Welcome and Logistics

http://web.stanford.edu/class/cs106l/

Welcome to CS 106L!

We're so glad you're here!

Haven Whitney and Fabio Ibanez

Spring 2024

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I'm Haven!

I'm Fabio!

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Now you all can meet (some of) each other!

First: Introduce yourself to the person on your right

Second: Introduce yourself to the person on your left

Potential Conversation Topics:

- What’s something you’re into and not into?
- Why do you want to take this class?

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Asking Questions

We welcome questions!

- Feel free to raise your hand at any time with a question.
- We'll also pause periodically to solicit questions and check understanding.

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Asking Questions

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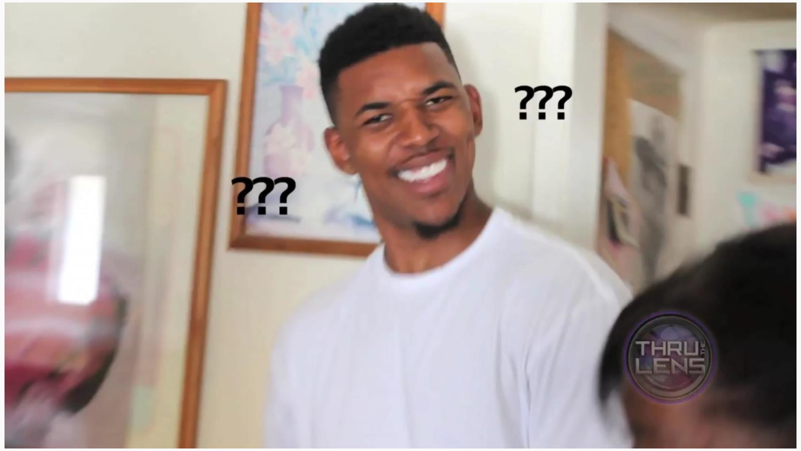

Access and Accommodations

- Disabled students are a valued and essential part of the Stanford community. We welcome you to our class.
- Please work with OAE but also let us know if there's anything we can do to make the course more accessible for you
- Don’t be shy asking for accommodations if problems arise. We’re very reasonable people and will do whatever we can to help.

Community Norms

- Shame-free zone
- Treat your peers and instructors with kindness and respect
- Be curious
- Communication is key!
- Recognize we are all in-process (humility, question posing, avoid perfectionism)

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Guiding Principles

We will do everything we can to support you. We want to provide flexibility to the best of our ability!

- We want to hear your feedback so we can ensure the class is going as smoothly as possible for everyone
- Please communicate with us if any personal circumstances or issues arise! We are here to support you.

Questions?

Lecture

- Held **Tuesdays** and **Thursdays** 4:30pm-5:50pm in Thornton 110
- No lecture after week 9!
- Lecture is not recorded.
- **Attendance is required**. Short participation quizzes (1-2 questions) will be given at the beginning of lecture starting in week 2. All students are given 5 free absences.

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Lecture

CS106L is an enrichment course to 106B! As such, we want to cover new and fun material that will be helpful in your C++ journey.

- C++ is a huge language. We want you to get practice with some things, exposure to others, and a lot is not covered.

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Illness

If you feel ill or are sick, for the wellbeing of yourself and others **please stay home**, take care of yourself, and reach out to us - **we never want** you to feel that you must attend class if you are not feeling well!

Similarly, if you have an emergency or exceptional circumstance, **please reach out to us** so that we can help!

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Office Hours

- OH time TBD and will be in person.
  - These will be settled by week 3 (before first assignment)
- We want to talk to you! Come talk!
- Extra office hours weeks 9-10!
- Watch the website (cs106l.stanford.edu) and Ed for more info.

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All class information can be found at:

cs106l.stanford.edu

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Assignments

There will be 7 short weekly assignments (typically takes 1 hour at most depending on experience).

- Submissions will be on Paperless or as directed on the assignment handout!

Assignments will be released on Thursdays and due in one week (the following Thursday)

- All students have three free late days.

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Grading

Grading is S/NC. We expect everyone to get a S!

How to get an S?

- Attend at least 8 of the 13 required lectures between Week 2 and Week 9
- Successful completion of 5 out of 7 weekly assignments

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Get in touch with us!

Here are the best ways to communicate with us, in no particular order:

- Email us: cs106l-spr2324-staff@lists.stanford.edu
    - Please use this email not our individual emails so we both receive the message!
- Public or Private Post on Ed
- After class or in our office hours

Questions?

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Course Content

Week	Topics
1	Admin, Brief Intro to C++ feature
2	Initialization + References, Streams
3	Containers, Iterators, Pointers
4	Classes, Template Classes, Const
5	Template Functions, Functions, Lambdas
6	Operators, Special Member Functions
7	Move Semantics, Type safety
8	Bonus Topics + MORE OFFICE HOURS
9	NO CLASS MORE OFFICE HOURS
10	NO CLASS MORE OFFICE HOURS

Why CS106L?

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CS106B

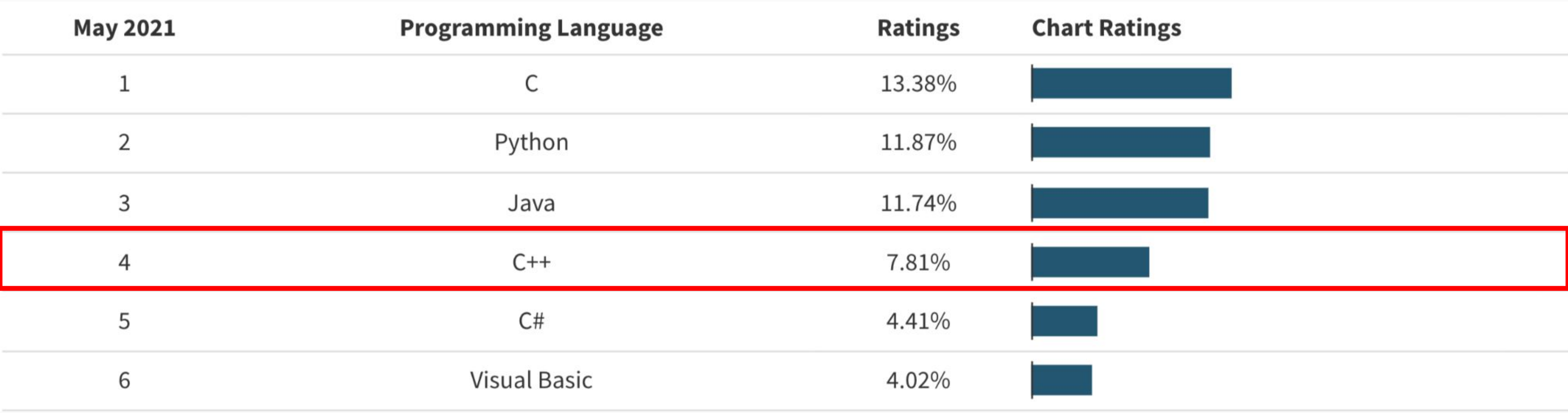
- Focus is on **concepts** like abstractions, recursion, pointers etc.
- Bare minimum C++ in order to use these concepts

CS106L

- Focus is on **code**: what makes it good, what **powerful** and **elegant** code looks like
- The real deal: No Stanford libraries, only STL
- Understand how and **why** C++ was made

Why C++?

C++ is still a very popular language!



May 2021	Programming Language	Ratings	Chart Ratings
1	C	13.38%	▬
2	Python	11.87%	▬
3	Java	11.74%	▬
4	C++	7.81%	▬
5	C#	4.41%	▬
6	Visual Basic	4.02%	▬

Tiobe Index, 2021

We use it in classes…

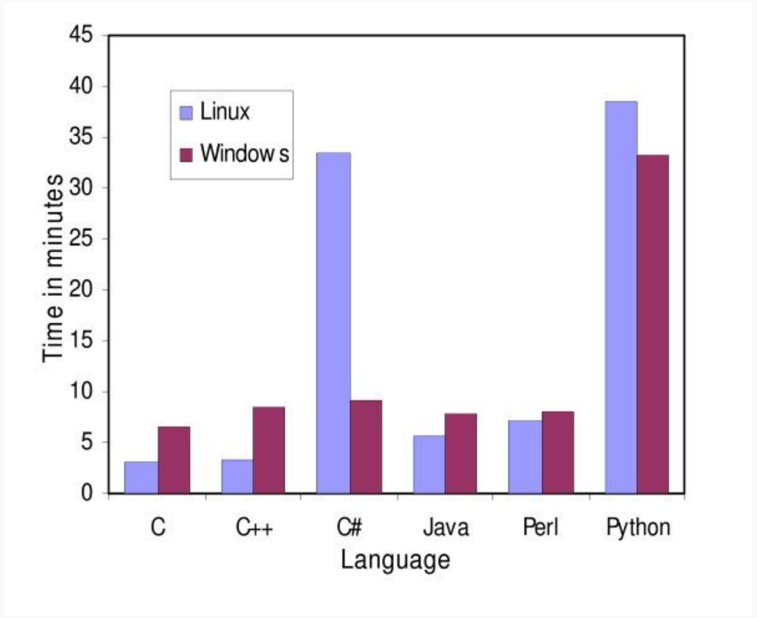
- CS 111: Operating Systems Principles
- CME 253: Introduction to CUDA (deep learning)
- CS 144: Introduction to Computer Networking
- CS 231N: Convolutional Neural Networks for Visual Recognition
- GENE 222: Parallel Computing for Healthcare
- ME 328: Medical Robotics
- MUSIC 256A: Music, Computing, Design I
- MUSIC 420A: Signal Processing Models in Musical Acoustics

… and more!

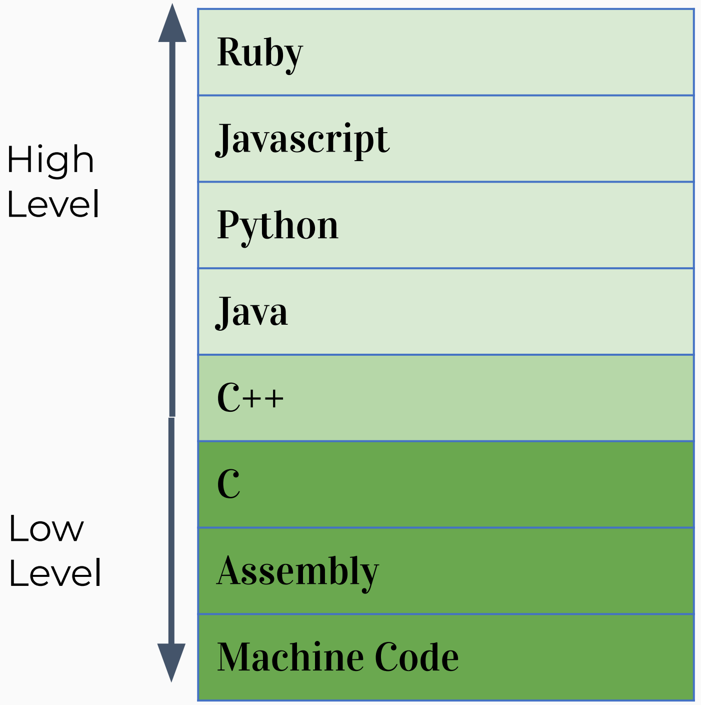
...and in real life!

Why C++?

FAST



Lower-level control



What is C++?

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This is some C++ code...

```cpp
#include <iostream>

int main() {
    std::cout << "Hello, world!" << std::endl;
    return 0;
}
```

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This is also some C++ code! (?)

```
#include "stdio.h"
#include "stdlib.h"

int main(int argc, char *argv) {
    printf("%s", "Hello, world!\n");
    // ^a C function!
    return EXIT_SUCCESS;
}
```

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Also technically C++ code!!

```
#include "stdio.h"
#include "stdlib.h"

int main(int argc, char *argv) {
   asm(  "sub    $0x20,%rsp\n\t"                        // assembly code!
         "movabs $0x77202c6f6c6c6548,%rax\n\t"
         "mov    %rax,(%rsp)\n\t"
         "movl   $0x646c726f, 0x8(%rsp)\n\t"
         "movw   $0x21, 0xc(%rsp)\n\t"
         "movb   $0x0,0xd(%rsp)\n\t"
         "leaq    (%rsp),%rax\n\t"
         "mov    %rax,%rdi\n\t"
         "call  __Z6myputsPc\n\t"
         "add    $0x20, %rsp\n\t"
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```

C++ is backwards compatible with lower level languages! Neat!

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C++ History: Assembly

```
section     .text
global      _start                          ;must be declared  for linker (ld)

_start:                                     ;tell linker entry point

    mov     edx,len                         ;message length
    mov     ecx,msg                         ;message to write
    mov     ebx, 1                          ;file descriptor (stdout)
    mov     eax, 4                          ;system call number (sys_write)
    int     0x80                            ;call kernel
    mov     eax, 1                          ;system call number (sys_exit)
    int     0x80                            ;call kernel

section     .data
msg     db  'Hello, world!',0xa             ;our dear string
len     equ $ - msg                         ;length of our dear string
```

C++ History: Assembly

Benefits:

- Unbelievably **simple** instructions
- Extremely **fast** (when well-written)
- Complete **control** over your program

Why don’t we always use assembly?

C++ History: Assembly

Drawbacks:

- **A LOT of code** to do simple tasks
- Very **hard to understand**
- Extremely **unportable** (hard to make work across all systems)

C++ History: Invention of C

Problem: computers can only understand assembly!

Idea:

- Source code can be written in a more intuitive language for humans.
- An additional program can convert it into assembly!
    - This additional program is called a **compiler**!

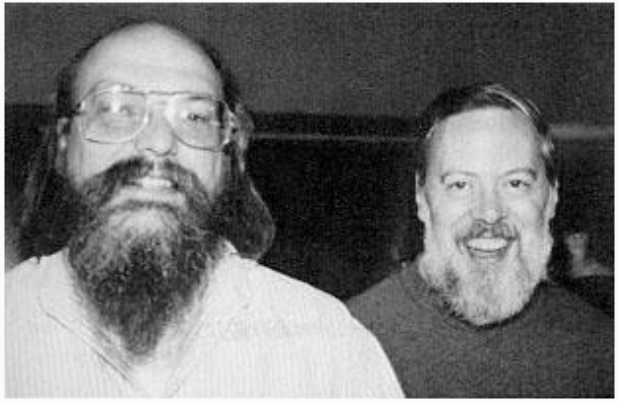
Take CS143 to learn more!

C++ History: Invention of C

Ken Thompson and Dennis Ritchie created C in 1972, to much praise.
C made it easy to write code that was:

- Fast
- Simple
- Cross-platform

Learn to love it in **CS107!**


Ken Thompson and Dennis Ritchie, creators of the C language.

C++ History: Invention of C

C was popular because it was simple.

This was also its weakness:

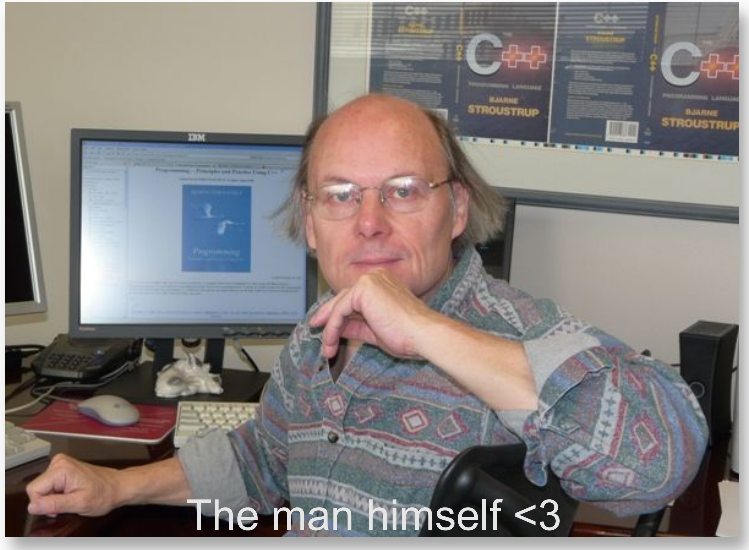
- No **objects** or **classes**
- Difficult to write **generic code**
- **Tedious** when writing large programs

C++ History: Welcome to C++!

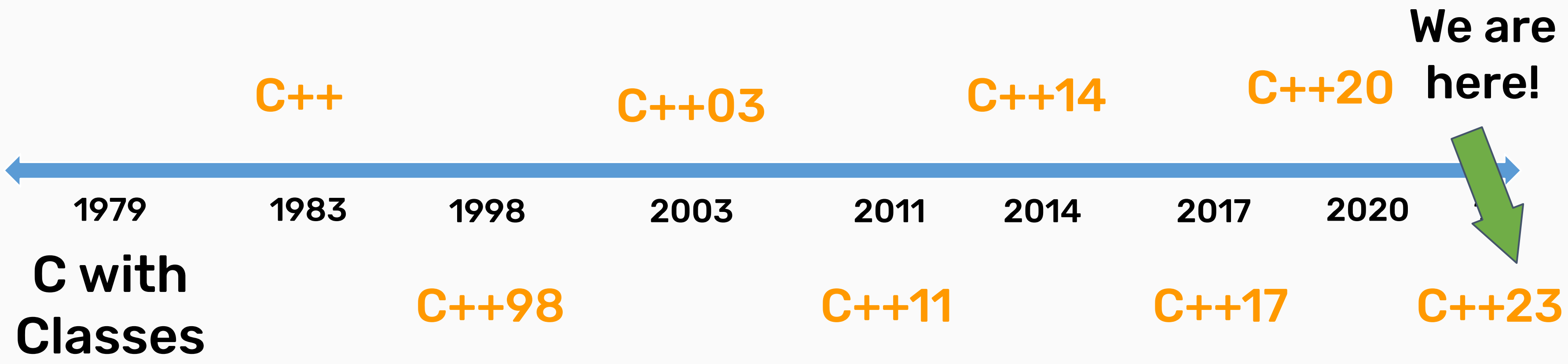
In 1983, the beginnings of C++ were created by Bjarne Stroustrup.

He wanted a language that was:

- Fast
- Simple to use
- Cross-platform
- **Had high-level features**



C++ History: Evolution of C++



Design Philosophy of C++

- **Only add features if they solve an actual problem**
- **Programmers should be free to choose their own style**
- Compartmentalization is key
- Allow the programmer full control if they want it
- Don’t sacrifice performance except as a last resort
- Enforce safety at compile time whenever possible

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But... what *is* C++?

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We’ll talk about it Thursday!

Thanks for coming! Next up: Types and Structs!