Welcome to CS 106L!

We're so glad you're here!

Haven Whitney and Fabio Ibanez

Fall 2023

CONTENTS ⌄

⌄

01.   **Introductions**

02.   **Course Logistics**

03.   **The ✨Pitch✨**

04.   **C++ Basics**

CONTENTS ⌄

01. **Introductions** ⌄

02. Course Logistics

03. The ✨Pitch✨

04. C++ Basics

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

I'm Haven!

I'm Fabio!

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 the story behind your name?

- What's something you're into and not into?

- Why do you want to take this class?

CONTENTS

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

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.

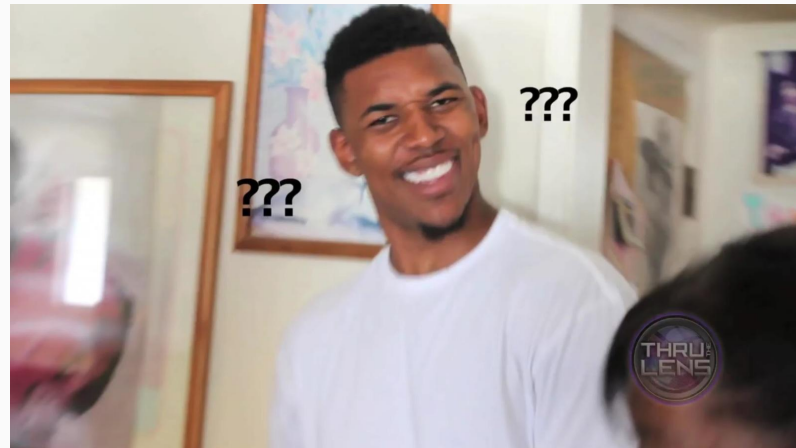http://web.stanford.edu/class/cs106l/

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.

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)

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

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.

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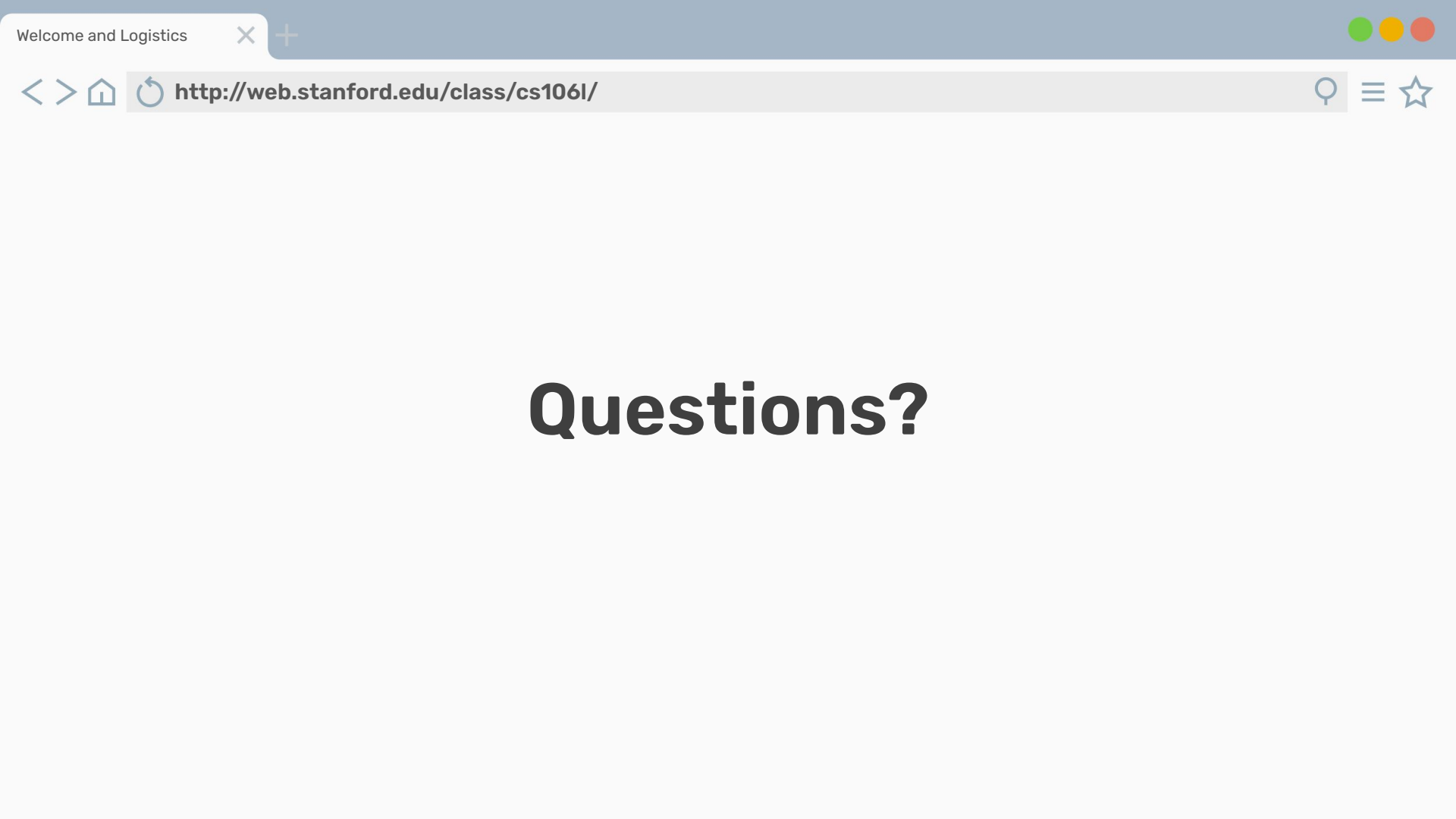
Questions?

Lecture

- Held **Tuesdays** and **Thursdays** 4:30-5:50pm in Turing Auditorium
- No lecture week 10 or week 6!
- Lecture is not recorded.
- Attendance is required. Short participation questions will be given at the beginning of lecture starting in week 2. All students are given 5 free absences.

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

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.

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

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!

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

Office Hours

- OH time TBD and will be in person and virtual.

- We want to talk to you! Come talk!

- Extra office hours week 6 and 10 when assignments are due!

- Watch the website (cs106l.stanford.edu) and Ed for more info.

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

All class information can be found at:

cs106l.stanford.edu

Assignments

There will be 2 short assignments (typically takes 2-4 hrs depending on experience).

- Pairs are allowed!

Assignment 1 Due Week 6: Friday, **Nov 3rd** @ 11:59pm (Late deadline: Sunday, **Nov 5th** @ 11:59pm)

Assignment 2 Due Week 10: Friday, **Dec 8th** @ 11:59pm (Firm Deadline)

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

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
- Submit both assignments without build errors

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

Get in touch with us!

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

- Email us: **cs106l-aut2324-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

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

Questions?

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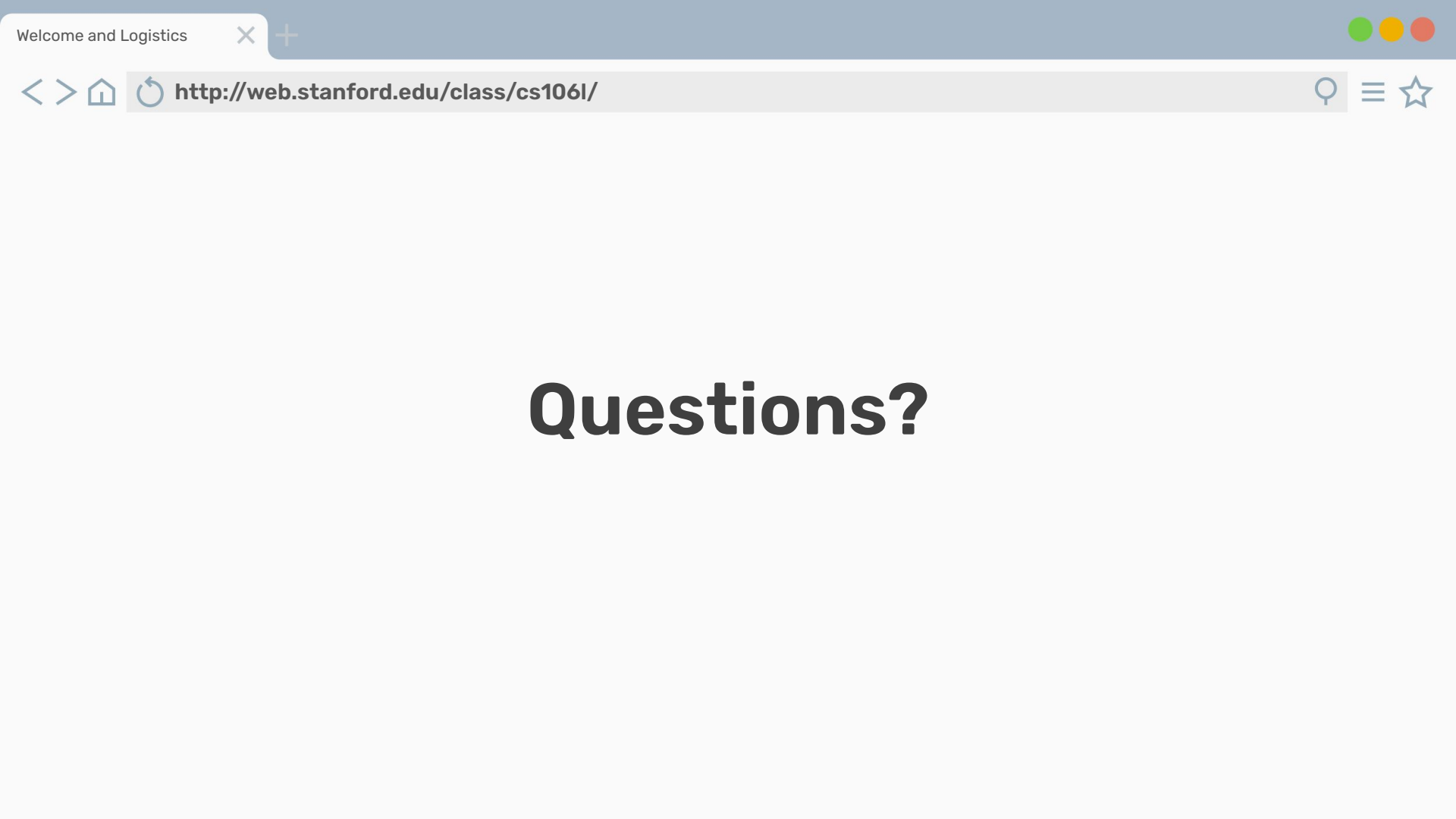
CONTENTS

01. Introductions

02. Course Logistics

03. The ✨Pitch✨

04. C++ Basics

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	No class, extra office hours, **Assn 1 Due Friday**
7	Operators, Special Member Functions
8	Move Semantics, Type safety
9	Bonus Topics + MORE OFFICE HOURS
10	NO CLASS MORE OFFICE HOURS, **Assn 2 Due Friday**

http://web.stanford.edu/class/cs106l/
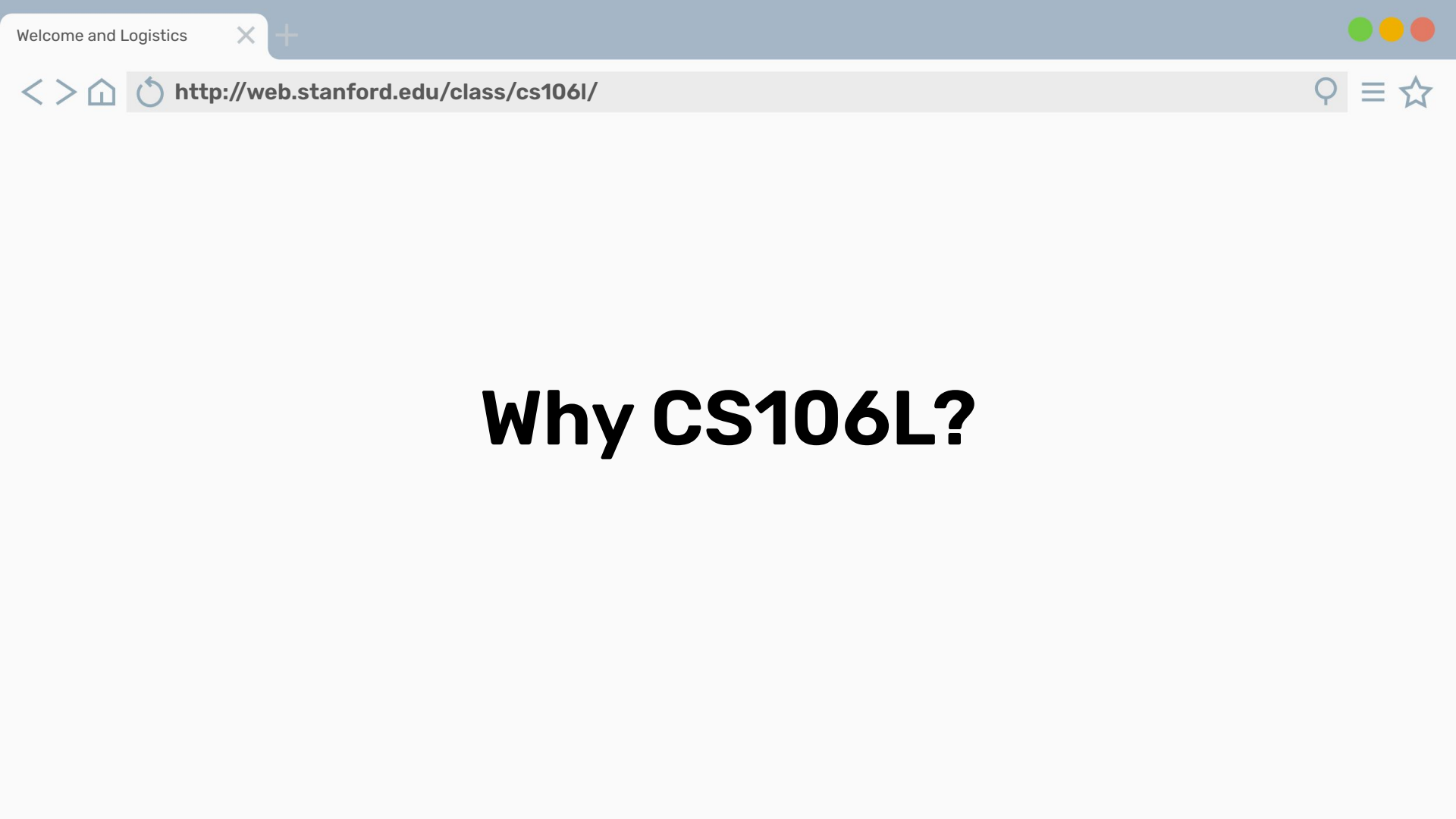
Why CS106L?

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

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

Why C++?

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

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

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

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!

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

...and in real life!

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

Why C++?

FAST
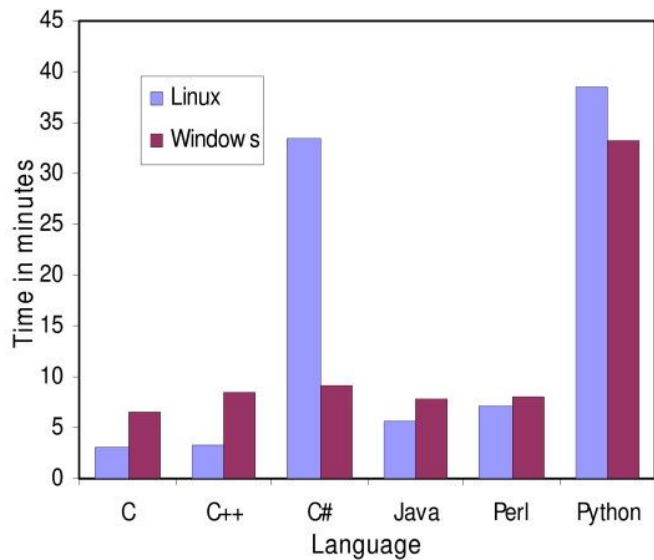
Lower-level control

	Ruby
High Level	Javascript
	Python
	Java
	C++
	C
Low Level	Assembly
	Machine Code

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

What is C++?

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

This is some C++ code...

```cpp
#include <iostream>

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

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

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

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

Also technically C++ code!!

```c
#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"
    );
    return EXIT_SUCCESS;
}
```

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

Also technically C++ code!!

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

int main(int argc, char *argv) {
    asm(  "sub    $0x20,%rsp\n\t"
          "movabs $0x77202c6f6c6c654
          "mov    %rax,(%rsp)\n\t"
          "movl   $0x646c726f, 0x8(%
          "movw   $0x21, 0xc(%rsp)\n
          "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"
    );
    return EXIT_SUCCESS;
}
```

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

Also technically C++ code!!

```c
#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"
    );
    return EXIT_SUCCESS;
}
```

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

C++ History: Assembly

```asm
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
```

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

C++ History: Assembly

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

Why don't we always use assembly?

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

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!
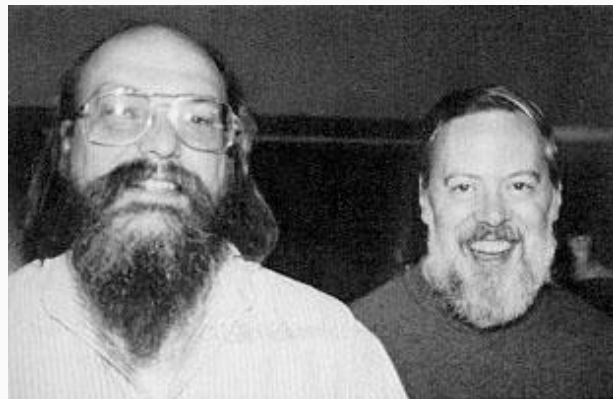 - This additional program is called a **compiler**!

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

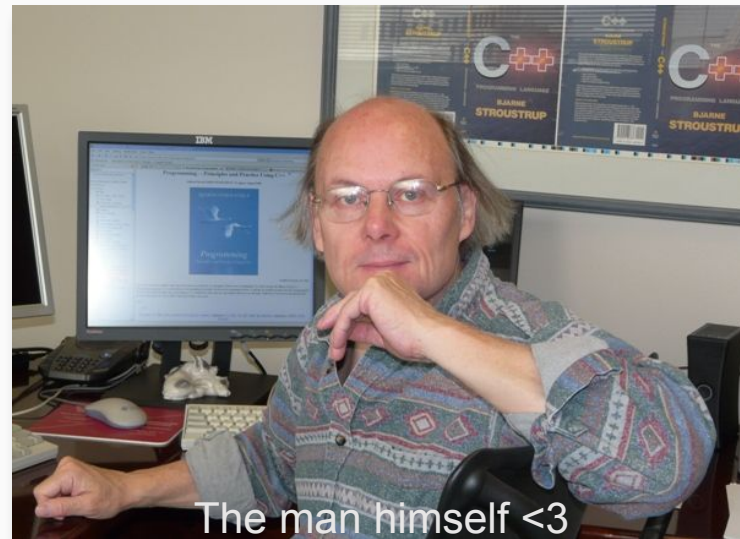C was popular because it was simple.

This was also its weakness:

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

C++ History: Welcome to C++!

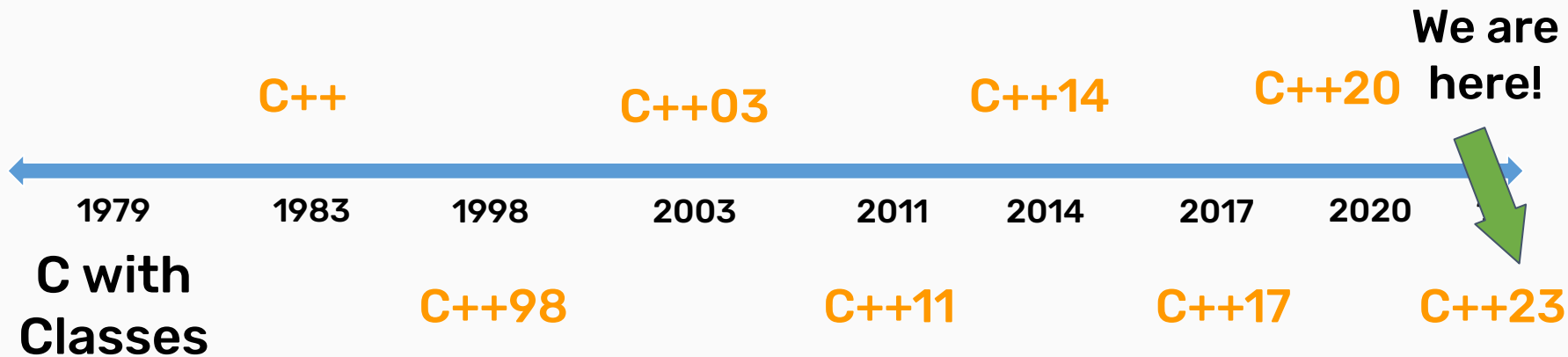In 1983, the beginnings of C++ were created by Bjarne Stroustrup.

He wanted a language that was:

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

The man himself <3

C++ History: Evolution of C++

We are here!

C++   C++03   C++14   C++20

1979   1983   1998   2003   2011   2014   2017   2020

C with Classes   C++98   C++11   C++17   C++23

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

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

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

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**

Questions?

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

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

We'll talk about it Thursday!

Thanks for coming! Next up: Types
and Structs!