Objectives

- Java Fundamentals
  - Print statements
  - Data types, variables
  - Arithmetic operators
  - Development process

Office Hours

- Wednesday, 3-4:30 p.m. in-person or on Zoom (see Canvas calendar)
- Others: announced week-to-week
- If you can't make it to office hours, email me for assistance or to set up another time

Review: Version Control

- What are the features/functionality/benefits of version control?
- What is git? Vs what is GitHub?
- What are some of the common Git commands and what do they do?
  - Put them together: what is a typical work flow for using git?
- How did the git lab go?

You can and *should* review slides if you don't remember answers

Review: Version Control Systems, in brief

- Track versions, changes
- Collaboration
- Documenting authorship, changes
- Sandbox
- Back up, restore

Review: Common Git Commands

Command	What it does
clone	Clones a repository – sets up your repository so that you can coordinate
add <*file*>	Adds the *file* to the staging area
commit	Commits all the staged files (locally)
push	Push all your changes to the remote → You need your code to be pushed so that I can see it.
branch	List all local branches
branch <*name*>	Creates a new branch named *name*
checkout <*name*>	Switches to the branch named *name*

https://xkcd.com/1597/

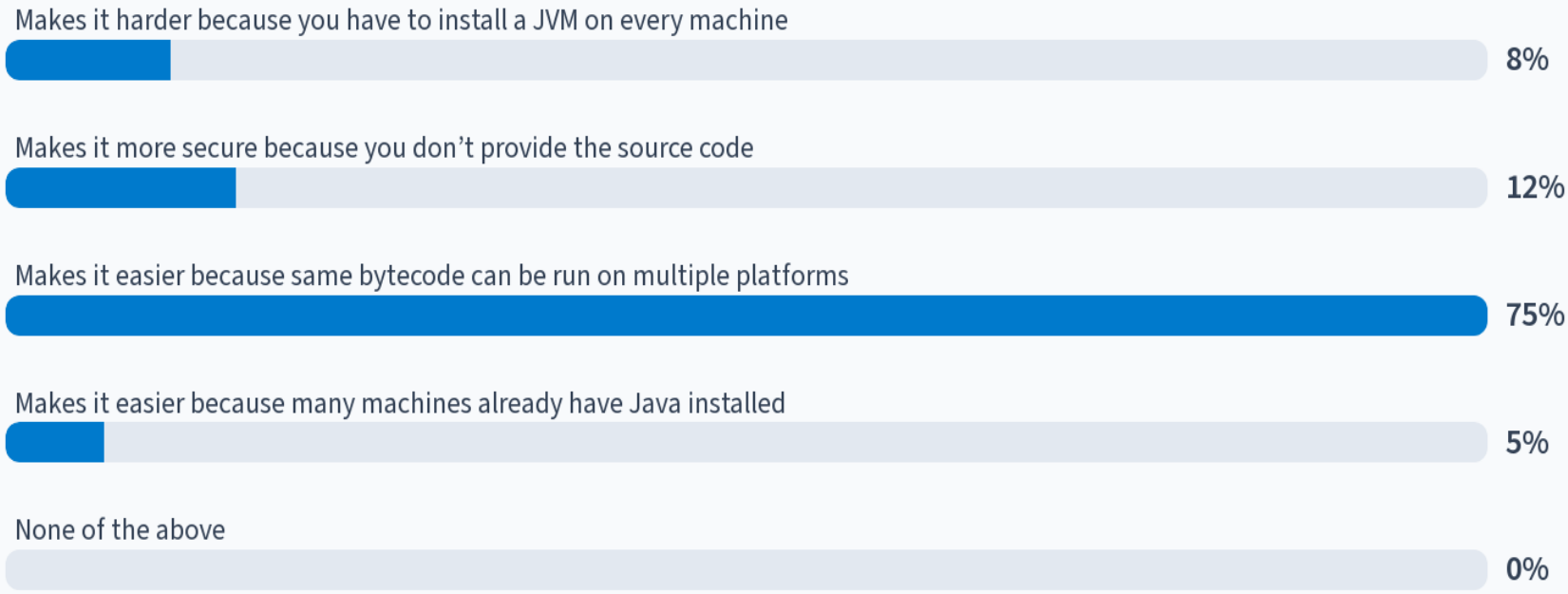
Typical Git Workflow

1. Clone repository
   - Git's default branch is `main`
2. Branch from `main` to a work-in-progress branch
   - Work on feature/next step/…
   - Add files to staging area
   - Commit with message
3. When complete, merge branch back into `main`
4. Push `main`
5. Switch back to and continue in work-in-progress branch (either same branch or new one)
6. Repeat

Review

- What are the benefits of Java?
- How do you compile and run Java programs?
- How do you display output in a Java program?
- What are the modifiers for the `main` method?
  - What are the parameter(s) to `main`?
  - How do you *call* the `main` method?
- How does Java compare to Python (so far)?

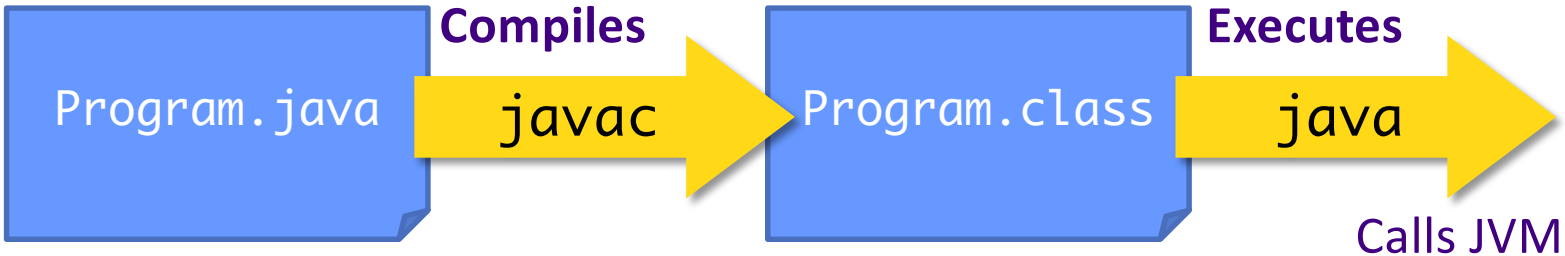
How does software being Java-based affect its distribution?



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
- Compiled
  - Find some errors before execution!
    - Statically typed
  - Can give performance boost through optimizations

Review: Compiling, Executing Java Programs




```
javac Program.java
java Program
```

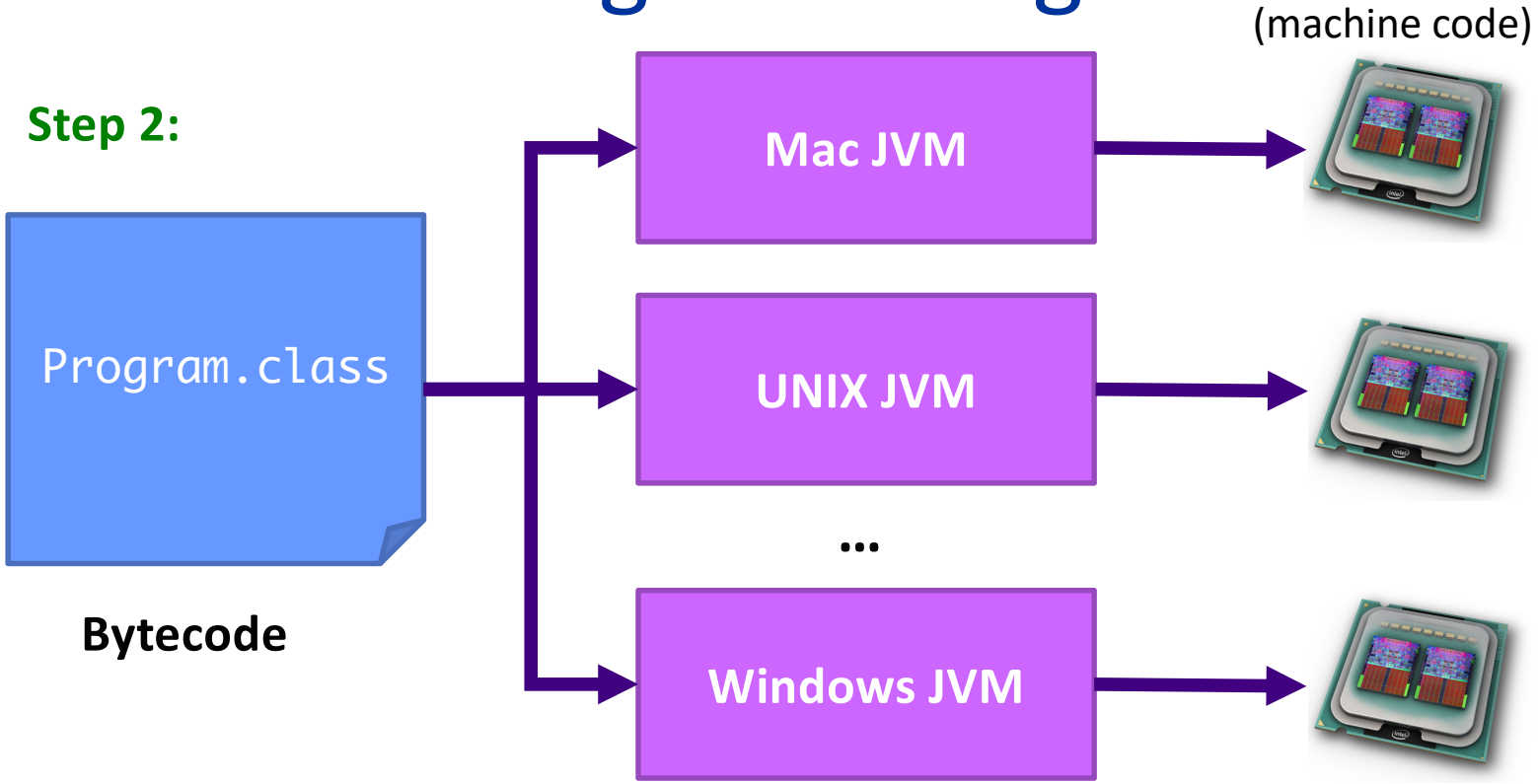
Compiling & Running a Single-Source Program

- If you want to run a Java class that's in **one** class and doesn't use need other classes, then you can compile *and* run the class using

```
java Program.java
```

  - Generated bytecode is not saved in a file
- Single-source program is *not* the common/general case
  - Instead compile, then run your code

Review: Executing Java Programs



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

Review: Example Java Program

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

`main` method is automatically called when you run

```
java Hello
```

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>
```

JAVA FUNDAMENTALS

Print Statement

- Syntax:

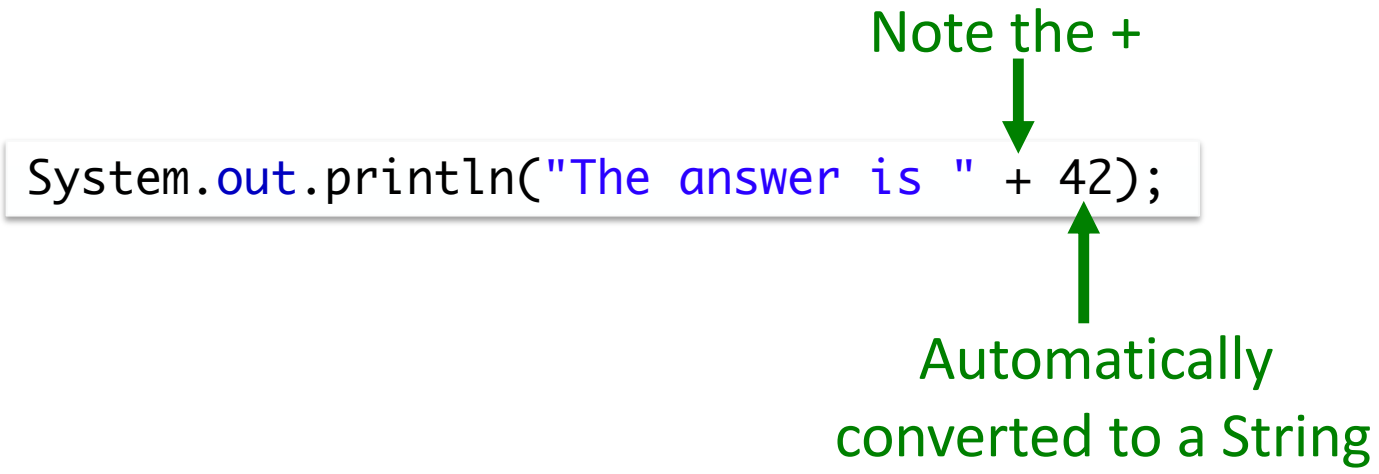
```
System.out.println(<String>);
System.out.print(<String>);
```

No newline at end

- Closer to how you use Python's `file.write()` method
  - Need to combine parameter into *one* `String` using `+`'s
    - Recall: Python's `print` used *commas*

String Concatenation

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



Conversion.java

Java keywords/reserved words

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

Data Types

- Java is ***strongly*** and ***statically typed***
  - Every variable must have 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`	`true` or `false`

Fun fact: Python *unified* ints and longs → no longer has long

Variables

- Need to specify variable's type, i.e., it must be ***declared***, before used
  - **Syntax**: `<datatype> <name> [= value];`

- Naming conventions:
  - Variable names (identifiers) typically start with *lowercase* letter
    - _ (underscore) also a valid first character
  - Subsequent words are capitalized
    - Examples: myFile, firstCousinOnceRemoved
    - Called "Camel Casing"

Variable Examples

- Need to specify variable's type, i.e., it must be ***declared***, before use
  - **Syntax**: `<datatype> <name> [= value];`

- Examples:
  - `int x;`
  - `double pi = 3.14;`
  - `char exit = 'q';`
  - `boolean isValid = false;`

Note ***must*** use *single* quotes for `chars`

Camel Casing

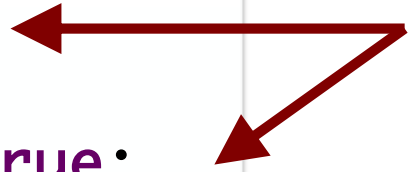
Python Transition **Warning**

You can**not** redeclare a variable name in the same scope

- Not OK:

```
int x = 3;
int x = -3;

boolean x = true;
```



Compiler errors

Python Transition **Warning**

You can**not** redeclare a variable name in the same scope

- Not OK:

```
int x = 3;
int x = -3;

boolean x = true;
```

Compiler errors

- OK:

```
int x = 3;
x = -3;
… // more code
x = 7;
```

Declaration

Definition

More Data Type-Related Information

- Result of integer division is an `int`
  - Same as C
  - Example: `5/3 = ??`
- If want a double as a result, need to *cast* at least one of numerator and denominator
  - Similar to Python for primitive types
  - Examples:
    - `5/(double) 3`
    - `(double) numerator/denominator`

Floats in Java

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

```
float f = 3.14;
```

Compiler reads `3.14` as a *double*

- Compiler error message:

```
Float.java:15: error: incompatible types: possible lossy
conversion from double to float
       float f = 3.14;
                 ^
1 error
```

- To fix code, add an `f` to specification of number or declare as `double`

`Float.java`

Arithmetic, Relational Operators

- Java has most of the same operators as Python:
  - Arithmetic operators: `+, -, *, /, %`
    - **Python transition gotcha: No power operator: `**`**
  - Relational operators: `==, !=, <, >, <=, >=`
    - Evaluate to a `boolean` value
  - Increment and decrement
    - `+= x, -= y,` etc.
    - Additional shortcut for += 1, -=1: `++ , --`

Escape Sequences

Same as Python:

Meaning	Sequence
Newline character (carriage return)	`\n`
Tab	`\t`
Quote	`\"`
Backslash	`\\`

- Combination of characters to represent something else
- Escape character: \
- In Java, you can represent a ' without escaping
- What does the following display?

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

Demo: Compiling and Running Programs

- Compiler errors:
  - Errors in the program's syntax or violations of Java rules
- Logic errors
  - Errors in your logic/coding
  - Found at runtime
  - After fixing program, need to go back and recompile

Unix Output Redirection: >

- 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 > output.txt`

Please follow instructions on names in assignments

Policy: Using the Web and Others

- I provide a lot of online resources
- Most of what I ask you to do is similar to my slides or examples
  - Exception: machine/software configuration
- Use my resources first
- Search online/ask someone else as a last resort
  - Need more experience to sort through the results you get in search engine and to understand results from AI
    - How do you get experience? More practice in CSCI209!

If it's taking more than ~3 minutes to get an answer, check in with me

To Do

- Textbook: Read “Java Data Types”, up to but not including String
- Assign 0
  - Part 1: First Java Program
  - Part 2: Fix compiler and logic errors from program
  - Due before Friday’s class