
8.3 Virtual methods

Description

In this section, we will introduce virtual methods. Virtual methods may be used to specify partial methods that may be further extended in subclasses.

In the next example, we define `withdraw` of `Account` as a virtual method:

```
class Account(owner: ref Customer):  
  ...  
  withdraw(amount: var float) -> newB: var float:<  
    inner(withdraw)  
    newB := balance
```

The symbol `'<'` specifies that `withdraw` is a virtual method.

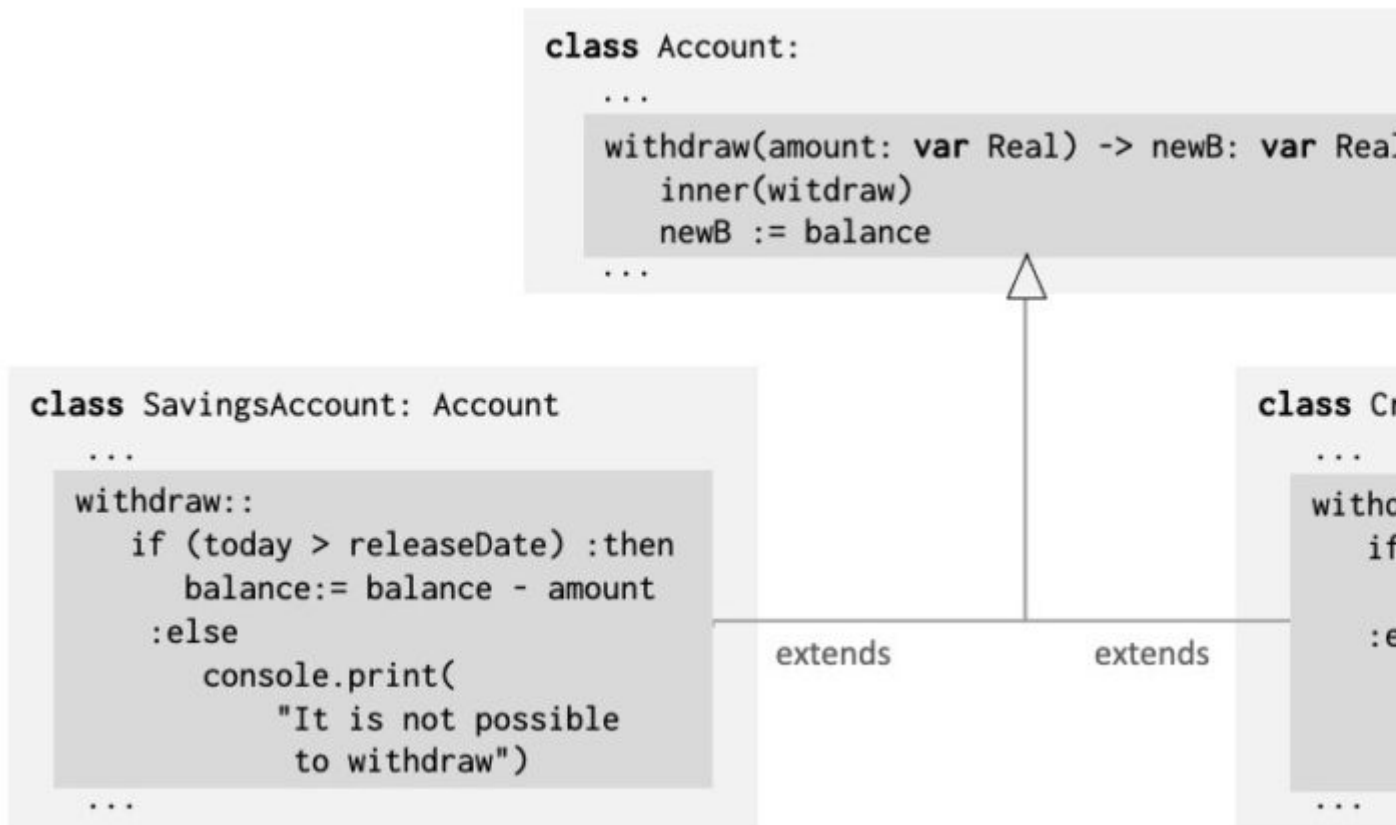
The statement part of `withdraw` consists of `inner` followed by `newB := balance`.

The statement `inner` specifies that when executed, possible statements in a further extension of `withdraw` in a subclass of `Account` will be executed.

In the next example, we show how to extend `withdraw` in a class `SavingsAccount`:

```
class SavingsAccount: Account  
  ...  
  withdraw ::  
    if (today > releaseDate) :then  
      balance:= balance - amount  
    :else  
      console.print("It is not possible to withdraw")
```

The symbol `'::'` specifies that `withdraw` is an *extension* of `withdraw` in the superclass `Account` of `SavingsAccount`.



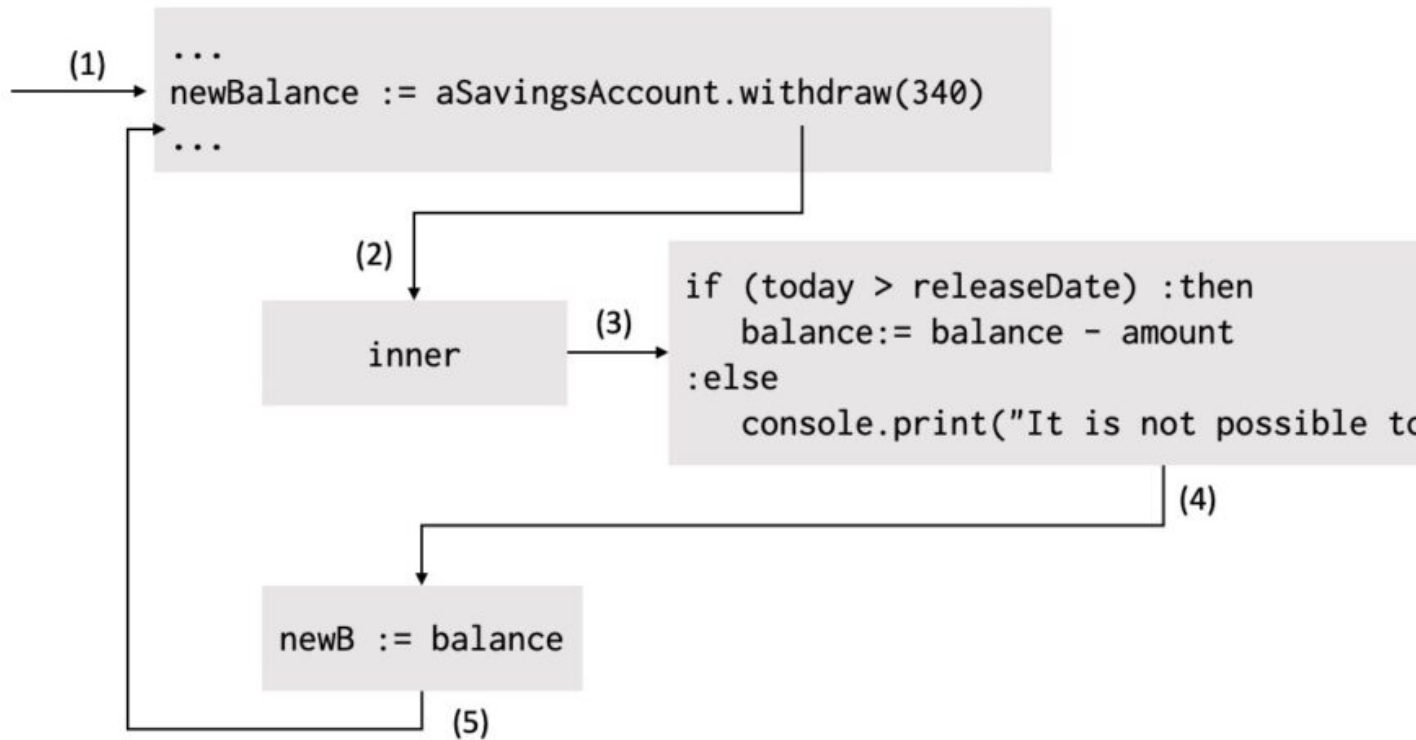
In the following example, we invoke `withdraw` on a `SavingsAccount`:

```
aSavingsAccount: obj SavingsAccount(JonhSmith)
newBalance: var float
newBalance := aSavingsAccount.withdraw(340)
```

Execution of `aSavingsAccount.withdraw(340)` takes place as follows:

1. Execution starts by execution of the statements in `withdraw` as defined in `Account`.
2. The first statement to execute is `inner`.
3. Execution of `inner` implies that the statements of `withdraw` in `SavingsAccount` are executed.
4. When the statements in `SavingsAccount` have been executed, control returns to the statements after `inner` in `Account`.
5. This implies that `newB := balance` is executed
6. Finally execution of `withdraw` is completed.

The figure below illustrates the execution of `aSavingsAccount.withdraw(340)`. The numbers show the order of execution of the involved statements:



Sequence of actions for the call SavingsAccount.withdraw(340)

We may extend withdraw in a similar way in CreditAccount:

```
class CreditAccount: Account
    ...
    withdraw ::
        if (-balance < maxCredit) :then
            balance := balance - amount
        :else
            console.print("Not possible to withdraw beyond max credit")
```

Invocation of withdraw on a CreditAccount object implies that execution of inner will execute the statements in withdraw in SavingsAccount.

A virtual print method

We now add one more virtual method to Account and its subclasses in the form of a print method that prints the status of a given account on the console.

Part of the print of status is the same for all accounts whereas other parts are special for the subclasses.

```
class Account(owner: ref Customer):
    ...
    createStatement:<
        stmt: var String
        stmt := "Account statement for " + owner.name + '\n'
            + "The account is a "
        inner(Account)
        stmt := stmt + "The balance is: " + balance + '\n'
    print:
        console.print(createStatement)
    sendEmail:
        owner.email(createStatement)

class SavingsAccount: Account
```

```
...
createStatement::
    stmt := stmt + "savings account." +
        "\nRelease date is " + releaseDate.asText
```