A Brief Introduction to Java for C++ Programmers: Part 2
ENGI 5895: Software Design

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- Interfaces
To use a class such as ArrayList from the Java API you have three choices:

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   import java.util.ArrayList;
   (This statement must go at the top of your .java file, outside the class)
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3. Utilize the full class name everywhere.
The following code illustrates **import**, the container class **ArrayList**, and one of the primitive wrapper classes, **Integer** (it also introduces **generics**, Java’s equivalent of templates!):

```java
import java.util.ArrayList;
// ALT: import java.util.*;

public class Import {
    public static void main(String[] args) {
        ArrayList<Integer> list =
            new ArrayList<Integer>();
        //
```
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```java
import java.util.ArrayList;
// ALT: import java.util.*;

class Import {
    public static void main(String[] args) {
        ArrayList<Integer> list = new ArrayList<Integer>();
        // list.add(new Integer(10));
        list.add(20);
        // list.add(30);
        for (Integer i : list)
            System.out.println(i);
    }
}
```
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All files belonging to the package must be placed in a corresponding directory
e.g. files in package `avardy.package1` must go in `avardy/package1` (relative to the `CLASSPATH` directory)
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```java
package mypackage;
public class X {
    private int i;
    int j;
}
```
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All files belonging to the package must be placed in a corresponding directory. For example, files in package `avardy.package1` must go in `avardy/package1` (relative to the CLASSPATH directory).

A class, member data item, or member method is either private, public, protected, or has package access, meaning that it is public within the package:

```java
package mypackage;
public class X {
    private int i;
    int j;
}
```

`j` is accessible from other classes within the package, but not `i`. 

...
package avardy.package1;

class A {
  int value = 42;
}

class B {
  private int value;
  public B(A refA) {
    // This is OK because A's value has package access
    value = refA.value;
  }
}

class Front {
  public static void main(String[] args) {
    A refA = new A();
    B refB = new B(refA);
  }
}
package avardy.package1;

class A {
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- Syntax
  - C++: class Derived : public Base
  - Java: class Derived extends Base
- Utilize `super` keyword to call the base class constructor or base class methods
class Animal {
    protected int legs;

    public Animal(int legs) {
        this.legs = legs;
    }

    //

class Animal {
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    //

    public void makeSound() {
        System.out.println("???");
    }
} //
class Animal {
    protected int legs;

    public Animal(int legs) {
        this.legs = legs;
    }

    public void makeSound() {
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    }

    public String getClassification() {
        if (legs == 2)
            return "biped";
        else if (legs == 4)
            return "quadroped";
        else
            return "unclassified";
    }
}
public class Dog extends Animal {
    private String name, owner;
}

public Dog(String name, String owner) {
    super(4);
    this.name = name;
    this.owner = owner;
}

@Override
public void makeSound() {
    System.out.println("W o o f!");
}

public static void main(String[] args) {
    Dog dog = new Dog("Bruno", "Andrew");
    System.out.println("Classification : " + dog.getClassification());
    dog.makeSound();
}
public class Dog extends Animal {
    private String name, owner;

    public Dog(String name, String owner) {
        super(4);
        this.name = name;
        this.owner = owner;
    }

    @Override
    public void makeSoound() {
        System.out.println("W o o f!" starring 4,000 dogs, 10 cats, and a mysterious owl)
    }

    public static void main(String[] args) {
        Dog dog = new Dog("Bruno", "Andrew");
        System.out.println("Classification : " + dog.getClassification());
        dog.makeSound();
    }
}
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    public Dog(String name, String owner) {
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        this.name = name;
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    }
    
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In Java, these methods are declared as abstract.

A class defined with any abstract methods must be declared as abstract.

You cannot instantiate an abstract class! Only a sub-class.

An abstract class may have implementations for non-abstract methods.
abstract class Instrument {
    public abstract void play();
    public String getName() {
        return "Instrument, but you'll " + "never see this!";
    }
}

class Drum extends Instrument {
    public void play() {
        System.out.println("Bang!");
    }
    public String getName() {
        return "Drum";
    }
}
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    public String getName() {
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    }
}
After adding a Guitar class, we can see that Instrument serves to standardize the interface to sub-classes:

```java
public class TestInstruments {
    public static void main(String[] args) {
        Instrument[] trio = new Instrument[3];
        trio[0] = new Drum();
        trio[1] = new Guitar();
        trio[2] = new Guitar();

        // Usage code is independent of
        // the creation code above.
        for (Instrument inst : trio)
            inst.play();
    }
}
```
Java goes further than abstract classes. An abstract class might contain some implementation:

```java
abstract class Instrument {
    public abstract void play();
    public String getName() {
        return "Instrument, but you'll never see this!";
    }
}
```

But often what we really want is to define the methods that a set of classes must have, and nothing more. For this purpose, we have interfaces which have no implementation and public access

```java
interface Instrument {
    void play();
    String getName();
}
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```java
interface Instrument {
    void play();
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}
```
Classes can **implement** an interface.

class Drum implements Instrument {
    public void play() {
        System.out.println("Bang!");
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}
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interface Vehicle {
    void drive(double km);
    double gasLeft();
}

interface Repairable {
    boolean canRepair();
    void repair();
}
```

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Implementing Multiple Interfaces

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- A car is both a vehicle and repairable...
class Car implements Vehicle, Repairable {
    double mileage = 0;
    double gas = 100.0;
    //
    @Override
    public void drive(double km) {
        mileage += km;
        gas = km / 10.0;
        // Not handling running out of gas!
    }
    //
    public double gasLeft() {
        return gas;
    }
    //
    public boolean canRepair() {
        return (mileage < 200000);
    }
    //
    public void repair() {
        System.out.println("Good as new!");
    }
    //
    public double getMileage() {
        return mileage;
    }
}
class Car implements Vehicle, Repairable {
    double mileage = 0;
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    //
    @Override public void drive(double km) {
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Features Not Covered

- Tools outside the Java language itself:

```
public static final double LIGHTSPEED = 299792458.0;
```

Various other uses

Inner classes

Exception handling

We saw only a tiny fraction of the Java API!

See links page for more information on these topics

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