Fast 

**National University of Computer & Emerging Sciences, Karachi**

**CS-Department**

**FAST School of Computing**

**Lab Mid Examination Paper A, Summer 2023**

|  |  |  |
| --- | --- | --- |
| **Course Code: CL1004** | **Course Name: Object Oriented Programming Lab** | |
| **Instructor Names: Mr. Muhammad Monis** | | |
| **Student Roll No:** | | **Section No:** |

***General Instructions:*** Carefully read the following instructions before attempting the paper.

* Except your Roll No and Section, **DO NOT WRITE** anything on this paper.
* The Final Exam consists of 3 questions on 2 printed sides of 1 page.
* In case of any ambiguity, you may make assumptions, but your assumption must not contradict any statement in the question paper.
* **DON’T** share your program, if your code is matched to any member of your class, both will get **straight F** in the course without asking who shared or who magically copied.

***Submission Instructions:***

* You must comment your student ID on top of each file. (Line#1 of your code).
* Name the .c file for each question according to Roll\_No e.g. **k22-xxxx\_Q1.c, k22- xxxx \_Q2.c** etc.
* Create a ZIP folder of all your solutions and copy it in the local storage with the title **K22-xxxx\_A.**
* Submission are on local storage that can be accessed using win+r keys and entering [\\172.16.5.41](file:///\\172.16.5.41) address in the dialog box.
* Enter your username as **khifast\K22xxxx** and its assigned password (Default is **Fast1234**).
* Zip folder needs to be pasted in the “**Exam Folder\teacherName\Your\_Roll\_No**” folder

**Total Time**: **120 minutes**  **Maximum Points**: **50**

***Question No 01 [Marks: 10 Points, 4 weightage]***

Emily is developing a banking system and needs to create a class to represent a bank account. The account class should have member variables to store the account number, account holder's name, account balance, and account type (e.g., savings or checking). Emily wants to ensure that when an account object is created, the necessary information is initialized properly. She also wants to implement a copy constructor to make it easier to create copies of existing account objects. Additionally, she wants to provide a way to deposit and withdraw funds from the account while keeping track of the account balance.

Write a Program for the account class that includes a default constructor, a parameterized constructor, a copy constructor, and member functions (Such as withdraw, deposit, check balance, print mini statement) to deposit and withdraw funds, check balance, and print a small mini balance statement. Ensure that the account balance is updated accordingly when funds are deposited or withdrawn. Additionally, provide an example usage of the copy constructor in a scenario where Emily creates a new account object based on an existing account object and performs some transactions on both accounts.

***Question No 02 [Marks: 20 Points, 8 weightage]***

Suppose you are developing a software application to manage a library system. The system consists of several classes, including Library, Book, and Member. The Library class represents a library and has a list of Book objects and a list of Member objects. The Book class represents a book in the library and has attributes like title, author, and availability. The Member class represents a library member and has attributes like name, ID, and a list of borrowed books.

a) Implement the Library class with appropriate data members and member functions to add books to the library, add members to the library, and associate a book with a member when it is borrowed. **2 points**

b) Implement the Book class with appropriate data members and member functions to track the availability of the book, update the availability when it is borrowed or returned, and provide information about the book. **2 points**

c) Implement the Member class with appropriate data members and member functions to borrow a book, return a book, and provide information about the member's borrowed books. **2 points**

d) Define an aggregation relationship between the Library and Book classes, where the Library class contains a collection of Book objects. **3 points**

e) Define a composition relationship between the Library and Member classes, where the Library class owns and manages a collection of Member objects. **3** **points**

Now, consider the following scenario. The library system is set up with a Library object named "Central Library." It has two books registered: "Introduction to Programming" by John Smith and "Data Structures and Algorithms" by Jane Doe. The library also has three members registered: John, Sarah, and Michael.

John wants to borrow "Introduction to Programming" from the library. Implement the necessary steps to associate the book with John, update its availability, and display relevant information about the borrowed book and John's membership status. Lastly, assume that Sarah and Michael also borrow books from the library. Calculate the total number of borrowed books in the library and display the count. **8 points**

***Question No 03 [Marks: 20 Points, 8 weightage]***

Sophia is a software developer working on a project to develop a simulation game that involves different types of characters. The character hierarchy includes a base class called "Character," a derived class called "Player," and another derived class called "Enemy." Sophia wants to implement static and constant functions and variables within the classes to ensure efficient resource management and prevent accidental modifications.

Your task is to demonstrate Hybrid inheritance by defining the classes "Character," "Player," and "Enemy." **2 points**

Within the classes, implement static and constant functions and variables as appropriate (You can make assumptions as to which methods can be considered static or constant i.e. For Player methods are movement, health\_regen, switch\_weapons, For Character methods are switch character, character type, character stats and for Enemy methods are attack, health\_regen, special\_attacks ) **8 points**

Additionally, provide an example scenario where Sophia creates objects of each class, calls their member functions (including static and constant functions), and accesses their member variables. **6 points**

In the game, characters have a name, health points (HP), and attack points (AP). The base class "Character" should have member functions to display the character's details and a constant function to calculate the total damage dealt by the character. The derived class "Player" should have a static variable to keep track of the total number of players created and a static function to display this count. The derived class "Enemy" should have a constant variable to represent the maximum health points an enemy can have. **4 points**

**Note:** For hybrid inheritance make sure there are at least two types utilized.