Course Number *CSci 120*
Descriptive Title *Object-oriented Programming*
Programming Language *Java*

Problem Set Number *6*
Problem Number *3*
Activity Title *Create Subclasses of Bank Accounts – CheckingAccount with SavingsAccount protection*

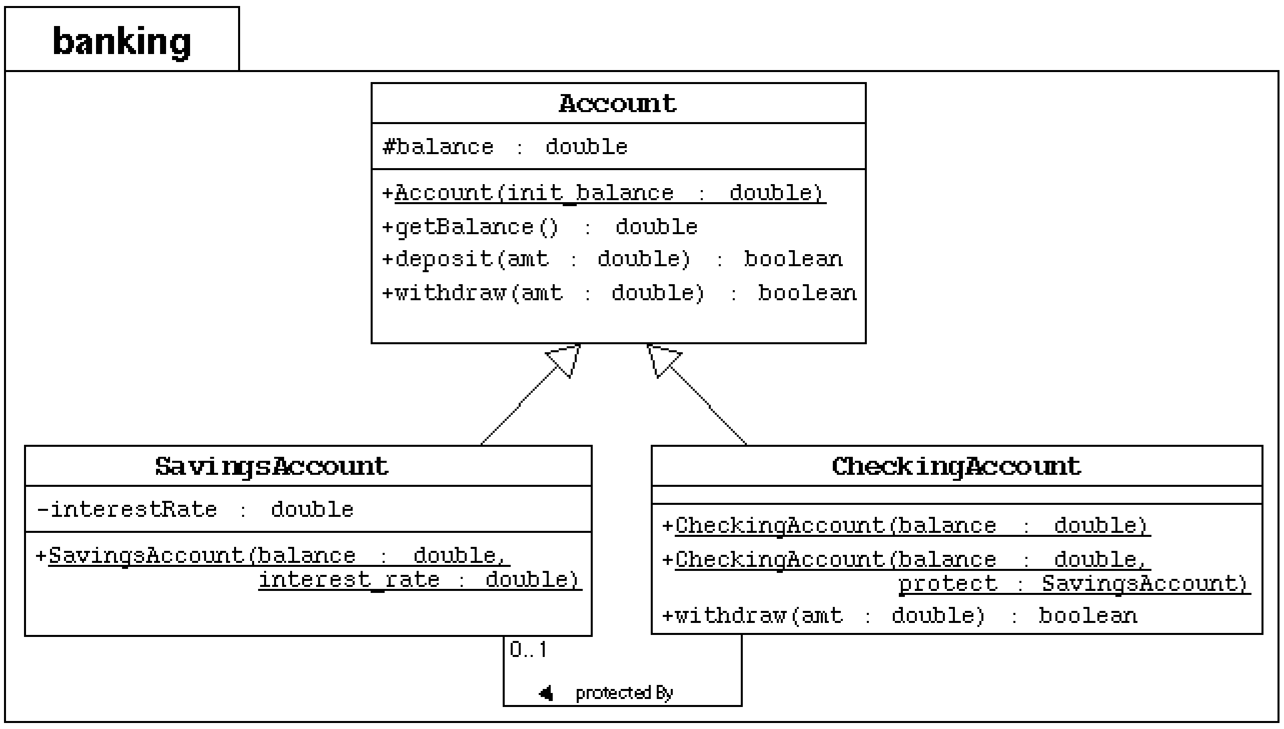
Objective

In this exercise you will create two subclasses of the `Account` class in the Banking project: `SavingsAccount` and `CheckingAccount`. It incorporate a more complex model of the overdraft protection mechanism. It uses the customer's savings account to perform the overdraft protection.

Directions

Start by changing your working directory to `Problem Set 6/Problem 3` on your computer.

Implementing the Account Subclasses



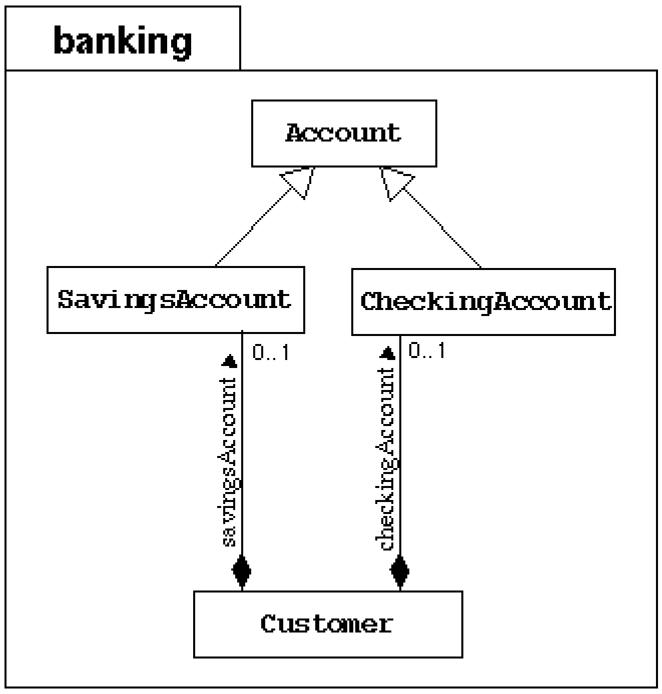
banking
Account
#balance : double
+Account(init_balance : double)
+getBalance() : double
+deposit(amt : double) : boolean
+withdraw(amt : double) : boolean
SavingsAccount
-interestRate : double
+SavingsAccount(balance : double, interest_rate : double)
CheckingAccount
+CheckingAccount(balance : double)
+CheckingAccount(balance : double, protect : SavingsAccount)
+withdraw(amt : double) : boolean
0..1
protected By

To the `banking` package, you will add the `SavingsAccount` and `CheckingAccount` subclasses as modeled by the UML diagram above.

1. Create the `banking` directory. Copy the previous Banking project files (from `Problem Set 6/Problem 1`) in this package directory.
2. Implement the `SavingsAccount` class as modeled in the above UML diagram.
3. The `SavingsAccount` class must extend the `Account` class.
4. It must include an `interestRate` attribute with type `double`.
5. It must include a public constructor that takes two parameters: `balance` and `interest_rate`. This constructor must pass the `balance` parameter to the parent constructor by calling `super(balance)`.
6. Implement the `CheckingAccount` class as modeled in the above UML diagram.
7. The `CheckingAccount` class must extend the `Account` class.
8. It has no additional data attributes, but an association attribute, called `protectedBy` must be included with the type `SavingsAccount`; the default value must be `null`.
9. It must include one public constructor that takes one parameter: `balance`. This constructor must pass the `balance` parameter to the parent constructor by calling `super(balance)`.

10. It must include another public constructor that takes two parameters: `balance` and `protect`. This constructor must pass the `balance` parameter to the parent constructor by calling `super(balance)`.
11. The `CheckingAccount` class must override the `withdraw` method. It must perform the following check: if the current balance is adequate to cover the `amount` to withdraw, then proceed as usual. If not *and if there is overdraft protection*, then attempt to cover the difference (`balance - amount`) by the savings account. If the latter transaction fails, then the whole transaction must fail with the checking balance unaffected.

Modifying Customer to Hold Two Accounts



Modify the `Customer` class to hold two bank accounts: one for savings and one for checking; both are optional.

1. Previously, the `Customer` class contained an association attribute called `account` to hold an `Account` object. Rewrite this class to contain two association attributes: `savingsAccount` and `checkingAccount` with default values of `null`.
2. Include two getter methods: `getSavings` and `getChecking`, which returns the savings and checking accounts, respectively.
3. Include two setter methods: `setSavings` and `setChecking`, which set the savings and checking account associations, respectively.

Test the Code

In the main `Problem Set 6/Problem 3` directory, compile and execute the `TestBanking` program. The output should be:

```
Customer [Simms, Jane] has a checking balance of 200.0 and a savings balance of
500.0
Checking Acct [Simms, Jane]: withdraw 150.00 succeeds? true
Checking Acct [Simms, Jane]: deposit 22.50 succeeds? true
Checking Acct [Simms, Jane]: withdraw 147.62 succeeds? true
Customer [Simms, Jane] has a checking balance of 0.0 and a savings balance of
424.88

Customer [Bryant, Owen] has a checking balance of 200.0
Checking Acct [Bryant, Owen]: withdraw 100.00 succeeds? true
Checking Acct [Bryant, Owen]: deposit 25.00 succeeds? true
Checking Acct [Bryant, Owen]: withdraw 175.00 succeeds? false
Customer [Bryant, Owen] has a checking balance of 125.0
```

Notice that Jane's checking account is protected by her savings account in the last transaction; whereas, Owen has no overdraft protection, so the last transaction on his account fails and the balance is not affected.