Days, George Orwell, 1934
8. Harry Potter and the Prisoner of Azkaban, j k rowling, 1999

Library System Menu:
```

```
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 3
Enter the title of the book you want to search for: Dublorun Dilemmasi
Books matching the title "Dublorun Dilemmasi":
No books were found.
Library System Menu:
1. Add books
2. Search for an author
3. Search for by book title
4. Display books
5. Quit
Enter your choice: 5
Goodbye!
```

General Rules and Guidelines about Homework

The following rules and guidelines will be applicable to all homework unless otherwise noted.

How to get help?

You may ask questions to TAs (Teaching Assistants) or LAs (Learning Assistants) of CS201. Office hours of TAs/LAs are at the SUCourse.

What and Where to Submit

You can prepare (or at least test) your program using MS Visual Studio 2019 C++ (Windows users) or using XCode (macOS users).

- Your code will be automatically graded using SUCourse. Therefore, it is essential that you ensure your output matches the exact same outputs given in the example test cases provided by SUCourse.
- After writing your code, use the "Check" button located under the code editor in SUCourse to see your grade based on the example test cases used. This grade will give you an idea of how well your code is performing.
- Note that the example test cases used for checking your code are not the same as the ones used for grading your homework. Your final grade will be based on different test cases. Therefore, it is important that you carefully follow the instructions and ensure that your code is working correctly to achieve the best possible grade on your homework assignment.
- To submit your homework, click on the "Finish attempt..." button and then the "Submit all and finish" button. If you wish to submit again before the due date, you can press the "Re-attempt quiz" button.
- Submit your work **through SUCourse only**! You will receive no credits if you submit by any other means (email, paper, etc.).

Grading, Review and Objections

Be careful about the automatic grading: Your programs will be graded using an automated system. Therefore, you should follow the guidelines on the input and output order. Moreover, It is important to use the exact same text as provided in the example test case outputs from SUCourse. Otherwise, the automated grading process will fail for your homework, and you may get a zero, or in the best scenario, you will lose points.

Grading:

- There is NO late submission. You need to submit your homework before the deadline. Please be careful that SUCourse time and your computer time may have 1-2 minute differences. You need to take this time difference into consideration.
- Successful submission is one of the requirements of the homework. If, for some reason, you cannot successfully submit your homework and we cannot grade it, your grade will be 0.
- If your code does not work because of a syntax error, then we cannot grade it; and thus, your grade will be 0.
- Please submit your **own** work only. It is really easy to find "similar" programs!
- Plagiarism will not be tolerated. Please check our plagiarism policy given in the Syllabus.

Plagiarism will not be tolerated!

Grade announcements: Grades will be posted in SUCourse, and you will get an Announcement at the same time. You will find the grading policy and test cases in that announcement.

Grade objections: It is your right to object to your grade if you think there is a problem, but before making an objection please try the steps below and if you still think there is a problem, contact the TA that graded your homework from the email address provided in the comment section of your announced homework grade or attend the specified objection hour in your grade announcement.

- Check the comment section in the homework tab to see the problem with your homework.
- Check the test cases in the announcement and try them with your code.
- Compare your results with the given results in the announcement.

Good Luck!
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