OO Programming Languages Syntax Exceptions Handling

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OO in Java

- **Abstract class defines shared implementation**
- **Methods declared Abstract MUST be implemented by subclasses**
- **Interface can only define method signatures (names, parameters, output) and no implementation**
- **Classes can *Extend* other classes and *Implement* interfaces**
- **By default, all class methods can be overridden (extended/ implemented) in the subclasses**

```
//abstract class declaration
 public abstract class Account
 {
      private int mAccountNumber;
      //constructor
      public Account(int accountNumber)
      {
           mAccountNumber = accountNumber;
      }
      // abstract method declaration
      public abstract void credit(Amount amount);
 }

 //interface declaration
 public interface IVerifiable
 {
      //declaring the interface method
      public boolean isVerified();
 }

 //PayPal derives from Account and realises IVerifiable
 public class PayPalAccount extends Account implements IVerifiable
 {
      //constructor, calls the superclass
      public PayPalAccount(int accountNumber)
      {
           super(accountNumber);
      }
      //implementation of the abstract method
      public void credit(Amount amount)
      {
           //send money to PayPal
      }
      //implementation of the interface method
      public boolean isVerified()
      {
           //do check and return result
      }
 }
```

OO in C#

- **Very similar to Java syntax and concepts, but also some differences**
- **Any non-abstract class methods have to be explicitly declared *virtual* so can be overridden (extended/ implemented) in the subclasses**
- **C# vs Java comparison:**
  - http://msdn.microsoft.com/en-us/library/ms836794.aspx

```
//abstract class declaration
 public abstract class Account
 {
      private int mAccountNumber;
      //constructor
      public Account(int accountNumber)
      {
           mAccountNumber = accountNumber;
      }
      // abstract method declaration
      public abstract void credit(Amount amount);
 }

 //interface declaration
 public interface IVerifiable
 {
      //declaring the interface method
      public boolean isVerified();
 }

 //PayPal derives from Account and realises IVerifiable
 public class PayPalAccount extends :Account, implements IVerifiable
 {
      //constructor, calls the superclass
      public PayPalAccount(int accountNumber) : base(accountNumber)
      {
          super(accountNumber);
      }
      //implementation of the abstract method
      public void credit(Amount amount)
      {
           //send money to PayPal
      }
      //implementation of the interface method
      public boolean isVerified()
      {
           //do check and return result
      }
 }
```

OO in C++

- **Methods need to be declared *virtual* to be extended (as in C#)**
- ***Pure virtual methods* (ending declarations with "=0") are equivalent to abstract methods in Java**
- **No dedicated concept of *Interfaces*, but same effect is achieved by defining a class that contains *pure virtual methods* only**
- **C++ and Java differences**
  - http://www.cprogramming.com/tutorial/java/syntax-differences-java-c++.html

```
//class declaration
 class Account
 {
      //declaring all publicly accessible methods/attributes
      public:
      //constructor
      Account(int accountNumber)
      {
           mAccountNumber = accountNumber;
      }
      // abstract method declaration
      virtual void credit(Amount amount) = 0;

      private:
          int mAccountNumber;
 };

 //interface (equivalent) declaration
 class IVerifiable
 {
      //pure virtual (abstract) method declaration
      public:
   virtual bool isVerified() = 0;
 }

 //PayPal derives from Account and IVerifiable
 public class PayPalAccount : public Account, public IVerifiable
 {
      public:
      //constructor, calls the superclass
      PayPalAccount(int accountNumber):Account(accountNumber)
      {
      }
      //declaring the implementation
      virtual void credit(Amount amount);

      //declaring the implementation
      virtual bool isVerified();
 }
```

Error Handling

- **All software encounters error conditions during operations**
- **Good software will manage error situations gracefully and robustly**
- **Error handling has to be implemented in the code**
- **A standard option from procedural languages – Error Codes**
- **Main idea:**
  - use a code to indicate some specific error
  - make the function to return a code
  - check the return code if it is OK or error

```
// add error reporting to code that can fail
public int doSomethingRisky()
{
    <..>
    if (problemNumber1Happened)
        return 1;
    else if (problemNumber2Happened)
        return 2;
    else
        return 0; //all good
}

//using this method, need to build in checks
int result = riskyAction.doSomethingRisky();
if (result == 0)
{
    //All good, can proceed
}
else if(result == 1)
{
    //handle Problem1
}
else if(result == 2)
{
    //handle Problem2
}
```

Exceptions

- **Errors such as the above represent exceptions to the normal program flow.**
- **Handling exceptions via return codes has a number of disadvantages:**
  - Extra code needs to be inserted in each function to pass the errors back.
  - If one function fails to check for errors and pass them back, the errors will not get handled
  - The extra error checking obscures the main function of the code, making it difficult to understand
  - Error recovery code becomes intertwined with the normal operation code
  - Functions cannot use return values for normal purposes
- **There is another way...**
- **Exceptions!**

```
// add error reporting to code that can fail
public void doSomethingRisky()
{
     <..>
     if (problemNumber1Happened)
      //throw forces us to exit the current
      //method and returns an exception object
          throw problemNumber1Exception;
     else if (problemNumber2Happened)
          throw problemNumber2Exception;
}

//using this method, wrap it in try/catch block
//to catch returned exceptions
try
{
     riskyAction.doSomethingRisky();
}
catch (ProblemNumber1Exception error)
{
     //handle Problem1
}
catch (ProblemNumber2Exception error)
{
     //handle Problem2
}
```

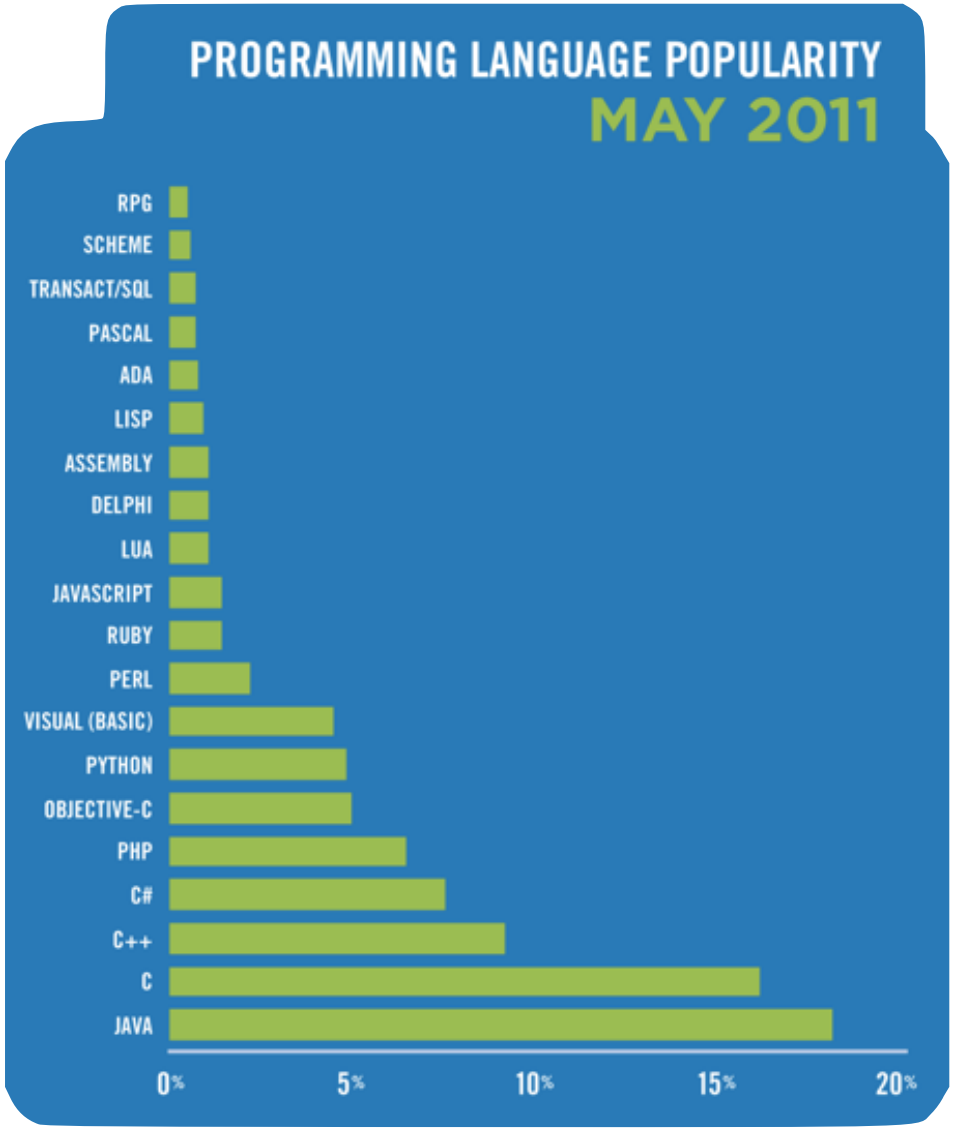
Exceptions

- **C++ example**
- **Using exceptions, the code is easier to follow because the error handling parts are clearly separated from the regular program flow**
- **An exception handler can throw the exception again allowing some errors to be trapped and repaired and others to be propagated, e.g. from *TE_GetPrice()* to *MyTrader()* to the main method, where it is handled**
- **Exceptions should REALLY be exceptional and not be a part of normal program flow**

```
//C++ class to define Exceptions
class TradingErr {
  TradingErr (ErrType ee, Time tt) {e=ee; t=tt;}
  ErrType e; Time t;
};
//main program method
int main() {
  try {
    <..>
    //MyTrader() can re-throw an exception
    MyTrader();
    <..>
  //Exception handling
  } catch (TradingError x) {
    ReportError(x.e, x.t);
  }
}
//-------------------------------------------------
void MyTrader() {
  <..>
  //code that can re-throw an exception
  float price = TE_GetPrice(day);
  <..>
}
//-------------------------------------------------
float TE_GetPrice(int day) {
  <..>
  //code that can throw an exception
  if (!Valid(day))
    throw TradingErr(BAD_DAY,TimeNow());
  <..>
}
```

No Code Wars! – Tools for the Job

- **Debating comparative advantages and disadvantages of programming languages makes a good (if often heated) conversation, but in reality the choice of the language is often dictated by the application!**
- **For example, in mobile application development:**
  - Android, Blackberry, J2ME: Java
  - iPhone: Objective-C
  - Windows Phone: C#
  - Symbian (RIP): C++
- **Being proficient in a range of languages helps**



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