

Objectives

- Basics of Java Syntax
- Java fundamentals
 - Primitive data types
 - Static typing
 - Arithmetic operators
 - Relational operators

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Review

- What are qualities of good software?
- What is Java?
 - Benefits to using Java?
- Linux:
 - What is the syntax of the `cp` command?
 - How do you copy an entire directory?
 - How do you make a directory?
 - How do you view the contents of a directory?

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Review: Benefits of Java

- Rapid development of programs
 - Large library of classes, including GUIs, Enterprise-level applications, Web applications
- Portability
 - Run program on multiple platforms without recompiling
- Statically-typed language
 - Compiling - find some errors before execution, performance benefits

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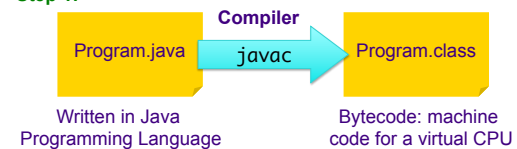
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Review: Java Programming Language

- Entirely object-oriented
- Similar to Python

Step 1:



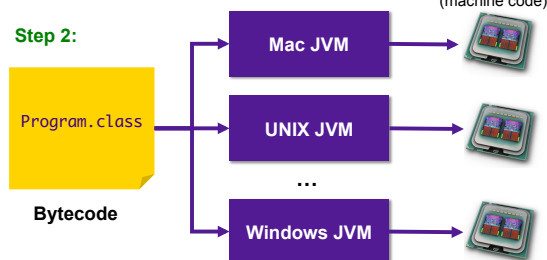
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Java Virtual Machine (JVM)

Step 2:



- Same **bytecode** executes on each platform
- Don't need to provide the source code

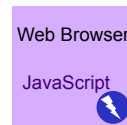
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Aside: JavaScript vs Java

- JavaScript is **not** Java
 - JavaScript is a *scripting* language, primarily embedded in HTML, executed by Web browsers



```

<script type="text/javascript">
function myFunction() {
    return ("Hello, have a nice day!")
}
</script>
</head>
<body>
<script type="text/javascript">
document.write(myFunction())
</script>
  
```

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Java Development Kit

- JDK: Java Development Kit
- SDK: Software Development Kit
- Free from Oracle
- Contains
 - **javac**: Java compiler
 - **java**: Java Virtual Machine
 - Java class libraries

<http://www.oracle.com/technetwork/java/javase/downloads/index.html>

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Java Development Kit

- Installed on Linux machines
 - Java 1.6 should be reachable using default path
 - To see which executable you're executing use
 - **which java**
 - Should be `/usr/bin/java` or `/opt/jdk1.6.0_21/bin/java`
- Run **java -version** to determine which version you're running
- You can download the JDK for your machine from <http://www.oracle.com/technetwork/java/javase/downloads/index.html>
- JRE is for **running** Java applications
 - Does not include the compiler

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Using the JDK

- Create a new directory for CS209
- Copy **First.java** from `/home/courses/cs209/handouts/`
 - `cp /home/courses/cs209/handouts/First.java .`
- Compile and run **First.java**
 - **javac First.java**
 - Compiles the program into **First.class**
 - **java First**
 - Runs the JVM, which executes the bytecode
- View **First.java** in jEdit
 - **jedit First.java**

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Python Review

```
# a Python program
def main():
    print("Hello")

main()
```

What does this program do?

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Example Java Program

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

What are your observations about this program?
What can you figure out?

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Example Java Program

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

- Everything in Java is inside a **class**
 - Java is *entirely* object-oriented
 - This class is named **Hello**

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Example Java Program

Blocks of code marked with { }

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

Defines the class "Hello"

- In general, each Java program file contains **one** class definition
 - Will have exceptions
- Name of the class is name of file
 - E.g., `Hello.java`

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Example Java Program

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

Access Modifier:

controls if other classes can use code in this class

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Example Java Program

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

method

- Class contains one method: **main**

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Example Java Program:main Method

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

- Similar to **main** in Python
 - But must be associated with a class
- Must take one parameter: an **array** of Strings
 - For command-line arguments
- Must be **public static**
- Must be **void**: data type of what method returns (nothing)
- main** is automatically called when program is executed from command line

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Example Java Program

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

- Method contains one line of code
 - What do you think it does?

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Example Java Program: Print Statements

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

- Calls the **println** method on the **System.out** object
- println** takes one parameter, a **String**
- Displays string on terminal, terminates the line with new line (**\n**) character

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Example Java Program: Comments

```
/**
 * Our first Java class
 * @author Sara Sprenkle
 */
public class Hello {
    public static void main(String[] args) {
        //print a message
        System.out.println("Hello");
    }
}
```

- Comments: `/* */` or `/** */` are special JavaDoc comments

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Code Style

```
/**
 * Our first Java class
 * @author Sara Sprenkle
 */
```

- **Comments** at top of program
 - Must include your name
 - High-level description of program
- Proper **indentation**
 - Similar to Python
 - Everything within sets of `{}` is indented the same

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

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Where are the Differences?

```
# a Python program
def main():
    print("Hello")

main()
```

```
/**
 * Our first Java class
 * @author Sara Sprenkle
 */
public class Hello {
    public static void main(String[] args) {
        //print a message
        System.out.println("Hello");
    }
}
```

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So Far: Java vs. Python

- **Semantics** the same, **syntax** different
 - Blocks of code
 - End statements
- Access modifiers
- Data type declarations
- Class-based programs
- Compiled
- We'll see more differences as we go...

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Literal Translation to Python Program?

```
/**
 * Our first Java class
 * @author Sara Sprenkle
 */
public class Hello {
    public static void main(String[] args) {
        //print a message
        System.out.println("Hello");
    }
}
```

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Translation to Python Program

```
class Hello:
    """Our first Python class"""

    def __init__(self):
        # fill in later...

    def main(self):
        print("Hello")
```

Semi-literal translation

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JAVA FUNDAMENTALS

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Print Statement

- Syntax:

```
System.out.println(<String>);
System.out.print(<String>);
```

No newline

- Similar to Python's `file.write()` method

- Need to combine parameter into one String using '+'s

- Python's `print` used *commas*

- More on String operations later

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String Concatenation

- If a string is concatenated with something that is not a string, the other variable is converted to a string.

Note +
↓
`System.out.println("Your score is " + 78);`
↑
Converted to a String

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Escape Sequences

- Same as Python:

Meaning	Sequence
Newline character (carriage return)	<code>\n</code>
Tab	<code>\t</code>
Quote	<code>\"</code>
Backslash	<code>\\</code>

- Note that in Java, you can print a ' without escaping

- What does the following display?

```
System.out.println("To print a \\, you must use \\\"\\\\\\\\\"");
```

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First.java

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Java keywords/reserved words

- Case-sensitive
- Can't be used for variable or class names
- Seen so far ...
 - `public`
 - `class`
 - `static`
 - `void`
- Exhaustive list
 - http://download.oracle.com/javase/tutorial/java/nutsandbolts/_keywords.html

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Data Types

- Java is **strongly-typed**
 - Every variable must be a **declared type**
- All data in Java is an **object** except for the **primitive data types**:

int	4 bytes (-2,147,483,648 -> 2,147,483,647)
short	2 bytes (-32,768 -> 32,767)
long	8 bytes (really big integers)
byte	1 byte (-128 -> 127)
float	4 bytes (floating point)
double	8 bytes (floating point)
char	2 bytes (Unicode representation), single quotes
boolean	false or true

Variables


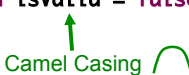
- Must be **declared** before used
 - Syntax: `<datatype> <name> [= value];`

- Variable names typically start with lowercase letter
 - '_' also a valid first character
 - Convention: Subsequent words are capitalized
 - Called "Camel Casing"

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Variable Examples

- Must be **declared** before used
 - Syntax: `<datatype> <name> [= value];`
- Examples:
 - `int x;`
 - `double pi = 3.14;`
 - `char exit = 'q';`

 - `boolean isValid = false;`


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Floats in Java

- Decimal literals are considered doubles
- This code won't compile:


```
float f = 3.14;
```
- Compiler error message:


```
Float.java:13: possible loss of precision
found   : double
required: float
float f = 3.14;
```
- To fix code, add an f to specification of number or declare as **double**

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Float.java 33

Python Transition Warning

- You cannot redeclare a variable name in the same scope
- OK:


```
int x = 3;
x = -3;
```
- Not OK:


```
int x = 3;
int x = -3;
...
boolean x = true;
```



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More Data Type Information

- Default data types
 - Same as Python
 - Result of integer division is an **int**
 - Example: `4/3 = ??`
- Casting
 - Similar to Python for primitive types
 - Example: `4/(double) 3`

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Output Redirection: >

- In UNIX, we can redirect output to a file
 - For example


```
ls *.java > java_files.out
```
 - Above command saves the output from the `ls` command into the file named `java_files.out`
- This is how you will save output from your Java programs initially
 - For example


```
java Intro > out
```

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Programming Assignment 0

- Write a program called Intro.java
 - Displays information about yourself
- Fix compiler and logic errors in a program
- Due Wednesday before class

- See Course Web Page
 - [Schedule page](#)
 - [Bookmark it!](#)