

CS2430 OOPSI Spring 2018

Program #5 (40 points)

Due Dates

Due date: Monday, May 14 @ 11:59pm

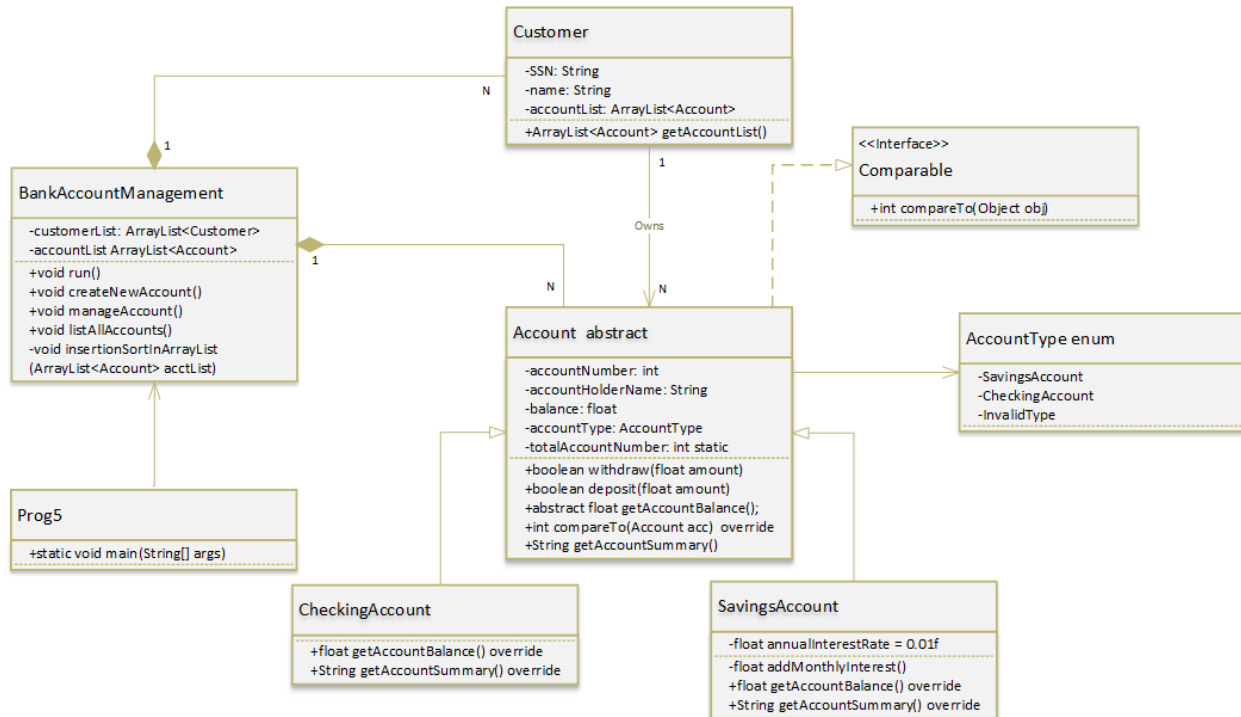
Grace date: Wednesday, May 16 @ 11:59pm

Program Description and Requirements

Program5 is comprehensive which requires knowledge of almost all the important topics covered in this class. For this program, you will be working in a group of two to implement a toy banking system that provides simple banking services to customers. You need to create **two versions**, a console version and a GUI version. Please refer to the class diagram that describes the architectural design of the system.

1. A customer shall be able to open a savings account or a checking account. The same customer may have multiple checking or savings accounts. Class *Customer* maintains a list of accounts.
2. Account number should be unique and composed of 5 digits.
3. *Account* is an abstract class. *SavingsAccount* and *CheckingAccount* are two subclasses. In *Account*, the method *getAccountBalance* is an abstract method that has to be implemented by its subclasses, and *totalAccountNumber* is a static variable that indicates the total number of accounts.
4. *Account* implements the interface *Comparable<Account>*, and provides implementation for method *compareTo*. *Comparable* is a built-in interface in Java. You **DO NOT** need to create a new interface for it. Provide a method *insertionSort* to sort all accounts by account balances in ascending order. The method *insertionSort* is called when a user has selected L in the main menu to list all accounts.
5. In *SavingsAccount* class, declare an instance variable called *annualInterestRate*, preset to 0.01, and provide an *addMonthlyInterest* method to update the balance, by adding ($balance * annualInterestRate / 12$) to the current balance. It is assumed that every time the method *getAccountBalance* on a savings account is called, six months have passed. The balance needs to be updated accordingly.
6. Only a savings account brings interest, and a checking account does not.
7. Class *BankAccountManagement* maintains a list of all accounts and a list of customers.
8. Use **ArrayList** instead of Account array and Customer array.
9. Social Security Number (SSN) is the unique identifier of customers. When opening an account, check if a customer has already existed, if so, associate the new account to the customer. It's illegal to have two customers with the same SSN in the customer list.
10. Handle exceptions with try-catch-finally whenever necessary. For example, *stdin.nextInt()* (in Scanner class) throws *InputMismatchException* if you enter non-digit characters.
11. Throw *IllegalArgumentException* whenever necessary. For example, when checking user input for SSN, the format has to be like 123-45-6789. If the length is not 11, characters are not digits, or the 3rd and 6th characters are not dashes, throw *IllegalArgumentException*.
12. Some exception handling can be avoided by taking advantage of an appropriate control in the GUI version, e.g., a radio button to allow users to select an account type.
13. Please refer to the following class diagram when you are coding, which shows the structure of the system. Feel free to add new classes and members, but **all classes, attributes and methods** mentioned in the class diagram have to be included in your implementation.
14. In class *BankAccountManagement*, you don't want to have a giant method handling user input. Add more methods to keep the method that accepts user input short and neat.
15. Please **zip all source code of the GUI version and submit to D2L** by one member of your group.
16. Submit the **console version** to the **Grader** by the other member.

17. **Design test cases to perform both system testing and module testing for your program.** Please use the same template to create a test specification as for program2. You are supposed to design **at least 30 test cases** for system testing and **at least 10 test cases for at least 10 methods**. **It is required** that you put testbed mains into your classes and fully test methods and constructors in each class. **The test specification is due in D2L along with the zipped GUI code before the due date.**
18. Make sure workload is distributed evenly between two members. Along with the zipped code file, the test case specification, fill out and submit the **Contribution Evaluation Form** to provide a detailed description of how tasks were divided between two members in your group.



Notes:

1. You **MUST** follow the software development ground rules that is available in D2L. Points off if not.
2. Fully test your program before submission.
3. **If you submit after due date and before grace date you will get 20% off the grade; Programs submitted after the grace date will get 0!**
4. You **MUST** use **SE tools** to keep an up-to-date log of the time spent working on this program. You must use the automatic **punch in** and **punch out** when possible. Select the activities and provide specific comments about what you worked on during that period. Up to **-5 points** if this is not done or you do not log all your time or you do not provide specific comments as to what you were working on.

Summary:

1. **One member of a group submits the console version to the Grader.**
2. **The other member of a group submits the GUI version (in a single zipped file), test case specification, and the evaluation form to the dropbox on D2L.**
3. **DO NOT forget to add comment blocks for all classes and methods.**
4. **Log your time in CSSE Hub.**

Sample Input and Output (normal features):

```
Banking System is running...!
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
c
Please enter the name of the customer:
Tom
Please enter the SSN of the customer (***-**-****):
123-45-6789
Please select account type: 1.Savings, 2.Checking
1
Please enter account number with five digits:
11111
The new account has been created. Account summary:
Account holder is Tom; Account number is 11111; Account type is savings;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
c
Please enter the name of the customer:
Mary
Please enter the SSN of the customer (***-**-****):
123-45-9876
Please select account type: 1.Savings, 2.Checking
2
Please enter account number with five digits:
22222
The new account has been created. Account summary:
Account holder is Mary; Account number is 22222; Account type is checking;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 2
Account holder is Tom; Account number is 11111; Account type is savings;
Account balance is 0
Account holder is Mary; Account number is 22222; Account type is checking;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
11111
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
1
Account holder is Tom; Account number is 11111; Account type is savings;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
11111
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
2
```

The balance is 0.0, Please deposit before withdraw.
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
11111
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit, 4.Main menu
3
Please enter the amount of money:
35.65
Your deposit has been received with an amount of 35.65
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
11111
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit, 4.Main menu
2
Please enter the amount of money:
50
You don't have enough balance. Please try a different amount.
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
11111
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit, 4.Main menu
2
Please enter the amount of money:
30
Your withdrawal has been accepted with an amount of 30
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 2
Account holder is Mary; Account number is 22222; Account type is checking; Account balance is 0
Account holder is Tom; Account number is 11111; Account type is savings; Account balance is 6.04
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
22222
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit, 4.Main menu
3
Please enter the amount of money:
300
Your deposit has been received with an amount of 300
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 2

Account holder is Tom; Account number is 11111; Account type is savings;
Account balance is 6.07
Account holder is Mary; Account number is 22222; Account type is checking;
Account balance is 300
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
c
Please enter the name of the customer:
Jeff
Please enter the SSN of the customer (***-**-****):
123-45-1111
Please select account type: 1.Savings, 2.Checking
1
Please enter account number with five digits:
33333
The new account has been created. Account summary:
Account holder is Jeff; Account number is 33333; Account type is savings;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
33333
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
100
Invalid type. Please try again
3
Please enter the amount of money:
100.21
Your deposit has been received with an amount of 100.21
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 3
Account holder is Tom; Account number is 11111; Account type is savings;
Account balance is 6.1
Account holder is Jeff; Account number is 33333; Account type is savings;
Account balance is 100.71
Account holder is Mary; Account number is 22222; Account type is checking;
Account balance is 300
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
Q
Thanks for using Banking System. Bye!

Sample Input and Output (handling invalid inputs):

Banking System is running...!
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit

M
The number of accounts is 0. Please create an account first.
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
B
Invalid command.
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
23
Invalid command.
Please enter C to create a new account, M to manage an existing account, L to list all account in the order by balance from lowest to highest, Q to quit
C
Please enter the name of the customer:
Tom
Please enter the SSN of the customer (***-**-****):
12345
Invalid Social Security Number. java.lang.IllegalArgumentException: The length of ssn has to be 11.
Please enter valid SSN:
12345678901
Invalid Social Security Number. java.lang.IllegalArgumentException: wrong format
Please enter valid SSN:
abcdefghijkl
Invalid Social Security Number. java.lang.IllegalArgumentException: wrong format
Please enter valid SSN:
abcdefg
Invalid Social Security Number. java.lang.IllegalArgumentException: The length of ssn has to be 11.
Please enter valid SSN:
123u456m789
Invalid Social Security Number. java.lang.IllegalArgumentException: wrong format
Please enter valid SSN:
123-45-6789
Please select account type: 1.Savings, 2.Checking
abc
Invalid Input. java.util.InputMismatchException Please try again
-5
Invalid type. Please try again
10
Invalid type. Please try again
3
Invalid type. Please try again
2
Please enter account number with five digits:
abcdef
Invalid Input. java.util.InputMismatchException Please try again
1234
Invalid account number. Please try again
-1234
Invalid account number. Please try again
12345
The new account has been created. Account summary:

Account holder is Tom; Account number is 12345; Account type is checking;
Account balance is 0
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
abcdef
Invalid Input. java.util.InputMismatchException Please try again
11111
The account number you entered does not exist. Please try again
34bcd
Invalid Input. java.util.InputMismatchException Please try again
12345
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
abc
Invalid Input. java.util.InputMismatchException Please try again
56
Invalid type. Please try again
2
The balance is 0.0, Please deposit before withdraw.
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
12345
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
3
Please enter the amount of money:
abc.efg
Invalid Input. java.util.InputMismatchException Please try again
12.bc
Invalid Input. java.util.InputMismatchException Please try again
1234.5678
Your deposit has been received with an amount of 1234.57
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
12345
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
2
Please enter the amount of money:
1234567.0
You don't have enough balance. Please try a different amount.
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
m
Please enter your account number:
12345
Please select account type: 1.View account summary, 2.Withdraw, 3.Deposit,
4.Main menu
2
Please enter the amount of money:
abc

Invalid Input. java.util.InputMismatchException Please try again
123.4
Your withdrawal has been accepted with an amount of 123.4
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
L
The total number of accounts is 1
Account holder is Tom; Account number is 12345; Account type is checking;
Account balance is 1111.17
Please enter C to create a new account, M to manage an existing account, L to
list all account in the order by balance from lowest to highest, Q to quit
q
Thanks for using Banking System. Bye!