CS134 Lecture 34:

Wrap Up

Announcements & Logistics

- **Lab 10** due Wed/Thus at 10 pm
- CS134 Scheduled Final: **Friday, May 17, 9:30 AM**
  - Room: **TCL 123 (Wege)**
  - Reduced distraction room: **Bio 112**
- CS134 **Review Session** before Finals:
  - Wednesday May 15, **4.30-5.30 pm**
  - Room: **TCL 123 (Wege)**
- We will release Practice Final soon

Do You Have Any Questions?

Last Time: Sorting

- Discussed efficiency of selection and merge sort
    - You implemented and compared wall-clock time in Lab 10
- Takeaways:
    - Efficiency matters!
    - Big Oh is a good predictor of wall clock time

Today and Friday

- Today we will **wrap up the topics of CS134** (first 30 mins):
    - Overview of what we learned
    - Concepts vs programming language: discuss high level differences between Python vs Java
    - How to do more CS stuff beyond this class

- Last 15 or so mins: **course evaluations**
- Friday's plan:
    - **Jeopardy style review session of concepts**!!
    - Form teams of 5-6 students, come up w team names
    - Split up topics between teammates to maximize chance of winning

CS134 in a Nutshell

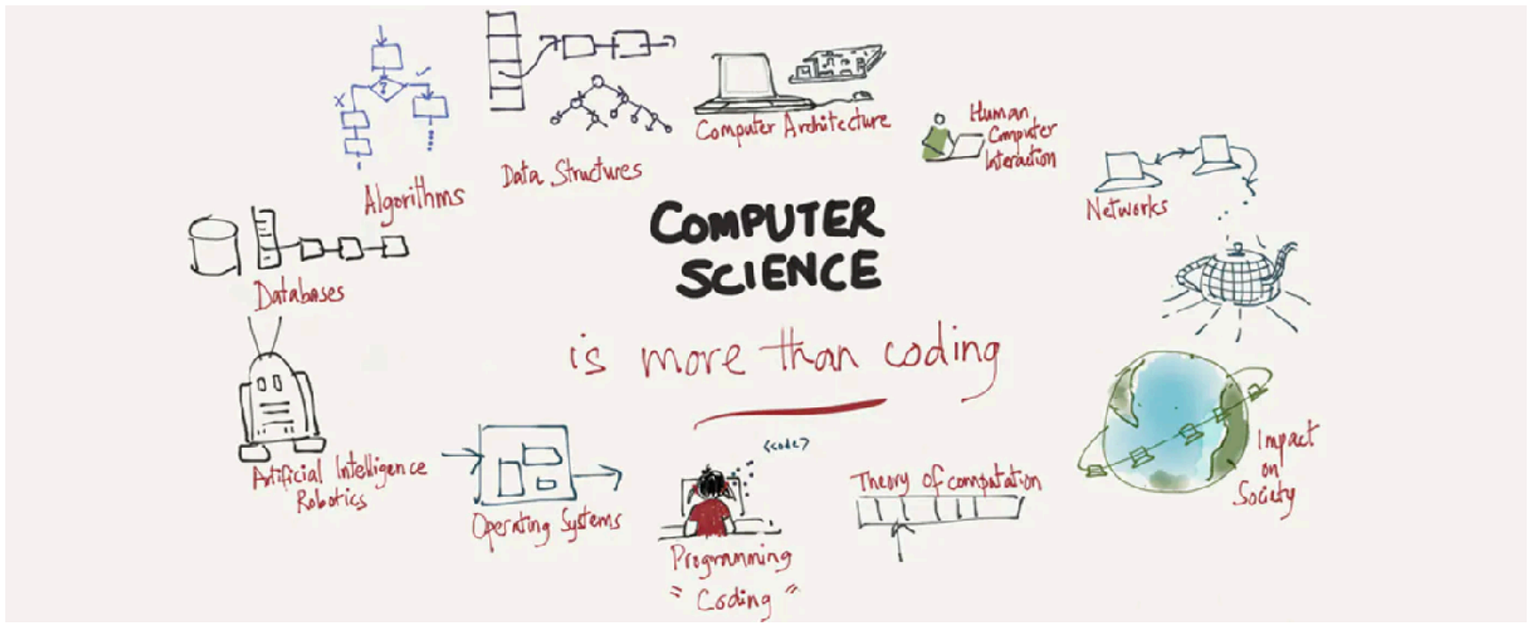
- We have covered many topics this semester!
- We started out learning the basics of Python and programming in general
- **Pre-midterm**
  - **Types & Operators** (int, float, %, //, /, arithmetic operators, etc)
  - **Functions** (variable scope, return vs print, defining vs calling functions)
  - **Conditionals** (if elif else and logical operators)
  - **Iteration**: for loops, while loops, nested loops, accumulation variables in loops
  - **Sequences**: strings, lists, ranges, lists of lists
  - **Mutability** and **aliasing**
  - **Data structures**: lists, tuples and sets

CS134 in a Nutshell

- Then we moved on to more advanced CS topics
- **Post-midterm**
    - **New data structure**: dictionaries
    - **File reading**: with … as, processing file lines in a loop
    - **Recursion**: recursive methods and classes
        - **Graphical recursion** with **turtle** graphics
- **Classes, Objects, and OOP**
    - attributes, special methods, getters, setters, inheritance
    - "Bigger" OOP Examples: Autocomplete, Tic Tac Toe, Boggle
    - Special methods and associated operators/functions
- **Advanced topics**:
    - Efficiency (Big-O), Linked Lists, Searching and sorting

Takeaway: What is Computer Science?

- Computer science ≠ computer programming!
- Computer science is the study of what computers [can] do; programming is the practice of making computers do useful things
- Programming is a big part of computer science, but **there is much more to CS** than just writing programs!
- Another part of CS is computational thinking



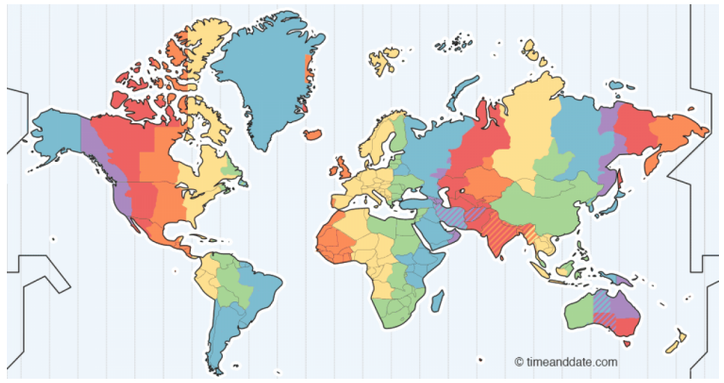
https://www.edsurge.com/news/2015-12-02-computer-science-goes-beyond-coding

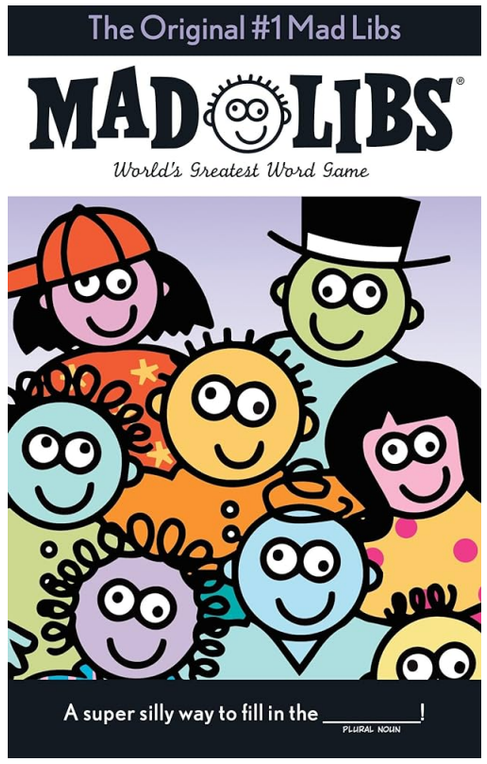
Take away: Computational Thinking

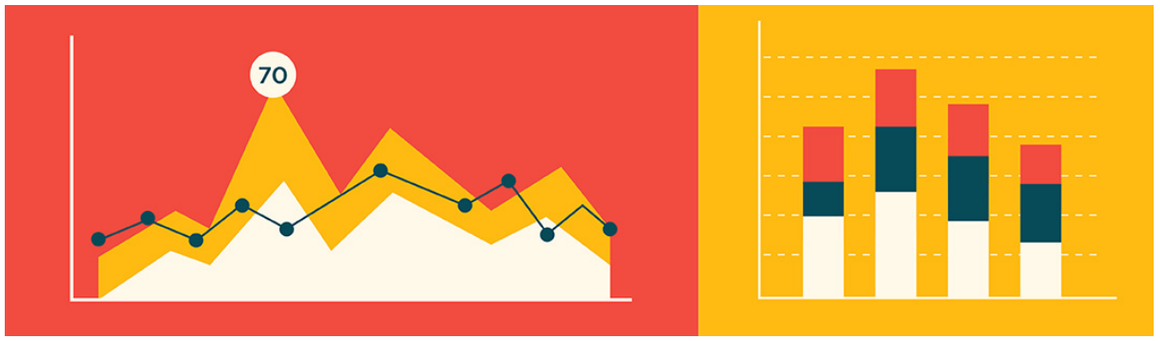
- Computational thinking allows us to develop solutions for complex problems. We present these solutions such that a computer, a human, or both, can understand.
- Four pillars of CT:
  - **Decomposition** - break down a complex problem into smaller parts
  - **Pattern recognition** – look for similarities among and within problems
  - **Abstraction** – focus on important information only, ignore irrelevant details
  - **Algorithms** - develop a step-by-step solution to the problem
- A computer can performs billion of operations per second, but computers only do exactly what you tell them to do!
- In this course we ~~will learn~~ **learned** how to 1) use CT to develop algorithms for solving problems, and 2) implement our algorithms through computer programs

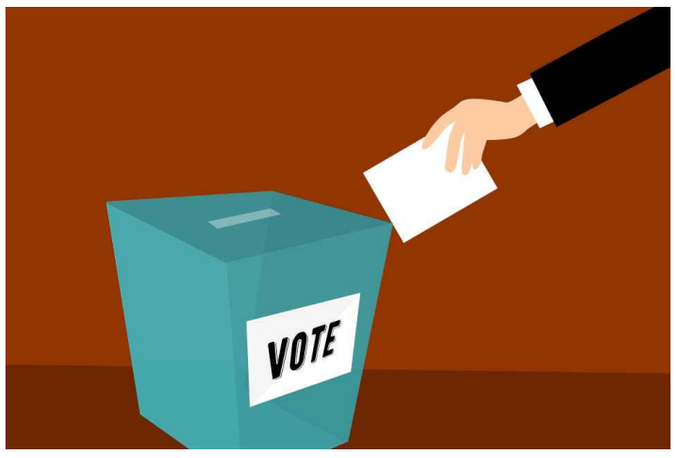
CS134 Labs: Practice with Computational Thinking

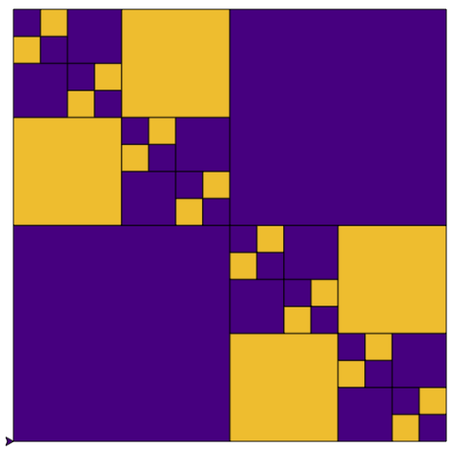
- Labs were designed to look at real life **commonplace** processes through a computational lens











Universal Skills and Toolkit

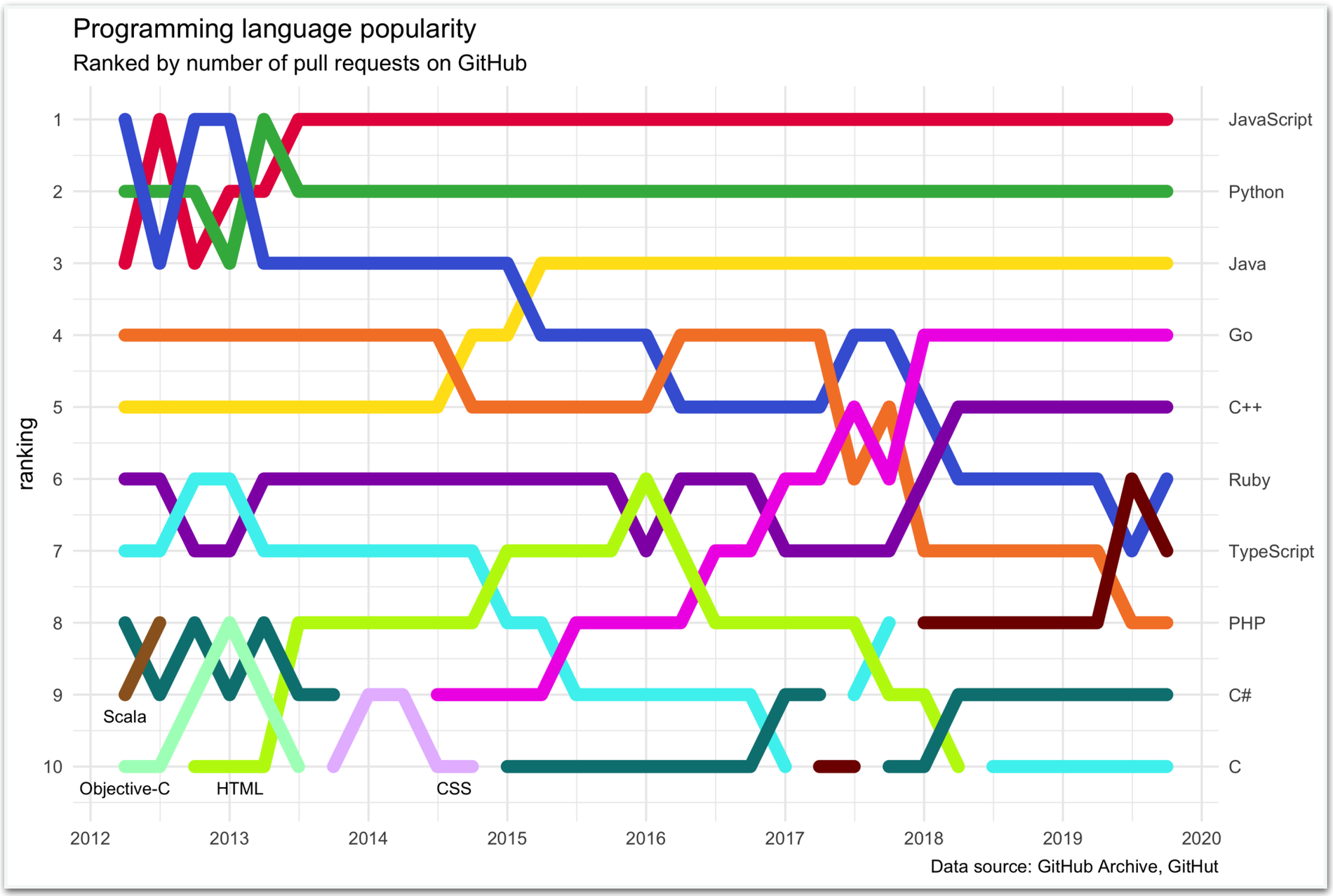
- Gained many skills that go beyond CS134/Python
  - Navigating around your computer via **Terminal**
  - Using **git** for collaboration
  - Ability to utilize existing libraries for plotting/ data visualization
- Practice on **testing a**nd **debugging**
- Skills that is useful irrespective of programming language

CS Concepts Carry Over

- We used Python as a tool to practice fundamentals of CS
  - Decomposition, Pattern recognition, Abstraction and Algorithms
- Programming language just gives us a way to express our logic
    - If the language changes, this expression changes
    - But the **algorithm (the logical steps)** stay the same!

Many Programming Languages

- Many programming languages out there
  - What is the most popular ones change over time



Adapting from One to Another

- Adapting to a new language is a matter of getting familiar with its syntax as well as practicing being "fluent" in it
- Let's discuss this through high level comparison of Python vs Java

Python vs. Java

Python

- Powerful language used by many programmers
- Designed for making common programming tasks simple
- Good for new programmers, and for scientific computing

Java

- Powerful language used by many programmers
- Designed for building large-scale systems design
- Good fit for large, scalable reliable software projects

Python vs Java: Hello World

- Python has low overhead to get started
- Java has more overhead upfront
    - Needed to ensure declaring classes and types from get-go

```
# hello.py

print("Hello, World!")
```

we can call the **function** `print` without needing to define a class

```
# Hello.java

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

Every Java program must define a **class**, and all code is inside a **class**. All functions in Java are **methods** and must be called using dot notation

Python vs Java: Running Our Code

- **Python** is an **interpreted** language: ***interpreter*** runs through the code line by line and executes each line: this can also be done interactively!
- **Java** is a **compiled** language: code must be compiled first (converted to machine code) before it is executed

```
# hello.py

print("Hello, World!")
```

```
% python3 hello-simple.py
Hello, World!
```

```
% python3
>>> print("Hello World!")
Hello World!
```

```
# Hello.java

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

```
% javac Hello.java
% java Hello
Hello, World!
```

Python vs Java: Data Types

- Both Python and Java have data types (Ints, Floats, Booleans, Char/String etc)
- **Python** is flexible about its type:
  - Loosey goosey (technical term: **loosely typed**) language
  - Makes it easy to get started, less cumbersome / overhead
  - Can lead to unexpected runtime errors, tries to "overcorrect" type issues whenever possible leading to unexpected behavior
- **Java** is a **strongly-typed** language: variables types need to be declared at initialization and cannot be changed
  - Makes the code more verbose /more overhead
  - But will catch most of these errors during compilation!

Downside of Loose Types

- Python tries to fix "type mismatches" by doing bizarre things at times
- Does this look familiar?

```
word1 = ["hello"]
word2 = "world"

word1 += word2  # calls.append secretly
print(word1)
```

```
['hello', 'w', 'o', 'r', 'l', 'd']
```

Beyond CS134

- For those interested in continuing on the CS path:
    - Take **CS 136** or **MATH 200**
    - If you want to practice Java over break: redo CS134 labs in Java
- In general, if you enjoy **puzzles and programming**, you can practice these skills on your own:
    - **Project Euler** (Math + CS puzzles)
    - **LeetCode** (Coding Interview Prep, Python/Java examples)
    - MIT course: **The Missing Semester of Your CS Education**
- CS courses as non-majors: can still take CS136, Math 200, winter study courses (Video games, Lida's winter study, etc)

Takeaways

- CS is all about breaking down a complex problem into smaller pieces and figuring out how to put the solution back together
    - This **problem-solving mindset** is a very useful skill to have!
- You all should be proud of how much you've learned!
- **Thank you** for your patience and enthusiasm throughout the course

WE MADE IT!

Course Evals Logistics

- Two parts: **(1) SCS form**, **(2) Blue sheets** (both online)
- Your feedback helps us improve the course and shape the CS curriculum
    - Your responses are **confidential** and we only receive anonymized comments after we submit our grades
    - We appreciate your constructive feedback
- **SCS forms** are used for evaluation, **blue sheets are open-ended** comments directed only to your instructor

*To access the online evaluations, log into **Glow** (glow.williams.edu) using your regular Williams username and password (the same ones you use for your Williams email account). On your Glow dashboard you'll see a course called "**Course Evaluations**." Click on this and then follow the instructions you see on the screen. If you have trouble finding the evaluation, you can ask a neighbor for help or reach out to ir@williams.edu.*