CST8132 Object-Oriented Programming

Lab 4: Banking System I

Due Date: Week 10 – in own lab hours

Marks: 20 marks (worth 7% of term mark)

Demo: Demo your code and output to your lab professor during your own lab hours.

Recommended Reading: Chapters 7-10 of Deitel and Deitel, Java How to Program book

Exercise

In this lab, we will create a few classes to represent a Bank system. A bank has various account holders in their system, and these account holders can have Savings account or Checking account. In this lab, we are developing a system that represent this scenario. We are creating a few classes namely Person, Account, Checking, Savings, and Bank, along with the Driver class. All personal attributes like first name, last name, email, phone number should be in Person class. Account class should have an account number attribute, accHolder which is a Person object, and a balance that is a double attribute which represents the balance amount (by having a Person object in Account class, we are implementing Composition). As we know that account can be Checking or Savings account, we need to create two classes – Checking and Savings, both extends Account class (As we are extending classes, we are using inheritance). Checking class should have a fee attribute that represents the monthly fee. Savings class should have interestRate attribute that represents **yearly** interest. Bank class will manipulate the bank accounts.

When you create classes, think about encapsulation, and make sure that you are using the correct access specifier. Also, you can have **only one Scanner** which is declared in main method. You have to pass that Scanner object to all the methods that requires a Scanner object (instead of creating multiple Scanner objects in various classes and methods). Make sure that your code will not crash at any point. Use conditions as required.

As the first step, you need to create the following classes:

`Person` class

Instance variables: `firstName`(String), `lastName`(String), `email`(String), `phoneNumber` (long).

Constructor: as required

Methods:

- getters that return name, email and phone number. Name should be returned as one string. If first name is “John” and last name is “Doe”, getter should return “John Doe”.

- readPersonalDetails() : Accepts a Scanner object, returns nothing. Reads personal information and stores in corresponding variables.

Account class (abstract)

Instance variables: `accNumber` (long), `accHolder` (Person), `balance` (double)

Constructor: as required

Methods:

1. `readAccountDetails()`: accepts Scanner object, returns nothing. Reads accNumber, invoke readPersonalDetails() to read personal details, and reads balance.
2. `displayAccount()`: accepts nothing, returns nothing. This method prints details of an account using formatted output (use printf).
3. `updateBalance`(): can we write any lines of code in this??? Otherwise, make this method abstract.

Checking class (extends Account)

Instance variables: `fees` (double)

Constructor: initializes fees with 13.50.

Methods: `updateBalance`(): accepts nothing, returns nothing. Calculate the new balance by reducing the fees.

Savings class (extends Account)

Instance variables: `interestRate` (double) which is the **yearly** interest rate.

Constructor: initializes interestRate with 3.99

Methods: `updateBalance`(): accepts nothing, returns nothing. Calculate the new balance by adding **monthly** interest.

Bank class

Instance variables: `name` (String) which is the name of the bank, and an ArrayList named `accounts`, which is an ArrayList of Account objects

Constructor: parameterized constructor that gets name and a size, which is the number of account holders as parameters. This constructor sets the name of the Bank and creates the ArrayList of accounts with the given size (name and size will be read in main(), and will be sent here when creating the Bank object)

Methods:

1. `readAccounts`(): accepts Scanner object, returns nothing. Reads details of all accounts. First, read the type of the account. Based on the type of the account, corresponding ArrayList object needs to be created (Polymorphism). Then, call readAccountDetails() method.
2. `runMonthlyProcess`(): accepts nothing, returns nothing. If the ArrayList is not empty, invokes updateBalance() for all accounts Otherwise, print an appropriate message (check output).
3. `displayAccounts`(): accepts nothing, returns nothing. If the ArrayList is not empty, prints the title and then in a for loop, call displayAccount() to print details of all accounts. Otherwise, print an appropriate message (check output).
4. `printStar`(): *static* method that prints a line using "*". Use for loop to print many stars.
5. `printTitle`(): *static* method that prints the title of the output. printStar() method will be called from this method to print lines. (Check Expected Output to see the format of the title)

BankTest class

This is the driver class (test class), which means this class has the main method.

Main method

- This method read the name of the bank (example: "Quality") and the number of accounts (stored in num).
- A Bank object will be created with the name and num.
- Display a menu. (you many need a do-while or a while loop)
    - Read details of all accounts
    - Run the monthly process on all accounts
    - Display details of all accounts.

Grading Scheme

Item	**Marks**
Person class (correct access specifiers, constructors, 4 methods)	Required
Account class (correct access specifiers, constructors, 3 methods)	1
Checking class (correct access specifiers, constructors, 1 method)	1
Savings class (correct access specifiers, constructors, 1 method)	1
Bank class (correct access specifiers, constructors, 5 methods)	3
BankTest class (main method)	3
Comments & Javadoc comments	3
UML	3
Test Plan	5

Submission

Zip your code, UML diagram and test plan in a folder named <LastName><FirstName>Lab4.zip and submit it to Brightspace before the due date. Demonstrate your work to your lab professor during your own lab hours. Be ready with the exported Javadoc too. Both submission and demo are required to get grades.

Expected Output (blue – user input)

```
Enter the name of the bank: QUALITY
How many account holders do you have: 3
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 2
No accounts to process
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 3
No accounts to display
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 1
1. Checking
2. Savings
Enter the type of account you want to create: 1
Enter Account Number: 123
Enter first name: John
Enter last name: Doe
Enter email: doe@test.com
Enter phone number: 123456
Enter balance: 1850
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 1
1. Checking
2. Savings
Enter the type of account you want to create: 2
Enter Account Number: 456
Enter first name: Paul
Enter last name: Matthew
Enter email: paul@test.com
Enter phone number: 456123
Enter balance: 7500
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 1
1. Checking
2. Savings
Enter the type of account you want to create: 1
Enter Account Number: 789
Enter first name: Peter
Enter last name: George
Enter email: peter@test.com
Enter phone number: 789456
Enter balance: 5520
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 3
```

```
*********************************************************************************
                                QUALITY BANK
*********************************************************************************
Acc Number   |             Name   |            Email   |   Phone Number   |     Balance
*********************************************************************************
       123   |         John Doe   |     doe@test.com   |         123456   |    1850.00
       456   |     Paul Matthew   |    paul@test.com   |         456123   |    7500.00
       789   |     Peter George   |   peter@test.com   |         789456   |    5520.00
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 2
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 3

*********************************************************************************
                                QUALITY BANK
*********************************************************************************
Acc Number   |             Name   |            Email   |   Phone Number   |     Balance
*********************************************************************************
       123   |         John Doe   |     doe@test.com   |         123456   |    1836.50
       456   |     Paul Matthew   |    paul@test.com   |         456123   |    7524.94
       789   |     Peter George   |   peter@test.com   |         789456   |    5506.50
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 1
1. Checking
2. Savings
Enter the type of account you want to create: 2
Enter Account Number: 321
Enter first name: James
Enter last name: Thomas
Enter email: james@test.com
Enter phone number: 321654
Enter balance: 1000
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 3

*********************************************************************************
                                QUALITY BANK
*********************************************************************************
Acc Number   |             Name   |            Email   |   Phone Number   |     Balance
*********************************************************************************
       123   |         John Doe   |     doe@test.com   |         123456   |    1836.50
       456   |     Paul Matthew   |    paul@test.com   |         456123   |    7524.94
       789   |     Peter George   |   peter@test.com   |         789456   |    5506.50
       321   |     James Thomas   |   james@test.com   |         321654   |    1000.00
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 2
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 3
```

```
*********************************************************************************
                                QUALITY BANK
*********************************************************************************
Acc Number   |             Name  |            Email  |   Phone Number  |     Balance
*********************************************************************************
       123   |         John Doe  |     doe@test.com  |         123456  |    1823.00
       456   |     Paul Matthew  |    paul@test.com  |         456123  |    7549.96
       789   |     Peter George  |   peter@test.com  |         789456  |    5493.00
       321   |     James Thomas  |   james@test.com  |         321654  |    1003.33
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 8
Invalid entry... please try again!
1. Read Accounts
2. Run monthly process
3. Display Accounts
4. Exit
Enter your option: 4
Goodbye... Have a nice day
```