Lecture 35:

INTRODUCTION TO JAVA

CSC111: Introduction to CS through Programming

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Material for this lecture based on:
http://interactivepython.org/runestone/static/java4python/index.html

Final Project Reception

Monday
December 10th
11am – 12:10pm
Ford Atrium

(open for setup at 10am for those who don't have class before)

Friends, family, & faculty are all welcome!

Discussion

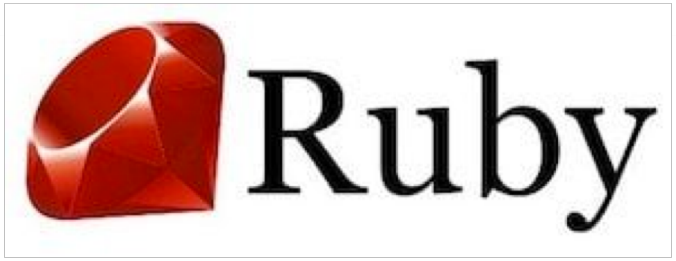
What's good about Python as a

programming language?

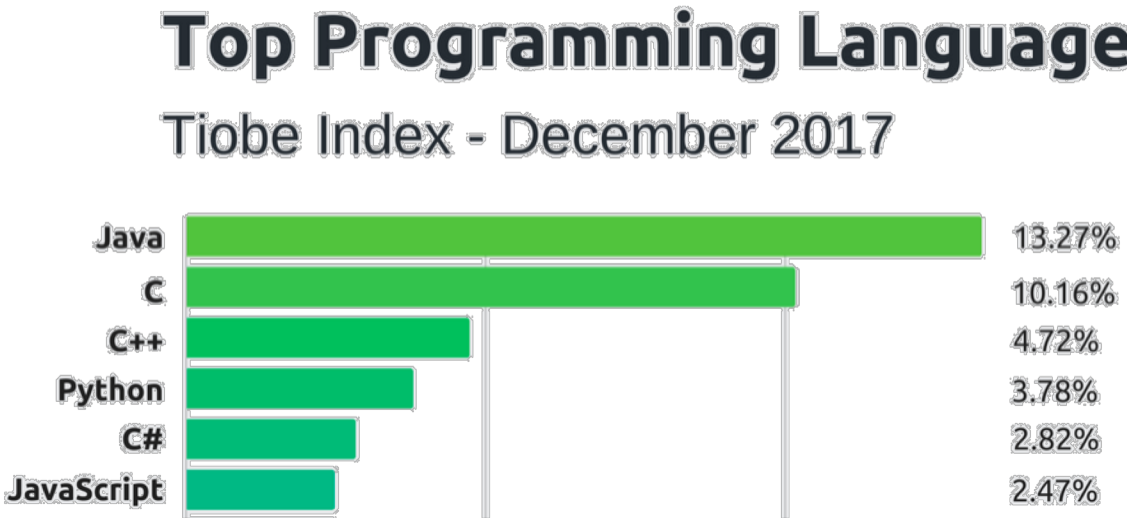
Discussion

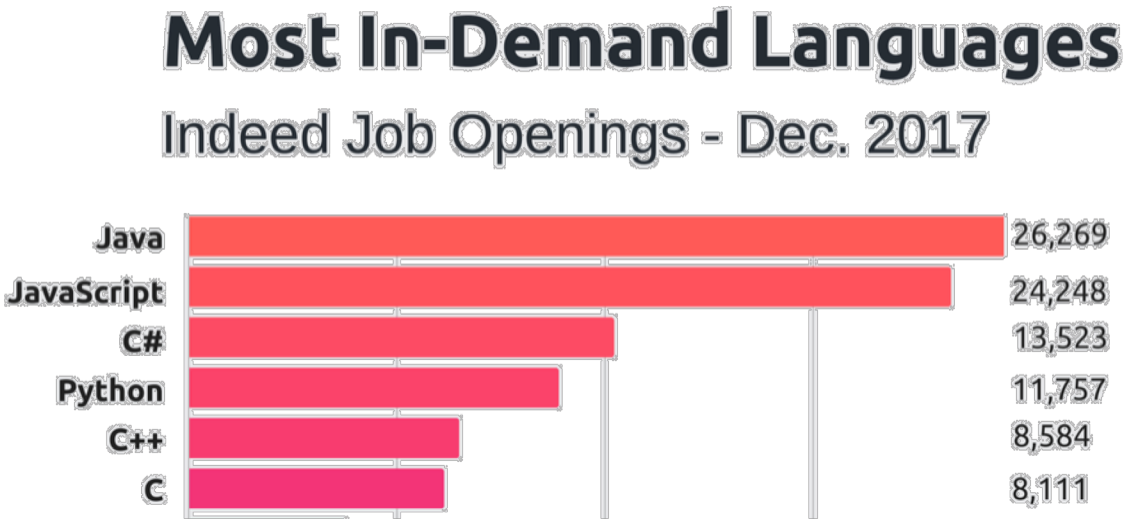
Why bother studying **more than one** programming language?

Dynamic vs. formal



Why Learn Java?





Let's compare…

multi-paradigm
interpreted language
with dynamic typing
and automatic memory management

Let’s compare…

an object-oriented
compiled language
with strong static typing
and automatic memory management

First big difference

an object-oriented
compiled language
with strong static typing
and automatic memory management

Compiled vs. interpreted languages

	COMPILER	INTERPRETER
What it takes in:	an entire program	a single line of code (or a single instruction)
What it returns:	intermediate object code (e.g. classes)	<nothing>
Relative speed:	faster	slower
Memory usage:	uses more memory (↑ objects take space ↑)	uses less memory (no intermediate objects)
Work is done:	just once	every time the code is executed
Reports errors:	after checking the entire program	after each instruction is run

Next big difference

an object-oriented
compiled language
with strong static typing
and automatic memory management

Example: `hello world`

```
def main():
    print("Hello world!")
```

Example: `hello world`

```
public class Hello {

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

}
```

Several similarities…

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public class Hello {

    public static void main(String[] args) {
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public class Hello {

    public static void main(String[] args) {
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}
```

a built-in function
to output stuff to the console

Some minor differences…

curly braces indicate containment
(instead of tabs)

```
public class Hello {

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

}
```

(in fact, we could any Java program on a single line!)

Some more significant differences…


```
public class Hello {

    public static void main(String[] args) {
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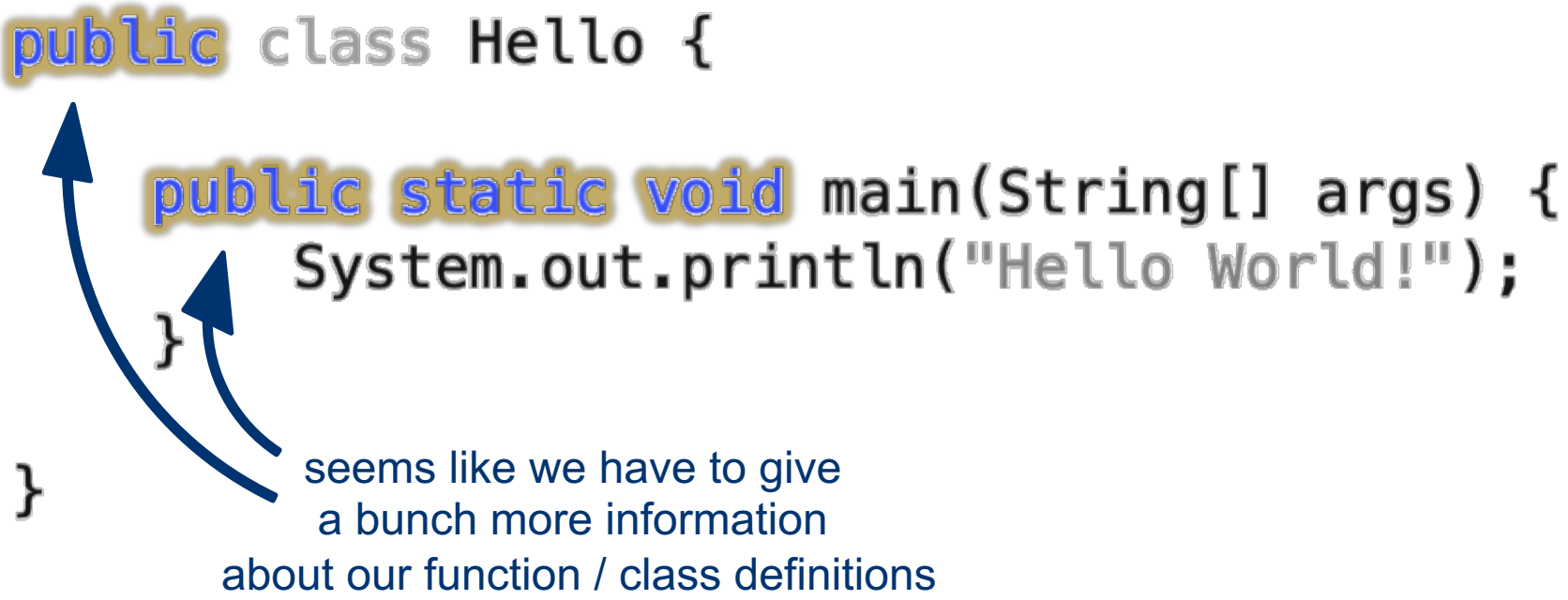
Some more significant differences…



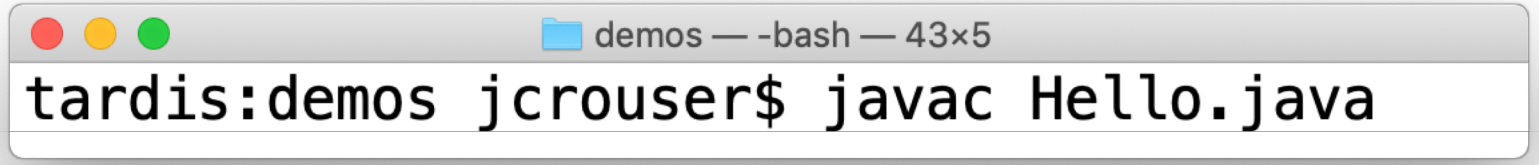
(in fact, we could any Java program on a single line!)

Discussion

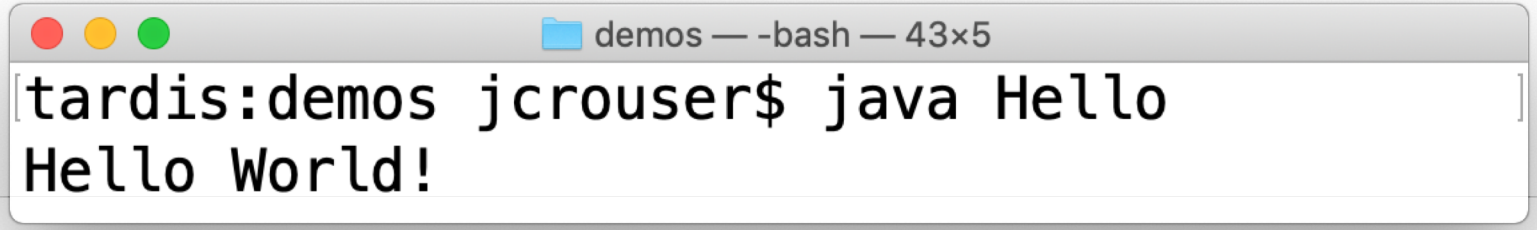
So how to we **run** it?

Two-step process

- Remember: java is a **compiled** language
- Step 1: compile



- Step 2: run



Basic rules of Java

1. Every Java program must define a **class**:
   - all code is inside the class
   - the file has the same name as the class
2. Everything in Java must have a **type** (nothing is **assumed**)
3. Every Java program must have a function called

```
public static void main(String[] args)
```

see why we developed this habit early?

Java: be specific!

```
public static void main(String[] args)
```

Java: be specific!

```
public static void main(String[] args)
```

we can call this method
from **outside** the class

Java: be specific!

```
public static void main(String[] args)
```

the method belongs to the class,
but not any **one instance**

Java: be specific!

```
public static void main(String[] args)
```

the method doesn't
return anything

Java: be specific!

```
public static void main(String[] args)
```

the method takes an
array (list) of Strings
as input

And the line that does the actual work?

```
System.out.println(“Hello world!”);
```

And the line that does the actual work?

```
System.out.println("Hello world!");
```

this is a
built-in **object**

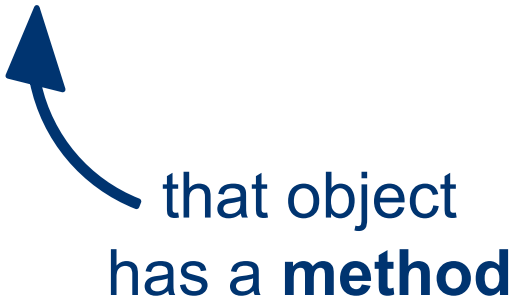
And the line that does the actual work?

```
System.out.println("Hello world!");
```

that object
has an **attribute**
(which is also an object)

And the line that does the actual work?

```
System.out.println("Hello world!");
```



And the line that does the actual work?

```
System.out.println("Hello world!");
```

every statement ends
with **a semi-colon**

Basic data types in Java

Primitive	Object
int	Integer
float	Float
double	Double
char	Char
boolean	Boolean

A slightly more interesting past program

```
def main():
    F = int(input("Enter the temperature in F: "))
    C = (F - 32) * 5.0/9.0
    print("The temperature in C is: ", C)

if __name__ == "__main__":
    main()
```

The same thing in Java

```
import java.util.Scanner;

public class TempConv {
    public static void main(String[] args) {
        Double F;
        Double C;
        Scanner in;

        in = new Scanner(System.in);
        System.out.println("Enter the temperature in F: ");
        F = in.nextDouble();

        C = (F - 32) * 5.0/9.0;
        System.out.println("The temperature in C is: " + C);

        System.exit(0);
    }

}
```

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    }

}
```

math looks pretty similar

as do string literals

The same thing in Java

importing works roughly the same way
(but there are WAY MORE built-in classes,
and they're organized hierarchically!)

```
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```

like `input(…)`

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}
```

but the prompt is separate

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    }

}
```

as is the call to get the actual input

Declaring variables

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import java.util.Scanner;

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```

unlike python, we have to tell Java in advance what type each variable will be

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Cleaning up

```
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        System.out.println("The temperature in C is: " + C);

        System.exit(0);
    }

}
```
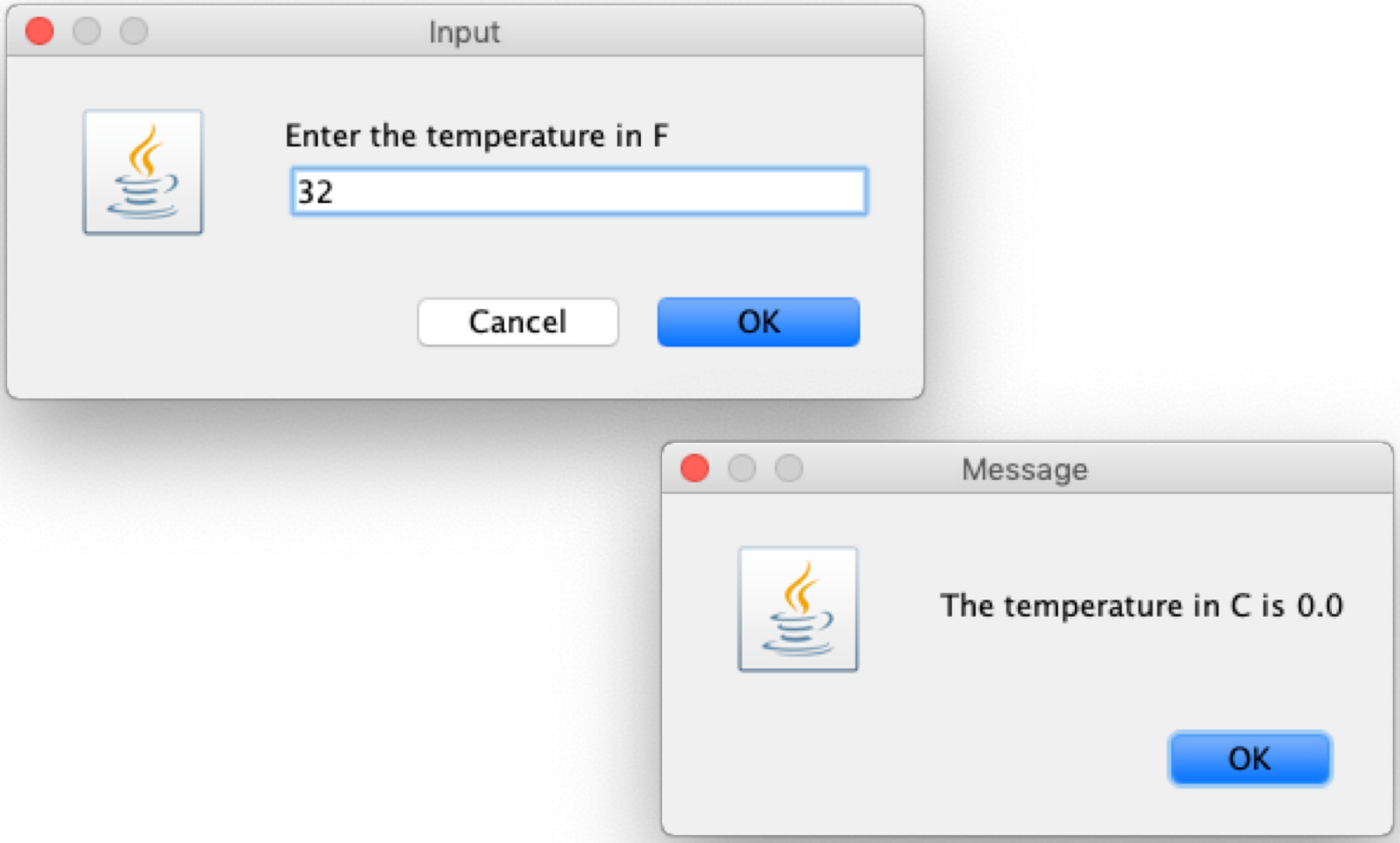

it's generally good practice to close the JVM when you're done (the 0 means "zero errors")

Discussion

Does this look like any **Java applications** you've encountered?

A more realistic Java program



Not a problem!

```
import javax.swing.*;

public class TempConvGUI {

    public static void main(String[] args) {
        String fString;
        Double F, C;

        fString = JOptionPane.showInputDialog("Enter the temperature in F");
        F = new Double(fString);
        C = (F - 32) * 5.0/9.0;

        JOptionPane.showMessageDialog(null, "The temperature in C is " + C);

        System.exit(0);
    }

}
```

Not a problem!

`javax.swing` is the Java equivalent of `tkinter` (`graphics`)

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        System.exit(0);
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}
```

which gives us input dialog boxes

Not a problem!

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        System.exit(0);
    }

}
```

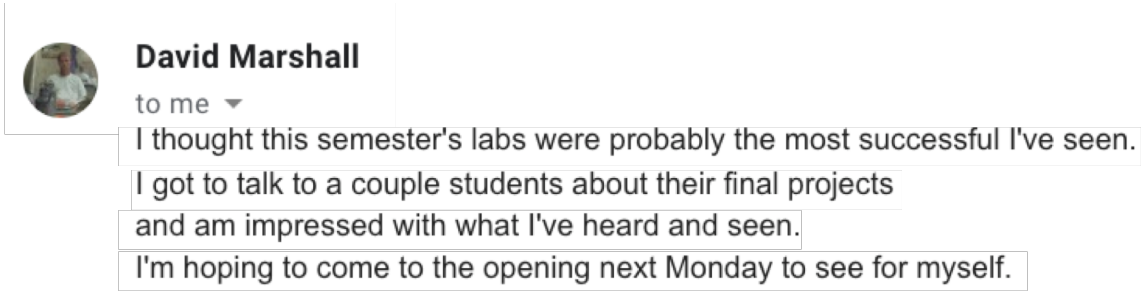
as well as
output dialog boxes
(and much, much more!)

Big takeaways

- Just like spoken languages, there are **many** different programming languages - each **expressive** in its own way
- This semester, you learned **fundamental ideas** in computer science (using Python as a medium):
  - variables
  - loops
  - conditional statements
  - functions
  - …and many more!
- These fundamental ideas are **still valid** in other languages!

Some parting thoughts…

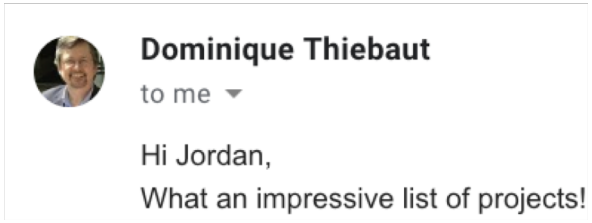
- Together we wrote more than **130,494** lines of code
  - that's roughly 1,450 lines **per person** (>30 printed pages)
  - or **3,700 lines** for every day that we met
- Some perspective on what you've done:



David Marshall

to me

I thought this semester's labs were probably the most successful I've seen.
I got to talk to a couple students about their final projects
and am impressed with what I've heard and seen.
I'm hoping to come to the opening next Monday to see for myself.



Dominique Thiebaut

to me

Hi Jordan,
What an impressive list of projects!

Joseph O'Rourke

to me

I enjoyed reading the list of project titles!
Take a photo and post it on Facebook
(or get Dominique to). :-j

Some parting thoughts…

- So the next time someone asks you if you know any Computer Scientists: