FAST School of Computing

Object Oriented Programming – Spring 2025

Software Engineering Department

LAB 06

Structure in C++

Learning Outcomes

In this lab you are expected to learn the following:

Implement all concepts of Structure

Problem 1:

Library Management System with Dynamic Book Records

Managing book records manually in a large library is inefficient, leading to misplaced books, slow retrieval times, and cataloging errors. Static memory allocation further limits flexibility, making it difficult to accommodate an expanding collection. A dynamic, well-structured system is needed to efficiently store, retrieve, and manage book records. Now, for simulation, add 5 book records dynamically and release them when the program terminates.

Approach:

Use nested structures with pointers for dynamic memory allocation.

Book Structure:

- **Attributes:** title, author, genre, bookID
- **Pointer Variables:** Borrower* borrowerInfo, Purchase* purchaseInfo

Borrower Structure:

- **Attributes:** borrowerName (string), issueDate (string), returnDueDate (string)

Purchase Structure:

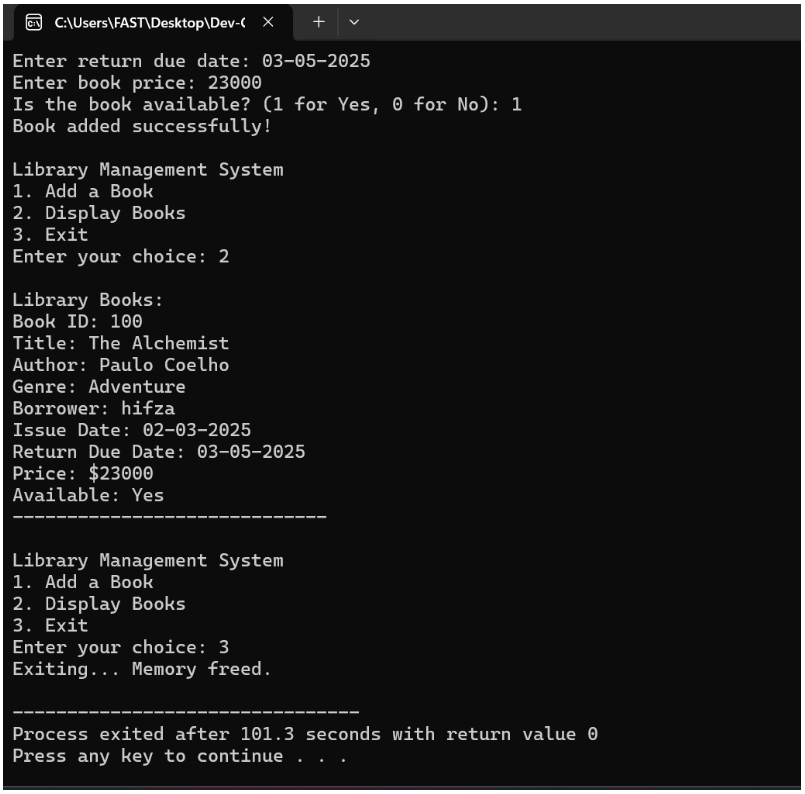
- **Attributes:** price (integer), isAvailable (Boolean)

Functions:

- **addBook()** → Allocates and registers book data
- **displayBooks()** → Retrieves and displays book records
- **releaseMemory()** → Frees allocated memory

In main function:

- *Create   Book* bookList = new Book[capacity];*
- Call the Functions based on user inputs like user press 1 for Add Book, 2 for displaybook and 3 for exit or releaseMemory.



```
Enter return due date: 03-05-2025
Enter book price: 23000
Is the book available? (1 for Yes, 0 for No): 1
Book added successfully!

Library Management System
1. Add a Book
2. Display Books
3. Exit
Enter your choice: 2

Library Books:
Book ID: 100
Title: The Alchemist
Author: Paulo Coelho
Genre: Adventure
Borrower: hifza
Issue Date: 02-03-2025
Return Due Date: 03-05-2025
Price: $23000
Available: Yes
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Library Management System
1. Add a Book
2. Display Books
3. Exit
Enter your choice: 3
Exiting... Memory freed.

--------------------------------
Process exited after 101.3 seconds with return value 0
Press any key to continue . . .
```
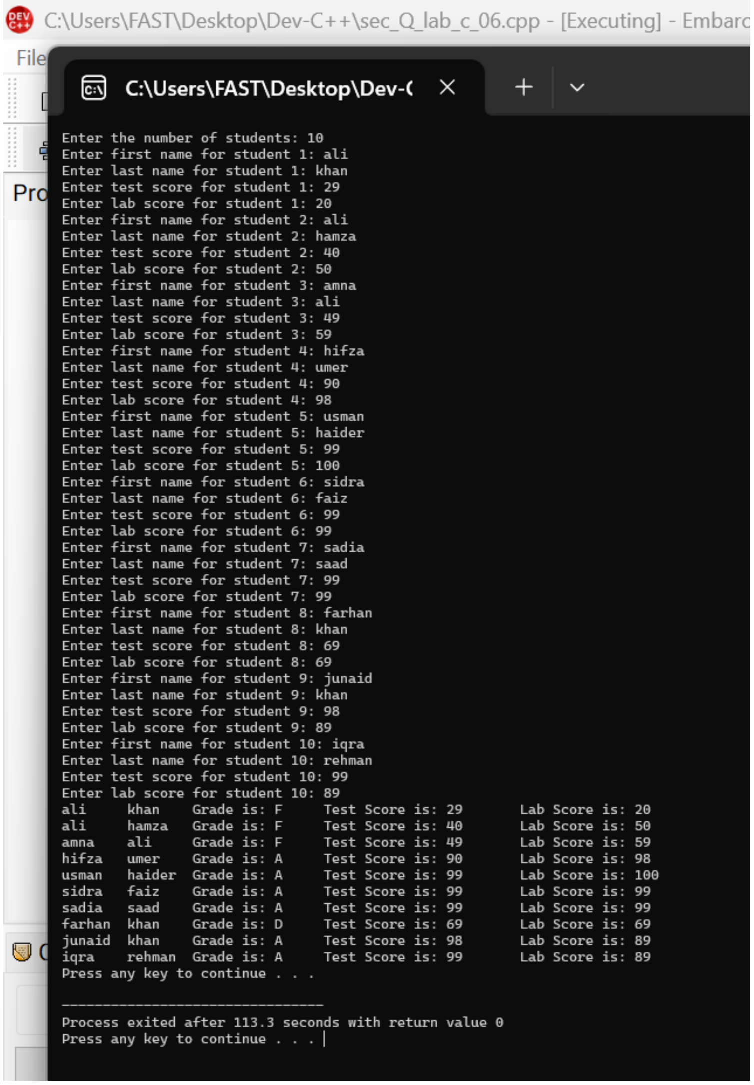

Problem 2:

a. You will define and declare struct data with the 10 student information. Assume **Lab score is 70%** and **Test score is 30%** of the total grades.

b. Perform the following tasks:

- Initialize/declare each student in struct data type.
- Implement a function getGrade() that calculates grades based on weighted scores. This could be a void function pass-by-reference or appropriate char function to return course grade. Inputs will be the test score and the labs score. The percentages (30% and 70%) could be defined as global double constants. Use step-by-step incremental approach to develop your code.
- Display the student information back to the user. Try to use a function call to print this output. A sample output might be:


C:\Users\FAST\Desktop\Dev-C++\sec_Q_lab_c_06.cpp - [Executing] - Embarc
File
Pro
C:\Users\FAST\Desktop\Dev-(

```
Enter the number of students: 10
Enter first name for student 1: ali
Enter last name for student 1: khan
Enter test score for student 1: 29
Enter lab score for student 1: 20
Enter first name for student 2: ali
Enter last name for student 2: hamza
Enter test score for student 2: 40
Enter lab score for student 2: 50
Enter first name for student 3: amna
Enter last name for student 3: ali
Enter test score for student 3: 49
Enter lab score for student 3: 59
Enter first name for student 4: hifza
Enter last name for student 4: umer
Enter test score for student 4: 90
Enter lab score for student 4: 98
Enter first name for student 5: usman
Enter last name for student 5: haider
Enter test score for student 5: 99
Enter lab score for student 5: 100
Enter first name for student 6: sidra
Enter last name for student 6: faiz
Enter test score for student 6: 99
Enter lab score for student 6: 99
Enter first name for student 7: sadia
Enter last name for student 7: saad
Enter test score for student 7: 99
Enter lab score for student 7: 99
Enter first name for student 8: farhan
Enter last name for student 8: khan
Enter test score for student 8: 69
Enter lab score for student 8: 69
Enter first name for student 9: junaid
Enter last name for student 9: khan
Enter test score for student 9: 98
Enter lab score for student 9: 89
Enter first name for student 10: iqra
Enter last name for student 10: rehman
Enter test score for student 10: 99
Enter lab score for student 10: 89
ali     khan    Grade is: F     Test Score is: 29       Lab Score is: 20
ali     hamza   Grade is: F     Test Score is: 40       Lab Score is: 50
amna    ali     Grade is: F     Test Score is: 49       Lab Score is: 59
hifza   umer    Grade is: A     Test Score is: 90       Lab Score is: 98
usman   haider  Grade is: A     Test Score is: 99       Lab Score is: 100
sidra   faiz    Grade is: A     Test Score is: 99       Lab Score is: 99
sadia   saad    Grade is: A     Test Score is: 99       Lab Score is: 99
farhan  khan    Grade is: D     Test Score is: 69       Lab Score is: 69
junaid  khan    Grade is: A     Test Score is: 98       Lab Score is: 89
iqra    rehman  Grade is: A     Test Score is: 99       Lab Score is: 89
Press any key to continue . . .

--------------------------------
Process exited after 113.3 seconds with return value 0
Press any key to continue . . .
```

Submission Details:

1. Save each question .cpp file with your roll no and lab number e.g. i22-XXXX_Lab6.cpp
2. Take screen shot of running test cases of tasks.
3. Zip the .cpp file and screen shots (Do not create .rar file) with roll no and lab no. e.g. i22-XXXX_Lab6.zip.
4. Submit the zip file on google classroom.