National University of Computer and Emerging Sciences

OOP (CS1004)

Lab Mid Exam

Date: March 19th 2024

Time: 8:00 – 09:30 am

Course Instructor(s)

Shafique Rehman, Ms Mahnoor, Ms Javeria, Ms Zainab.

Total Time: 1.5 Hours

Total Marks: 50

Total Questions: 03

Semester: SP-2024

Campus: Karachi

Dept: Computer Science

M. Zajnan Aslam	23K 0880	2A	
Student Name	Roll No	Section	Student Signature

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 Exam consists of 3 questions on 3 printed sides of 2 page.
- In case of any ambiguity, you may make assumptions, but your assumption must not contradict any question.

Submission Instructions:

- You must comment your student ID on top of each file.
- Name the .cpp file for each question according to Roll_No e.g. k23xxxxQ1.c, k23xxxxQ2.c etc.
- Create a folder with the name K23XXXX according to your student id.
- Put all your .cpp files (1 for each question) in the above folder. Then paste this folder on the local share.
- Submissions are on local storage that can be accessed using win+R keys and entering \\172.16.5.43

Paper A

Question Q1 ***Weightage: 6 ;*** **Marks: 15**

You are tasked with designing a statistical calculation module for a financial software system. Below are the requirements for the module: **First,** Implement a C++ class named **'FinancialStatistics'** with a ***calculateMean*** function that computes the mean of an array of numerical data. The function should be accessible without creating an instance of the class and optimized for efficiency. Explain the approach you would take to ensure flexibility for different data sets, considering the dynamic nature of financial data. **Second,** Extend the **FinancialStatistics** class by implementing a member function ***getVariance*** that calculates the variance of a given array of numerical data. Optimize this function for efficiency and ensure it is resistant to unintentional modifications of the object's data.

$$S^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

Where:

n is the number of data points

xi represents each individual data point

$\bar{x}$ is the mean of the data set, calculated as $\frac{\sum_{i=1}^{n} xi}{n}$

Question Q2 ***Weightage: 6 ;*** **Marks: 15**

You are tasked to create a social media application for Pakistan that will work only in Pakistan. Now Design the Application with the following classes: **Post, User, and Comment.**

a) Implement the **Post** class with **Member Variables**: ***title***: string - to store the title of the post, ***content***: string - to store the content of the post, comments: ***Comment**** array - to store pointers to the comments on the post and *numComments*: int - to store the number of comments on the post and **Member Functions**: ***Post (const string&_title, const string&_content)***: Constructor to initialize the post object with a given title and content, ***addComment (Comment* comment), removeComment (Comment* comment) and displayInfo () const.***

b) Implement the **User** class with Member Variables: **name**: string - to store the name of the user, posts: **Post*** array - to store pointers to the posts created by the user and **numPosts**: int - to store the number of posts created by the user and Member Functions: **User (const string& _name)**: Constructor to initialize the user object with a given name, **createPost (const string& title, const string content), addCommentToPost (Post* post, Comment* comment), void removeCommentFromPost (Post* post, Comment* comment) and void displayUserPostsAndComments () const:** Function to display information about the user's posts and comments.

c) Implement the **Comment** class with Member Variables: **content**: string - to store the content of the comment and Member Functions: **Comment (const string& _content)**: Constructor to initialize the comment object with a given content, **void editContent (const string& newContent) and string getContent ().**

d) Figure out the between the relationship Post, Use and Comment classes.

Now, consider the following scenario: A user named Shafique Rehman has created two posts: "My Vacation Adventure" and "Homemade Dinner" The "My Vacation Adventure" post has comments such as "Looks amazing!" and "I wish I could go there too" The "Delicious Homemade Dinner" post has comments like "Yum, what's the recipe" and "Can I come over for dinner" Implement the necessary steps to associate the comments with the respective posts created by Shafique Rehman and display relevant information about the posts and their comments. Additionally, Shafique Rehman decides to edit the comment "Yum, what's the recipe?" to "Yum, can you share the recipe? "Update the comment accordingly and display the updated information.

Question Q3 ***Weightage: 8 ;* Marks: 20**

As a software engineer, you're tasked with enhancing a restaurant management system to accommodate various order types and integrate reward calculations.

Consider the following scenario: The restaurant system must now accommodate various order types, such as dine-in, takeout, and delivery. Additionally, there are special considerations for dine-in customers: they receive a complimentary dish if they order more than two dishes and one drink. Furthermore, customers aged below 5 or above 70 are entitled to a free drink, in short only dine-in costumers enjoy the special reward. To ensure robustness, the system should prioritize security using object-oriented programming (OOP) concepts.

Your task involves:

a) Outlining the class structure for the restaurant system, specifying relationships between different order types and the special features for loyal customers.

b) Define the necessary data members (order amount, order type, customer loyalty status) and member functions for each order type to fulfill its purpose effectively.

c) Integrate reward point's calculation functionality based on the provided criteria into the system, ensuring it's seamlessly incorporated into the order management process.

d) Utilizing initializer lists and getter/setter functions for encapsulation. Additionally, given the scenario, which constructor and destructor will be invoked first: the Order class or the Reward class? Provide constructor and destructor for each class.

Please proceed with the implementation, prioritizing security alongside functionality by incorporating OOP concepts.

Wish You Best of Luck!