National University of Computer and Emerging Sciences

Karachi Campus

Object Oriented Programming (CS1004)

Date: April 6th 2024

Course Instructor(s)

Mr. Basit, Mr. Minhal, Ms.Sumaiya, Ms.Sobia, Ms.Abeeha, Ms.Bakhtawer, Ms.Abeer, Ms.Atiya, Ms.Rafia

Sessional-II Exam

Total Time (Hrs): 1
Total Marks: 30
Total Questions: 03

23k-0701 Roll No

BCS-2C Section

Student Signature

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Attempt all the questions.

CLO #1: Discuss knowledge of underlying concepts of object-oriented paradigm like abstraction, encapsulation, polymorphism, inheritance etc.

Q1: Write short answers (2-3 lines) for the following questions: **[15 minutes, 10 marks(5*2)]**

a. Do you agree with the statement: *"When a function is declared a friend by a class, it becomes a member of that class"*? Justify your answer.
b. Can a constant member function be overloaded with a non-constant version?
c. Can the diamond problem be mitigated explicitly disambiguating member function calls in the derived class?
d. What will be the order of constructors and destructors in a code snippet given below:

```
class A { };
class B { };
class C : public B, public A { };
class D : public C { };
main() { D d1; }
```

e. Is there any problem in a code snippet given below? If yes, how can we resolve it?

```
class A { public: int x;};
class B : private A { };
class C : public B { public: C() {x = 10; } };
main() { C c1;}
```

CLO #4: Design and assess small and medium scale C++ programs using OOP principles.

Q2: You are developing a software system to manage various security professionals and their roles within a firm. The system has a class hierarchy to represent different roles and entities involved in the industry. **[20 minutes, 10 marks (4*2.5)]**

a. Create an Employee class that has basic information about individuals employed such as their name, employee ID, salary all of which are protected members. Create a parameterized constructor to set these attributes.
b. Create an Analyst class that represents security analysts and inherits from the Employee class. It has additional attributes "specialization" and "isCertified". Create a parameterized constructor to set the attributes. The specialization can only be "Network", "Incident

Response", or "Threat Intelligence". The class has a function HasCertifications ( ). If the analyst has one certification then display that certification and if the analyst has more than one certification then display the list of certifications or else display "Not Certified".

c. Create an Engineer class that represents security engineers and also inherits from the Employee class. It has additional attributes isExpert, isAssigned (initially set to false), and a list of projects which is dynamically allocated. Each security engineer works on atleast 1 project. Create a parameterized constructor to set the attributes. The class has functions AddProjects( ) and AssignProject( ).
   - AssignProject( ) – The engineer is assigned a project if he/she is an expert. If the engineer is an expert set isAssigned to "True" or else set it to "False".
   - AddProjects( ) – If the engineer is assigned a project add the project to the list of projects or else display no projects to add.

d. Create a class for Lead Professional who excels in both security analysis and engineering. Implement a functionality that shows the projects and certifications for the lead professional.

CLO #4: Design and assess small and medium scale C++ programs using OOP principles.

Q3: You are required to develop a Software for a pastry shop located in UAE. The system should assist in managing the pricing, taxes, and profits from pastry sales. Each pastry has a production cost, and the price at which it is sold by the shop is subject to certain taxes and pricing regulations. Additionally, there is a requirement to calculate the retail price for each pastry, considering a 6% Goods and Services Tax (GST). **[25 minutes, 10 marks (5*2)]**

Below are the detailed regulations:

- All pastries are subject to a 10% production cost markup to cover labor and other expenses.
- Sweet pastries are subject to an 8% sales tax, whereas savory pastries are subject to a 5% sales tax.
- After calculating taxes, the shop retains 70% of the retail profit from the total cost per pastry.

Tasks: The system should accommodate the following functionalities:

a. **Pastry Classes:** Implement two classes, SweetPastry and SavoryPastry, derived from a base class Pastry. Each class should store information about the pastry name, ingredients, production cost, and tax rates specific to each type of pastry.
b. **Polymorphism:** Utilize function overriding for the function(s) defined in the Pastry base class to calculate total cost, retail price, and profit for each type of pastry.
c. **Friend Function:** Implement a friend function named PastryCalculator to perform specific calculations related to pastries. This function should calculate the total cost of a pastry, including taxes.
d. **Friend Class:** Implement a friend class named PastryReport to generate a report of the total sales and profits for the pastry shop.
e. **PastryShop Class:** Implement a class named PastryShop to manage multiple pastries. This class should allow adding pastries and calculating the total profit from all sales.

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