|  | **National University of Computer and Emerging Sciences (Lahore)** | | | |
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| **Course:** | **OOP** | **Course code:** | **CS217** |
| **Section:** | **BSCS-2B** | **Semester:** | **Spring 2024** |
| **Duration:** | **40 minutes** | **TotalMarks:** | **10** |
| **Date:** |  | **ID:** | **B** |
| **Name:** |  | **Roll no:** |  |

**Question 1:**

**NOTE:** **Read the entire question first before attempting.**

A retail store needs to develop a customer management system to handle different types of customers. Implement a system that categorizes customers into three classes: Regular, VIP, and Thieves. Make sure that all customers must belong to one of the specialized types and no generic customer is created in the system at any point and all types of customers are able to purchase. Each type of customer derived from a base class has some shared and some unique attributes and/or behaviors as described below:

1. **Regular Customer:**
   * Attributes: name (string), age (int), membershipPoints (int), limit (double)
   * Behaviors: double purchase(double bill) → is only allowed to purchase up to a value of limit and the final bill returned is equal to “bill - membership points”.
2. **VIP Customer:**
   * Attributes: name (string), age (int), rank (int).
   * Behaviors: purchase(double bill) → final bill is equal to bill - (bill \* rank / 100)
3. **Thief:**
   * Attributes: name (string), age (int).
   * Behaviors: double purchase(double bill) → final bill is always zero.
4. Implement default and parameterised constructors, destructors and a purchase() method in each derived class to calculate the salary of the respective employee type based on the provided attributes.
5. Give output of the main given on the next page.

| **int main() {**  **// Create customer objects**  **vector<Customer\*> customers;**  **customers.push\_back(new RegularCustomer("Muzammil Aleem", 20, 50, 1000.0));**  **customers.push\_back(new VIPCustomer("Manal Asif", 20, 20));**  **customers.push\_back(new Thief("Abdul Muhaimin", 20));**  **// Simulate purchases**  **double bill = 100.0;**  **for (const auto& customer : customers) {**  **double finalBill = customer->purchase(bill);**  **cout << customer->name << "'s Final Bill: $" << finalBill << endl;**  **}**  **// Free memory**  **for (const auto& customer : customers) {**  **delete customer;**  **}**  **return 0;**  **}** |
| --- |
| **Output:**  **Muzammil Aleem's Final Bill: $50**  **Manal Asif's Final Bill: $80**  **Abdul Muhaimin’s Final Bill: $0** |

**Solution Code:**

#include <iostream>

#include <string>

using namespace std;

// Base class for all types of customers

class Customer {

public:

string name;

int age;

Customer(string name, int age) : name(name), age(age) {}

virtual ~Customer() {}

virtual double purchase(double bill) = 0; // Pure virtual function

};

// Regular Customer class

class RegularCustomer : public Customer {

public:

int membershipPoints;

double limit;

RegularCustomer(string name, int age, int membershipPoints, double limit)

: Customer(name, age), membershipPoints(membershipPoints), limit(limit) {}

double purchase(double bill) override {

if (bill <= limit) {

double finalBill = bill - membershipPoints;

return finalBill < 0 ? 0 : finalBill;

} else {

return limit - membershipPoints;

}

}

};

// VIP Customer class

class VIPCustomer : public Customer {

public:

int rank;

VIPCustomer(string name, int age, int rank)

: Customer(name, age), rank(rank) {}

double purchase(double bill) override {

return bill - (bill \* rank / 100.0);

}

};

// Thief class

class Thief : public Customer {

public:

Thief(string name, int age)

: Customer(name, age) {}

double purchase(double bill) override {

return 0;

}

};