**Inheritance & Polymorphism:**

**Introduction**

There are three basic capabilities that a modern object oriented programming language typically will have:

1. *Abstract Data Types*- The ability to create new data types (classes)
2. *Polymorphism* - The interpretation of a message is in the hands of its receiver. *Inheritance* - The mechanism that allows one class to share the methods and representation of another class.

One of the advantages of inheritance is code reuse. If we can define the behavior of a class A in terms of a previously defined class B, we can reduce the amount of code that we need to write for class B. In addition, by reusing the code from class B, we can reduce the amount of testing that we need to do for class A.

**Design of the AccountKinds Hierarchy**

In the following section, we will discuss steps used in designing a hierarchy of classes. This discussion is not in depth and there are a number of books that focus solely on how to design object oriented programs including the proper use of class hierarchies and inheritance.

**The Problem Description**

Suppose we have been given the task of creating a program that will keep track of all the accounts for a bank. There are a number of different kinds of accounts that the bank supports.

* Regular Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is no interest. There is a penalty of 10.00 if the balance falls below a minimum of 500.00.
* Interest Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is interest of 7% paid monthly. There is no minimum balance required.
* Checking Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is annual interest of 7% paid monthly . There is a penalty of 10.00 if the balance falls below a minimum of 100.00. There is a charge of 0.10 for each transaction.
* CD Account - This account charges a fee of which is the smaller of 10 or 10% of the balance at the end of the month. There is interest of 15% paid yearly. There is no minimum balance required, but if there is a withdrawal before 12 months have gone by there will be a penalty of 20% of the current balance.

Each of these accounts has a personal identification number (PIN) with it to provide protection.

**Attributes and Methods**

Our first task is to identify the attributes and methods that each of the classes will need. At first look, we can identify the following attributes for each of the classes:

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| --- | --- | --- |
| Attributes for Regular Account | Type | Description |
| name | String | the name of the account holder |
| balance | double | balance in the account |
| pin | String | personal identification number |
| minimum balance | double | minimum balance for the account |
| penalty | double | penalty if balance falls below the minimum balance |

|  |  |  |
| --- | --- | --- |
| Attributes for Interest Account | Type | Description |
| name | String | the name of the account holder |
| balance | double | balance in the account |
| pin | String | personal identification number |
| interest | double | yearly interest |

|  |  |  |
| --- | --- | --- |
| Attributes for Checking Account | Type | Description |
| name | String | the name of the account holder |
| balance | double | balance in the account |
| pin | String | personal identification number |
| interest | double | yearly interest |
| minimum balance | double | minimum balance for the account |
| penalty | double | penalty if balance falls below the minimum balance |
| transactions | int | the number of deposits and withdrawals in a month |

|  |  |  |
| --- | --- | --- |
| Attributes for CD Account | Type | Description |
| name | String | the name of the account holder |
| balance | double | balance in the account |
| pin | String | personal identification number |
| interest | double | yearly interest |
| penalty | double | penalty if early withdrawal |
| months | int | number of months since the creation of the account |

All of these classes need to have basically the same methods

* Create the account.
* Deposit an amount.
* Withdraw an amount.
* Access the balance.
* Access the name.
* Check the validity of the PIN.
* Compute the fees.
* Compute the interest.