

COMP 215: INTRO TO PROGRAM DESIGN

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“Chris”

“Prof. Chris”

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This Class

- 50% of content: modern programming and program design
 - The Java programming language will be used (no prior Java assumed)
 - But this is not a “Java class” per se
 - Goal is proficiency in modern OO program development
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- 50% of content: modern algorithms
 - Modern computer science IS NOT programming
 - Modern computer science IS algorithmic thinking
 - We only program because we have to... it’s a necessary evil :-)
 - In keeping with this view, will try to avoid studying programming in a vacuum
 - Means we’ll have to cover a lot of algorithms to motivate our programming

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 - Abstraction means taking complicated machinery and wrapping it up in such a way that people can use the machinery w/o understanding the details
 - Abstraction is all about defining and enforcing **interfaces**
- Why is **abstraction** good?
 - In theory, effort to build/maintain system is linear in system functionality, SLOC
 - Why? With proper abstraction, everything is local
 - W/o abstraction, effort is quadratic: $1 + 2 + 3 + \dots + n$ is prop. to n^2

On To Java!

- “Java”... what is it? What’s the big idea?
 - OO programming language first released in 1995 (wow, pretty old already!)
 - Unique in that it was designed to run on a “virtual machine” (**JVM**)
 - To run a Java program, someone must have JVM installed on their machine
 - You write your program, software called **compiler** translates into Java **bytecode**
 - You give your bytecode to someone who wants to run your program
 - JVM on their machine **interprets** that bytecode
 - **Interprets** = uses underlying hardware to take actions spec’d by bytecode

On To Java! (cont'd)

- The JVM is a really big deal!
 - Same bytecode runs on a Mac, PC, Unix server, smartphone, anything with a JVM
 - JVM ensures a set of key algs, data structures, and I/O capabilities are there to use
 - All bundled in the “Java Class Library”... comes with the JVM
 - Back in '95, a typical PL might have a target-specific compiler + some low-level libraries (such as libc for C/C++ I/O)
 - Needed hash table? You wrote your own, asked your friends, or searched the web
 - Using Java? Just use the hash table that comes with the JVM
 - Hard to overstate significance of this change!

Compilation vs. Interpretation

- Java is a “compiled” language
 - Since entire program is translated into low-level bytecode, all at once
 - Then the bytecode is run
- Python is an “interpreted” language
 - Python interpreter actually executes Python
- Why might we prefer a compiled language?

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- Python is an “interpreted” language
 - Python interpreter actually executes Python
- Why might we prefer a compiled language?
 - Often far faster to execute (though use of JVM does hurt a bit in the case of Java)
 - Can catch many errors at compile time

So Is Java A Good Language?

- The bad stuff:
 - It's going on 20 years old, and showing its age a bit
 - Some stuff (such as “generics”) are arguably not done correctly
 - It's a big and complicated language (so our class is quite back-loaded!)

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 - The JVM
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- The good stuff:
 - **It's the most modern of the widely-used languages**
 - The JVM
 - It's somewhat difficult to really screw up in Java (compared to C, for example)
- Why are we using it?
 - For me, comes down to pragmatics
 - Meanwhile, we can sit and hope for a better alternative! C# anyone?

Writing Your First Java Program

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- First, you'll need to download a “JDK”
 - Contains compiler, JRE (JVM, object library), and a bunch of other stuff
 - The one you want comes from Sun/Oracle (just Google “JDK”)
 - You'll want version 7

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- Then, you'll want an “IDE”
 - Allows you to manage the source files associated with a program
 - Typically has support for debugging, testing, editing source code
 - Standard open source IDE is called “Eclipse”
 - We'll use one targeted towards “Java 101” users called DrJava

Once You've Installed the JDK and DrJava

- Fire up DrJava
 - Check “Full Java” under “Language Level”

- Then type in your first program:

```
public class HelloWorld {  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```

- Press “compile” and then “run” and watch it go...

What Does This Program Do?

```
// A "class" is a bundle of data plus functionality (methods)
// A "program" consists of a set of classes
class HelloWorld {
    public static void main(String[] args) {
        System.out.println("Hello World");
    }
}
```

What Does This Program Do?

```
public class HelloWorld {  
  
    // This is a "static" method called "main"  
    // "static" means that it is shared by all objects of  
    //   type HelloWorld  
    // "public" means it can be called from outside the  
    //   class  
    // In every program, a class must have a public, static  
    //   method called "main" that's invoked at startup  
    // "args" is the list of parameters passed via the  
    //   command line when the program is run  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```

What Does This Program Do?

```
public class HelloWorld {  
    public static void main(String[] args) {  
  
        // "System" is a special class in the SCL  
        // It has a data item (aka, a "member") called "out"  
        // that corresponds to your console  
        // "out" has a method called "println" that accepts a  
        // string and outputs it  
        System.out.println("Hello World");  
    }  
}
```