

CS 220

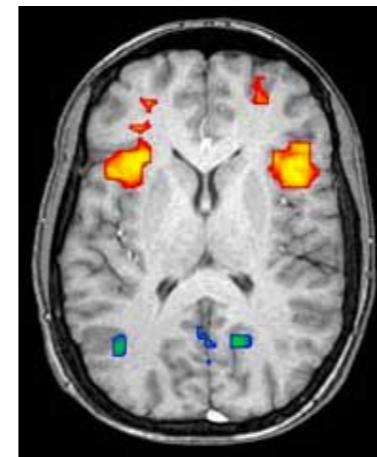
Introduction

Meena Syamkumar
Mike Doescher

Welcome to Data Programming I!

Data is exploding in many fields

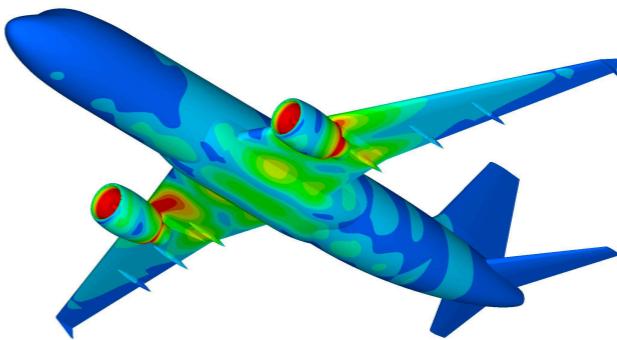
- Journalism
- Biology, physics, chemistry
- Psychology, sociology, economics, business
- Engineering (mechanical, electrical, industrial, etc)



<https://fivethirtyeight.com/features/the-midwest-is-getting-drenched-and-its-causing-big-problems/>

<https://en.wikipedia.org/wiki/Neuroimaging>

<https://science.howstuffworks.com/life/genetic/gattaca-gaptacaz-adding-letters-the-genetic-alphabet.htm>



Welcome to Data Programming I!

Data is exploding in many fields

- Journalism
- Biology, physics, chemistry
- Psychology, sociology, economics, business
- Engineering (mechanical, electrical, industrial, etc)

How can we gain insights from that data?

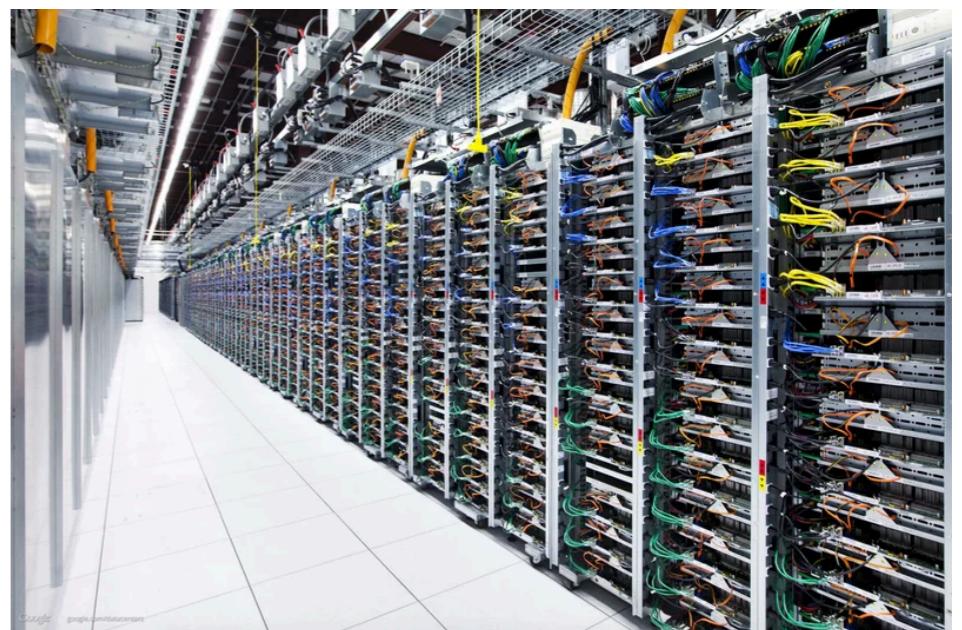
- With computation

Approach 1: human computation



https://en.wikipedia.org/wiki/Human_computer

Approach 2: machine computation



<http://fortune.com/2015/11/15/intel-super-7/>

Welcome to Data Programming I!

CS 220 is about approach 2

- Faster, more reliable, can churn through more data
- Automate to save human effort

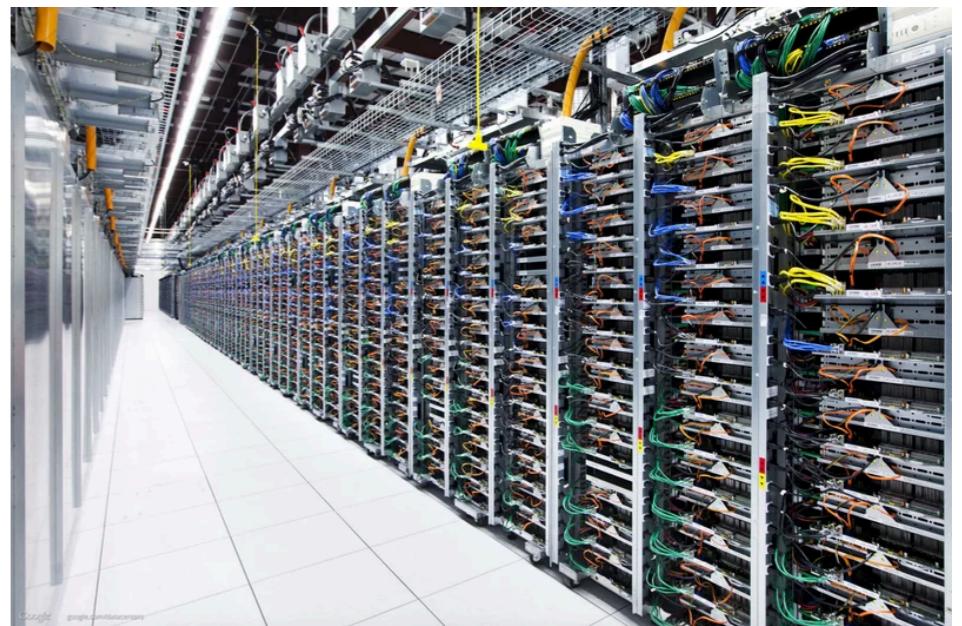
*“Find the leverage in the world, so you can **be more lazy!**”*

~ Larry Page

Approach 1: human computation



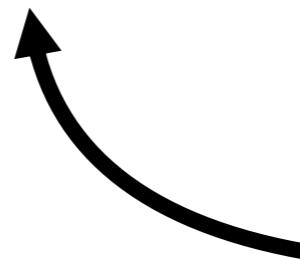
Approach 2: machine computation



Welcome to Data Programming I!

CS 220 is about approach 2

- Faster, more reliable, can churn through more data
- Automate to save human effort
- Requires being able to tell computers what to do!



**society needs more domain experts
in specific fields who can write code**

Goal: become "bilingual"

- Speak the language of **biology**, mech eng, journalism, etc)
- Speak the language of **computing**

Why CS 220?

Typical intro CS

- Challenging language (e.g., C++ or Java)
- CS students and other majors together
- Heavy on theory, light on data

vs

CS 220 approach

- Python (powerful but easier to learn)
- Bring more coding into other fields
- Light on theory, heavy on data
- Emphasize questions and communication

50 Best Jobs in America for 2019

Job Title	Median Base Salary	Job Satisfaction	Job Openings	
#1 Data Scientist	\$108,000	4.3/5	6,510	View Jobs
#2 Nursing Manager	\$83,000	4/5	13,931	View Jobs
#3 Marketing Manager	\$82,000	4.2/5	7,395	View Jobs
#4 Occupational Therapist	\$74,000	4/5	17,701	View Jobs

https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm

Today's Topics

Introductions

- Who am I? Who are you?

Course overview

Computer hardware basics

Website

Who am I?

Meena Syamkumar

- Email: ms@cs.wisc.edu
- Please call me “Meena”

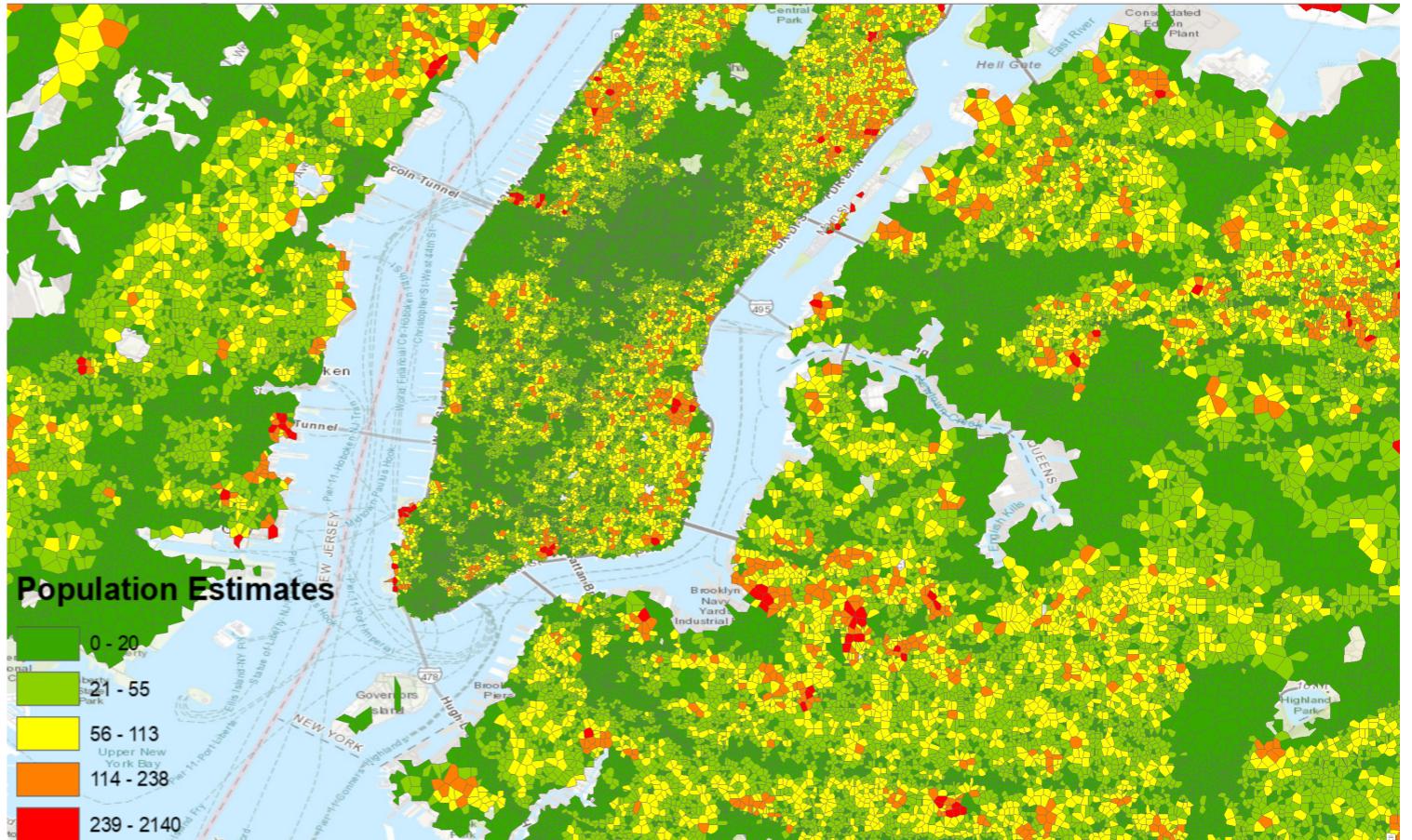
Industry and Teaching experience

- Citrix, Cisco, and Microsoft
- CS367 (Summer 2017), guest lectures in CS640, CS740, Grandparents University, Android programming workshops

Passion: Running



Research: Internet measurements



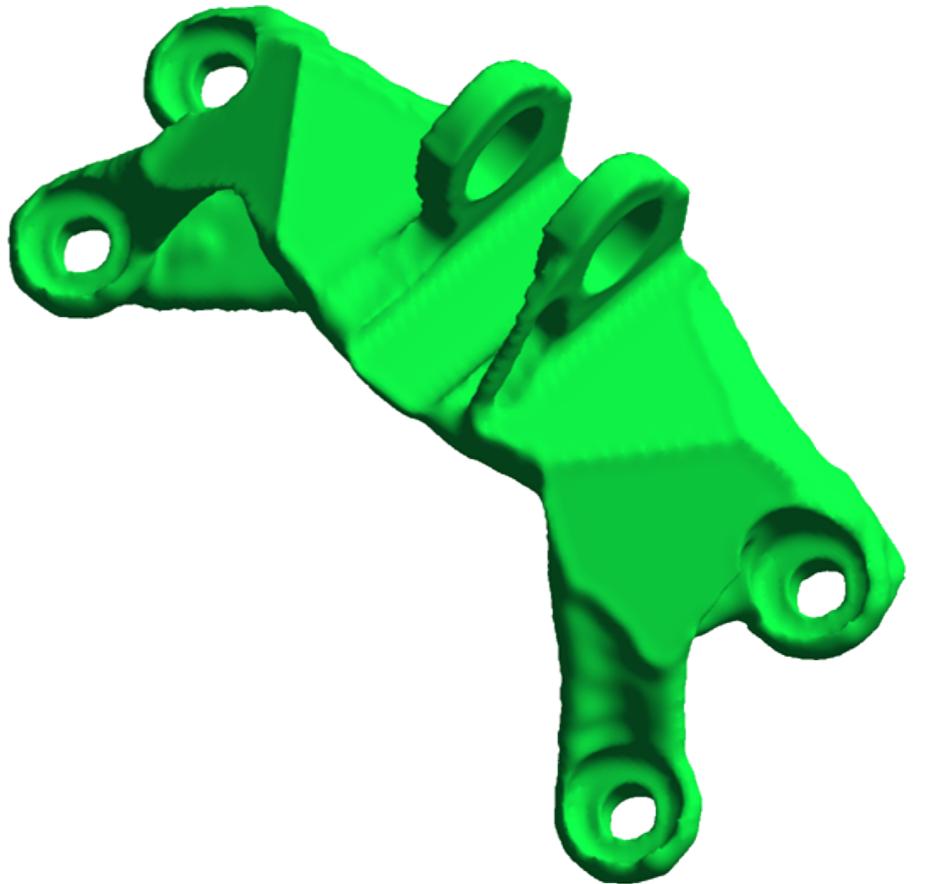
Who am I?

Mike Doescher

- Email: mdoescher@wisc.edu
- Please call me “Mike”

Industry and Teaching experience

- Naval Research Laboratory
- Benedictine College
- SciArt Software
- UW Madison



Who am I?

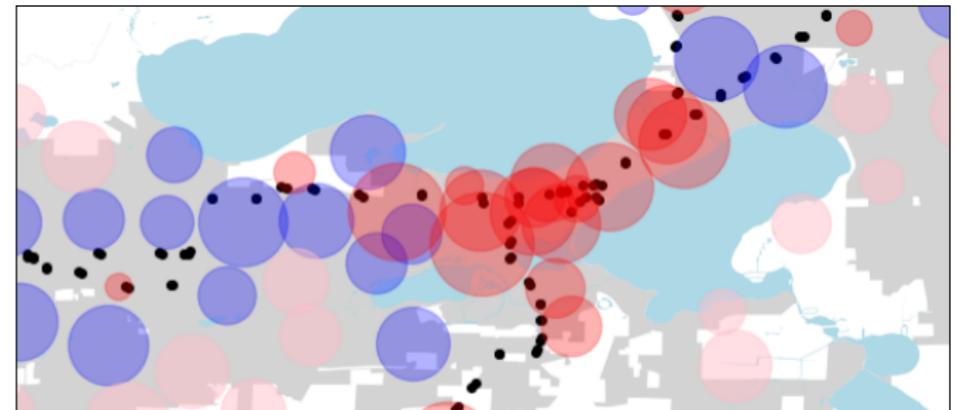
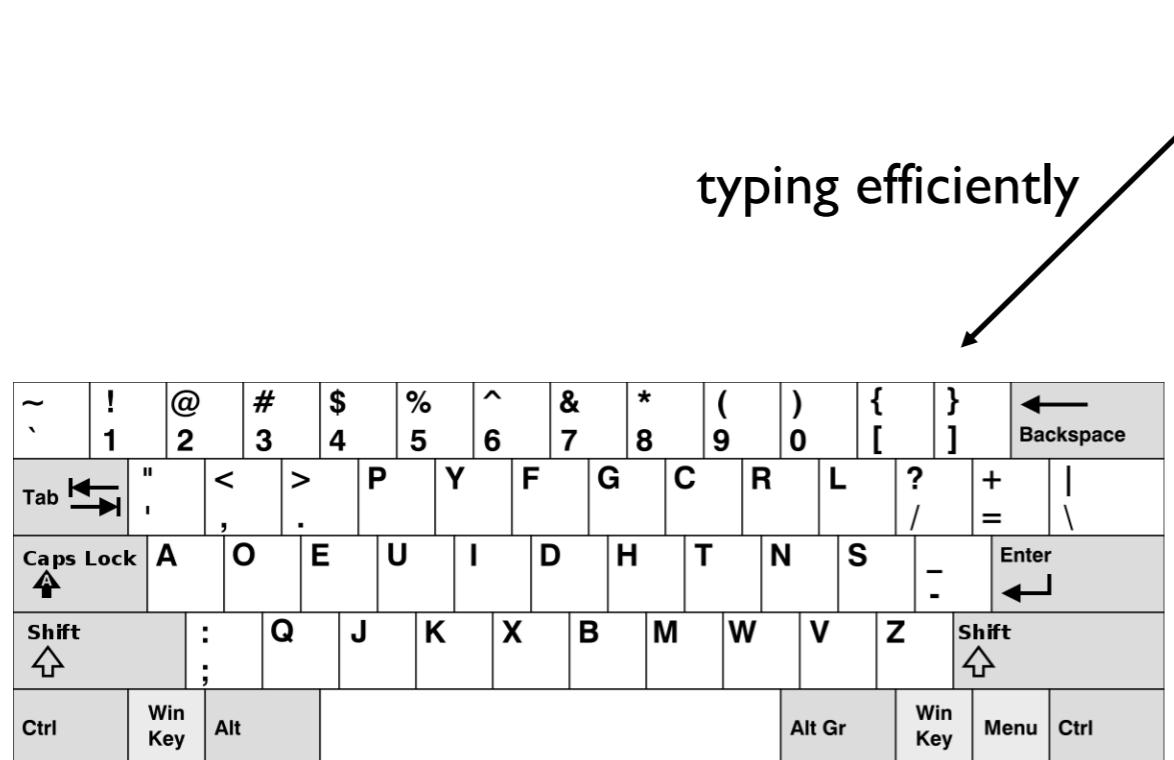
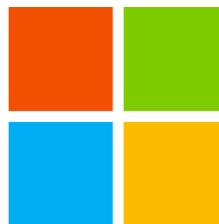
Tyler Caraza-Harter

- Long time Badger
- Email: tylerharter@gmail.com
- Just call me “Tyler”



Industry experience

- Worked at Microsoft on SQL Server and Cloud
- Other internships/collaborations:
Qualcomm, Google, Facebook, Tintri



Plot by [Jin Woo Lee](#) (previous CS 220 student)

More: <https://wisc-ds-projects.github.io/f19/>

Who are You? Survey (counts for participation)

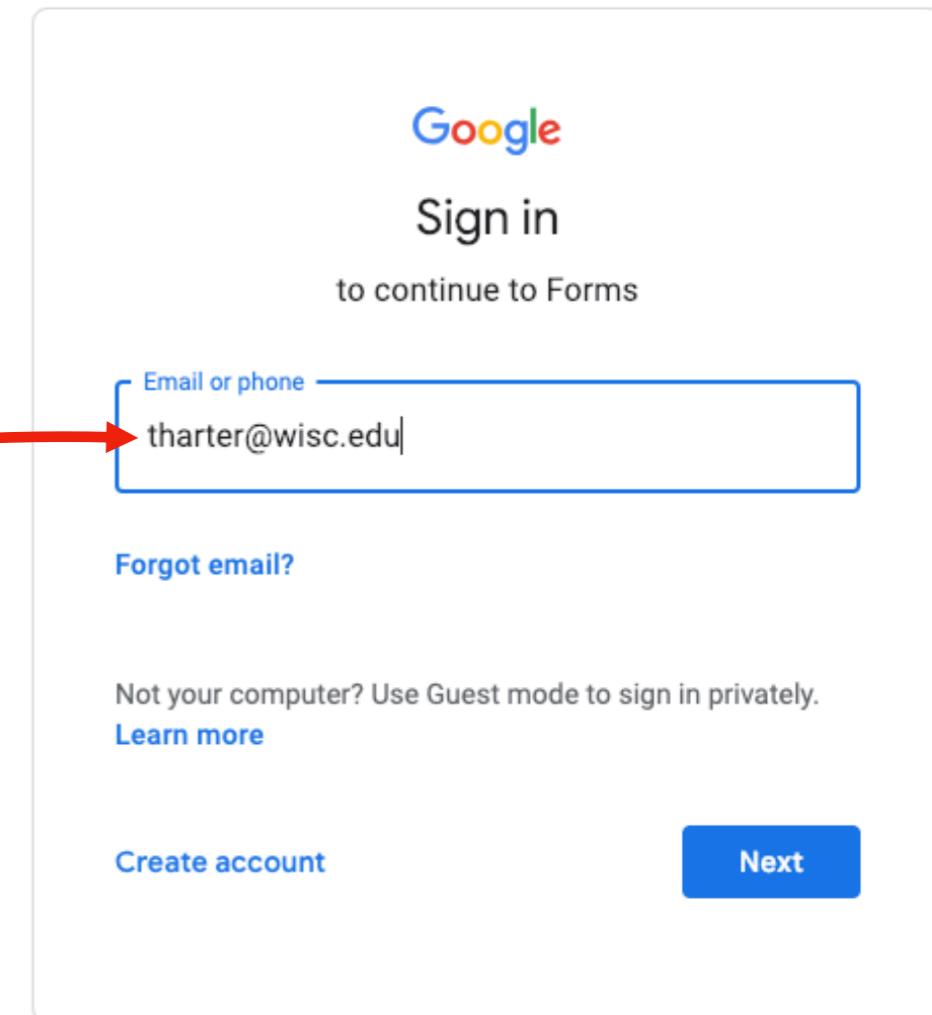
Please help us get to know you (not anonymous):

<https://forms.gle/te3C7dZzCwGqHPB88>

Purposes:

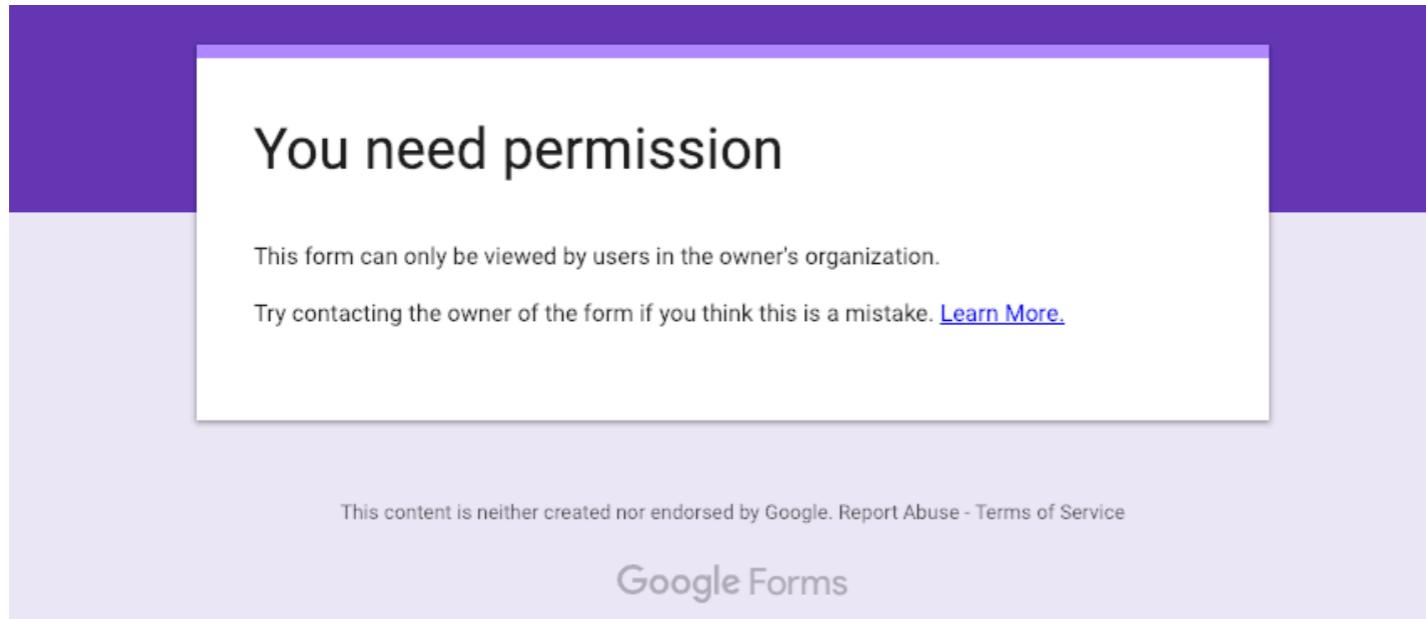
- gauge class interest/experience
- determine who on **waitlist** is attending
(please finish by 11:59pm tomorrow!)
- correlate experience with later scores

be sure to use your
campus email!



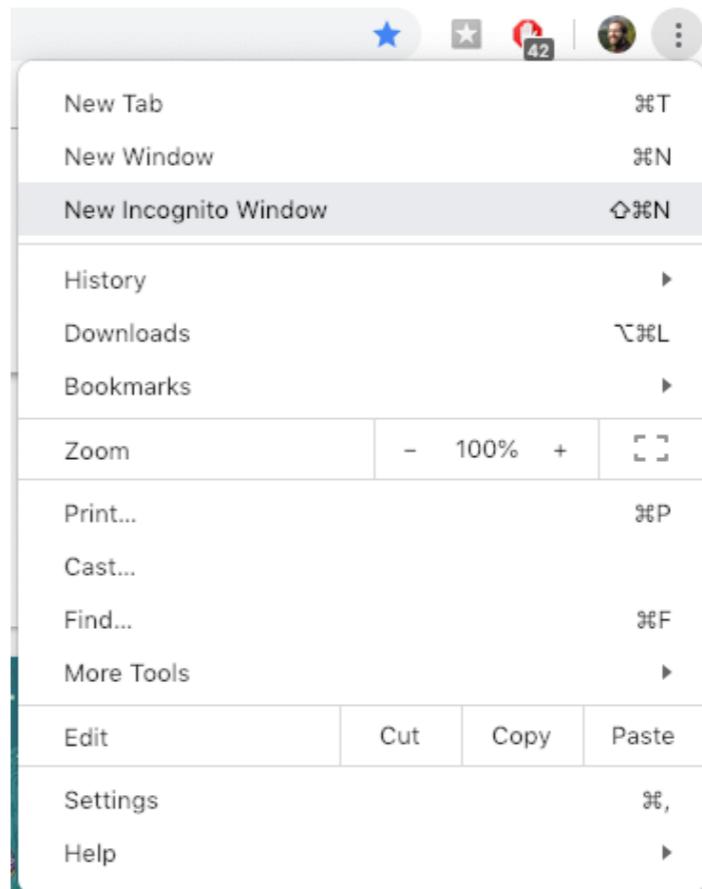
The image shows a Google sign-in interface. At the top right, it says "Sign in to continue to Forms". Below that is a "Email or phone" input field containing "tharter@wisc.edu". A thick red arrow points from the text "be sure to use your campus email!" to this input field. To the right of the input field is a "Forgot email?" link. Further down, there's a note about guest mode and a "Create account" button. On the far right is a blue "Next" button.

Survey: Common Technical Issues

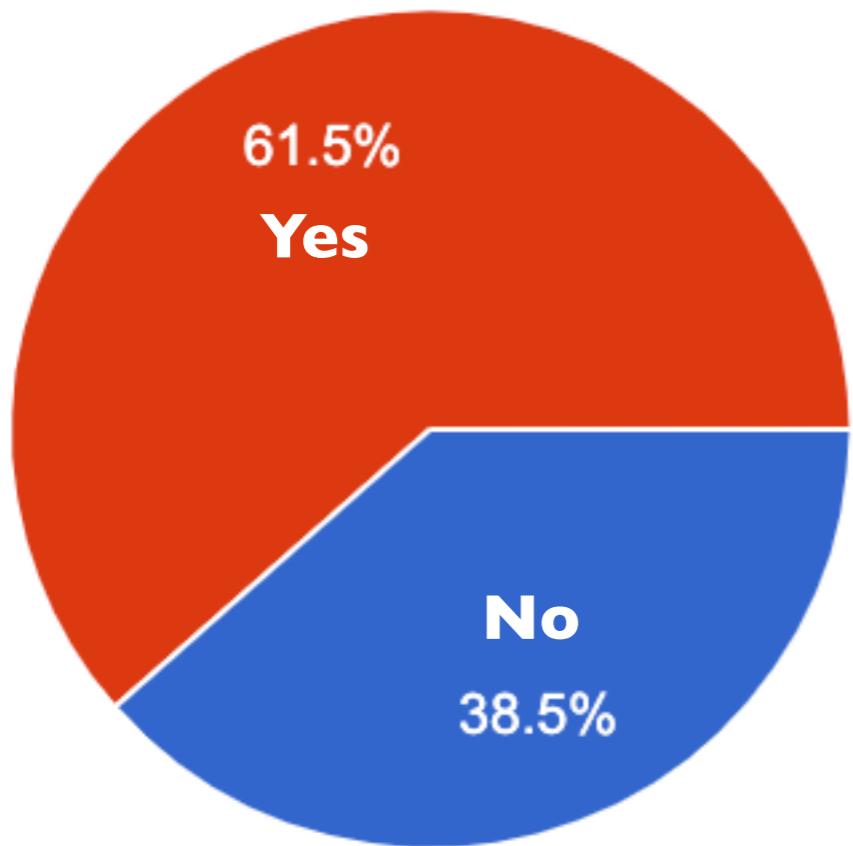


if you were automatically signed into gmail without being asked, consider clearing cookies or using an Incognito Window (in Chrome)

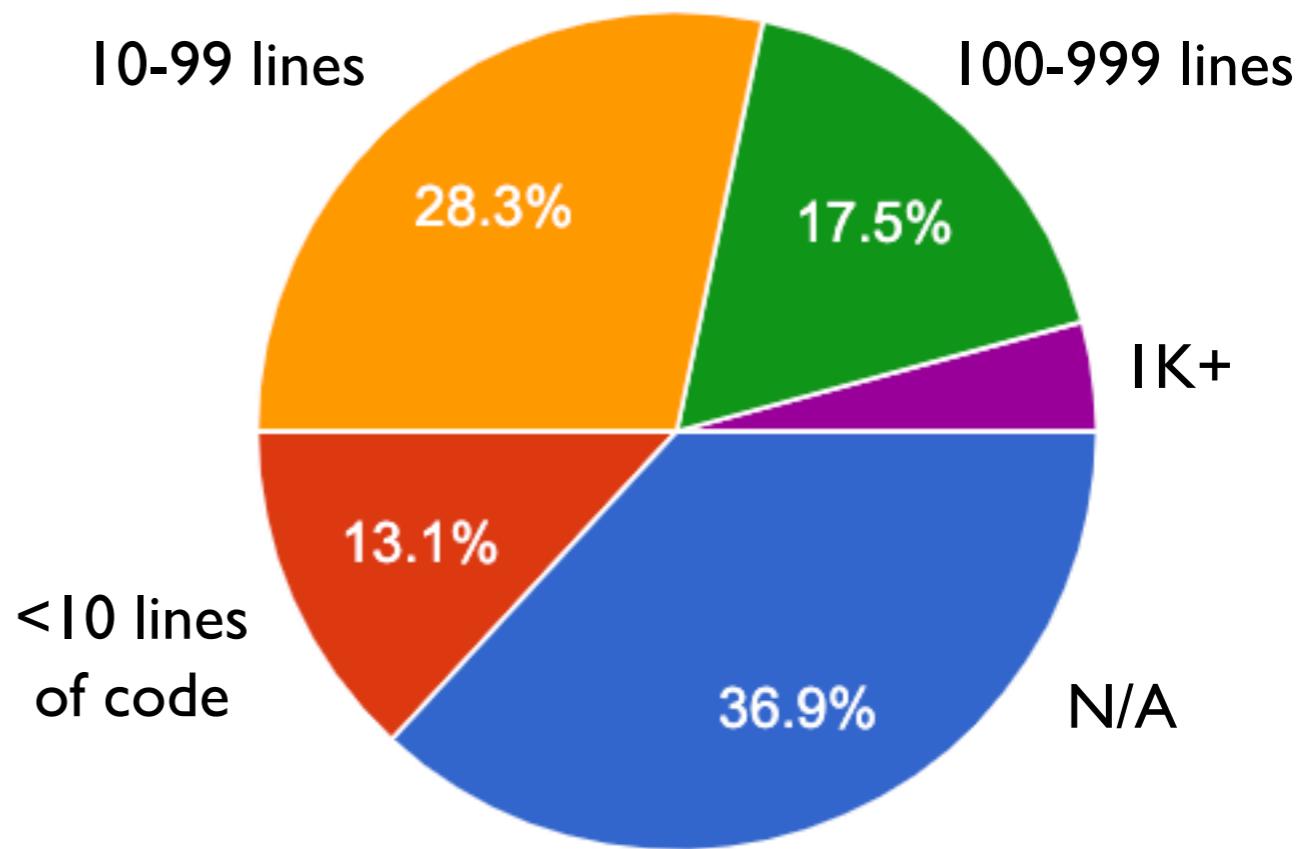
if you see this, it means you're signed in via Gmail instead of your campus email



Some results from Spring 2019...



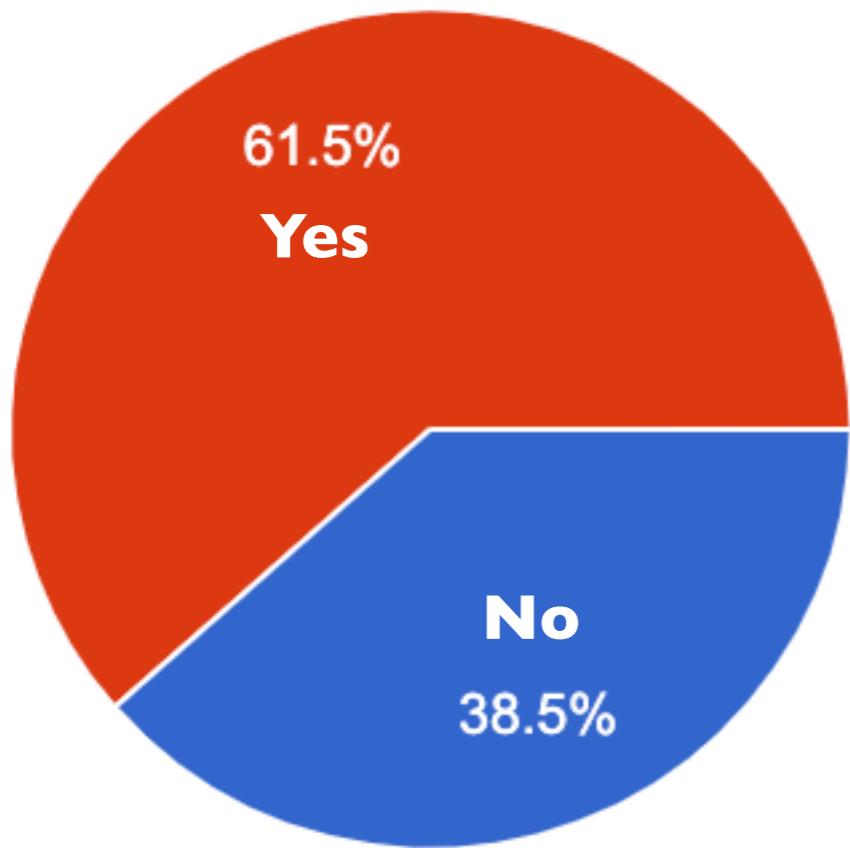
First time taking a CS course?



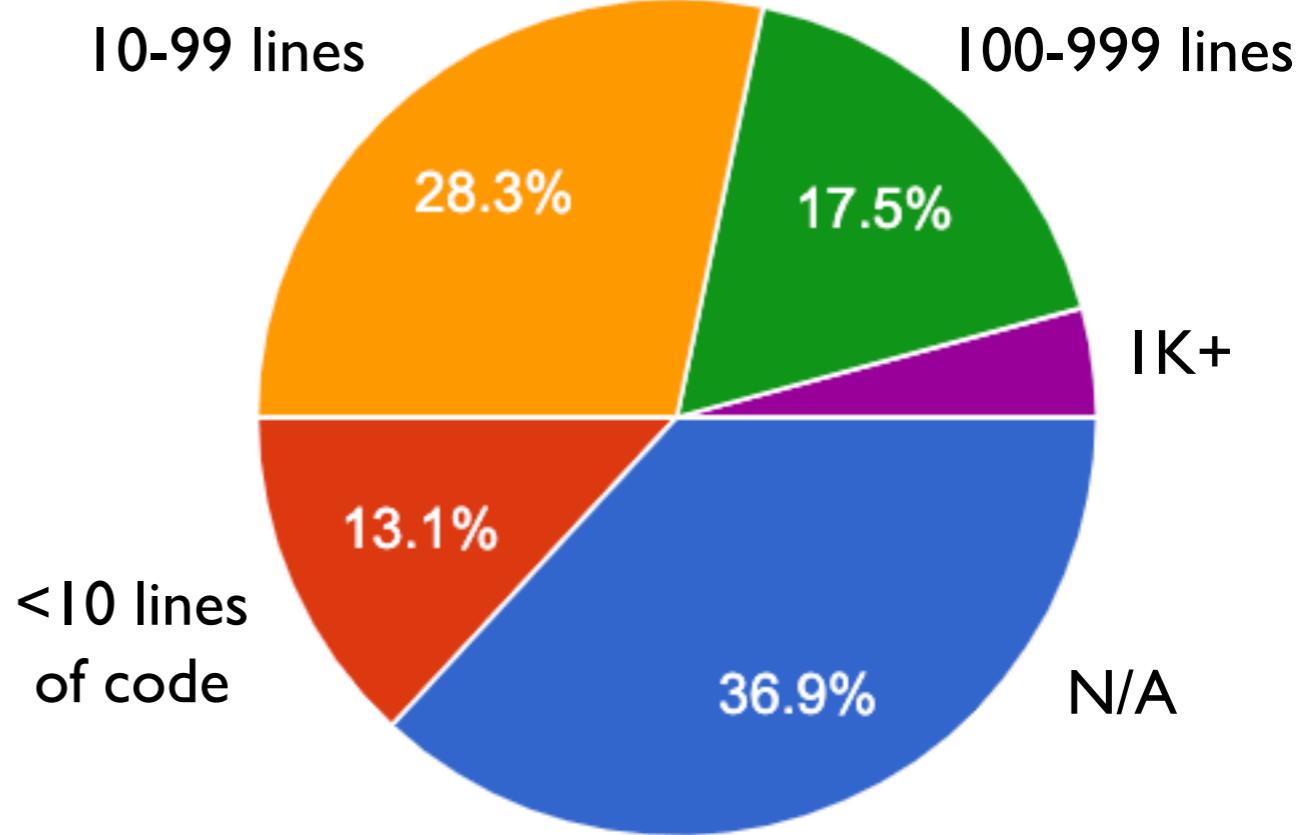
Largest program written prior?

from 548 students

Some results from Spring 2019...



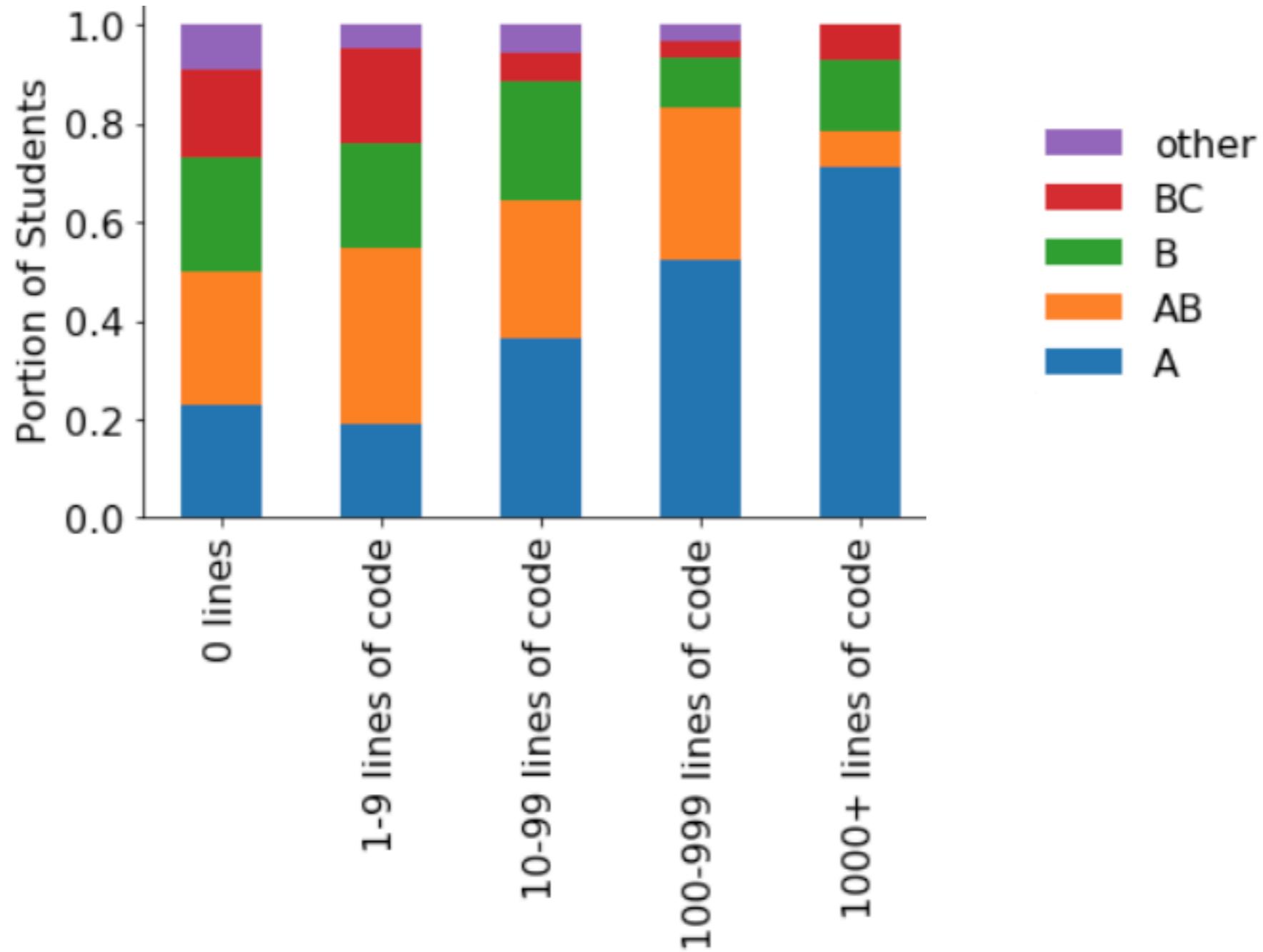
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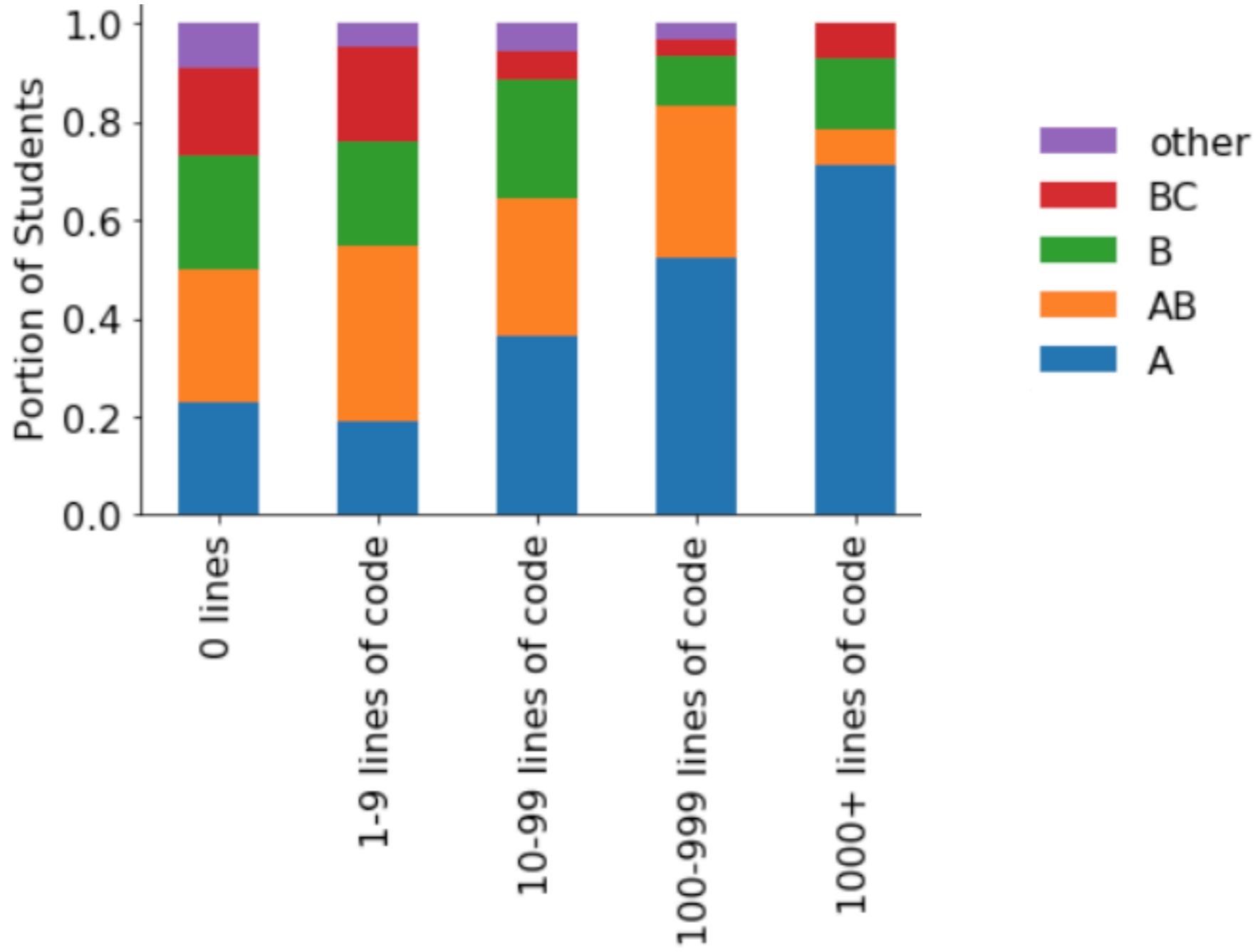
Largest program written prior?

how did students in each group do?

from 548 students



Experience and grades



Some comments on Fall 2018 course evals:

- I am a senior CS student, *this class was very easy for me*
- Make it significantly easier. *None of [us] will ever code again...*
- Good course, I think *there is a good pace for this course*, speaking as someone with zero programming experience coming into the class.

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- Lecture
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- Class communication
- Grades
- Projects
- Exams & quizzes

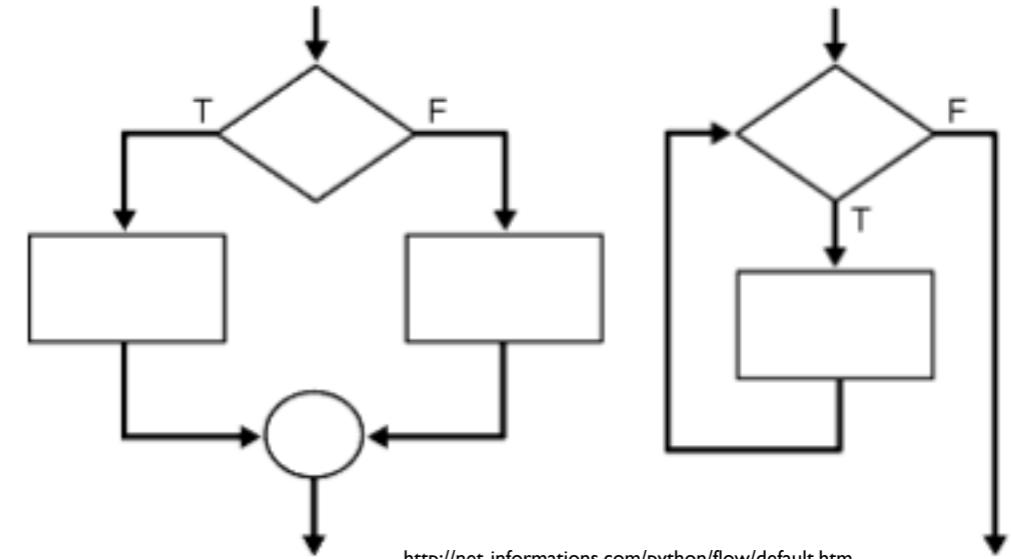
Computer hardware basics

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220 Topics

Part I: Control Flow

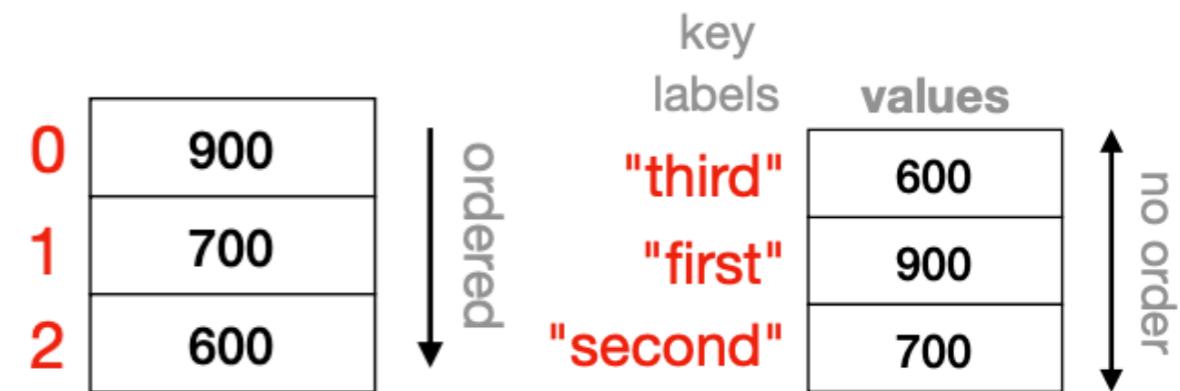
- What step is currently executing?
- How to write functions?
- How to conditionally do something?
- How to repeat steps?



<http://net-informations.com/python/flow/default.htm>

Part 2: State

- How to structure lots of data?
- How to save data in files?



Part 3: Data Science

- Tabular data
- Internet
- Databases
- Plotting



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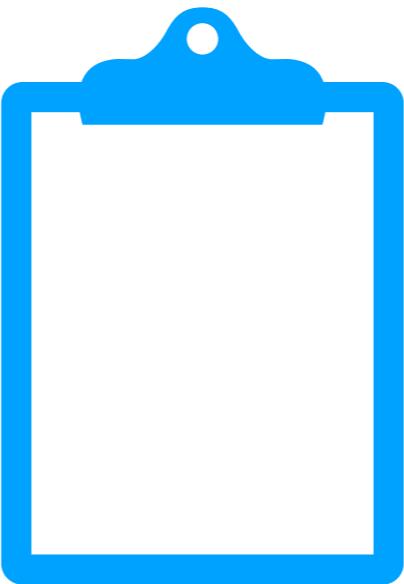
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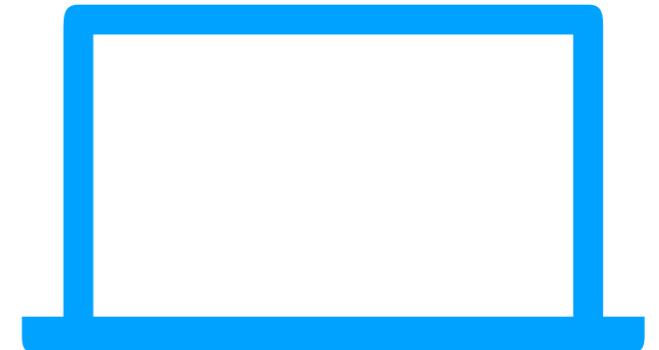
Lecture Style



general concepts



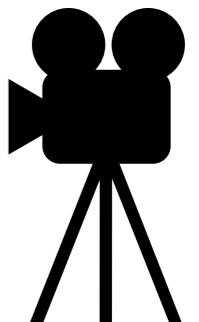
worksheet practice



live coding

Your role

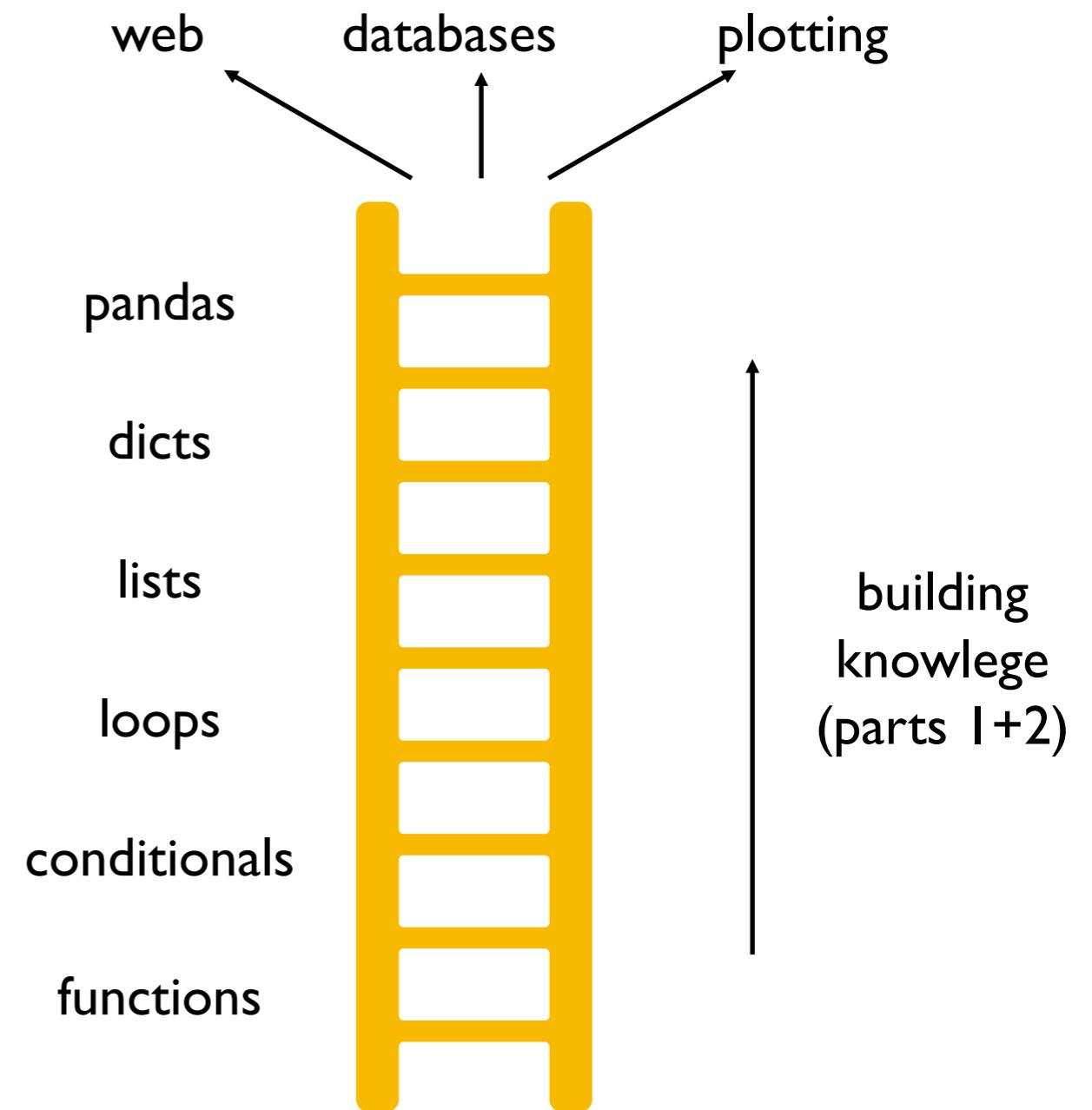
- do **readings** before or after
- I love to get **questions**, ask us during the Q/A sessions



Especially Avoid Holes in Understanding in Parts 1+2 of the course



see Salman Kahn...



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Labs

Format

- 60 minutes on Thu or Fri, leave when you're done
- **self guided**, not graded
- lab document will be posted each week
- **do the lab before starting the project!**
- get help with projects+content too! (just ask a TA/mentor)

People

- best to do lab docs with a partner
- 1-2 TAs will be there to answer questions

we will have labs this first week

(also, get any help needed installing Python during this one)

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- **Readings**
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Computer hardware basics

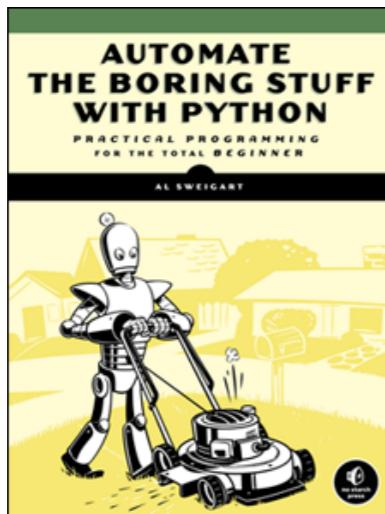
Website

Readings (all free!)



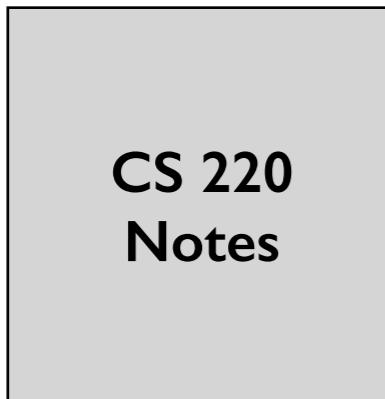
Think Python, 2nd Edition

- Allen B. Downey
- Assumes no programming background
- It's very concise
- Get the 2nd edition, which is for **Python 3!**



Automate the Boring Stuff

- Al Sweigart
- Useful for some more advanced topics related to using data



Course Notes

- 220 instructors
- Mostly for data science part of class

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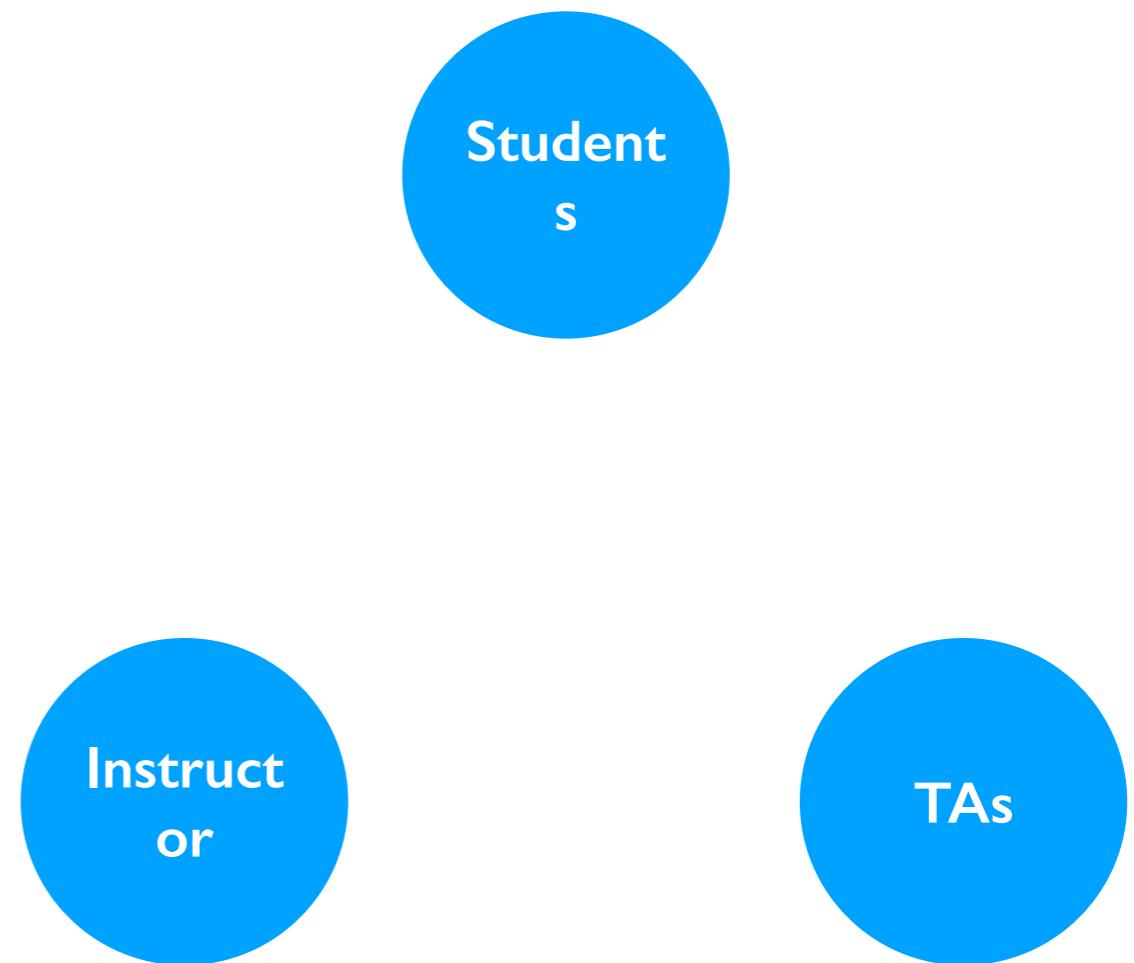
Communication is CS 220

Good communication is critical for a class of this size

- Who needs to communicate: students, TAs (+mentors!), instructors

Communication tools

- Piazza
- Email
- Feedback Forms
- Project Submission
- Canvas



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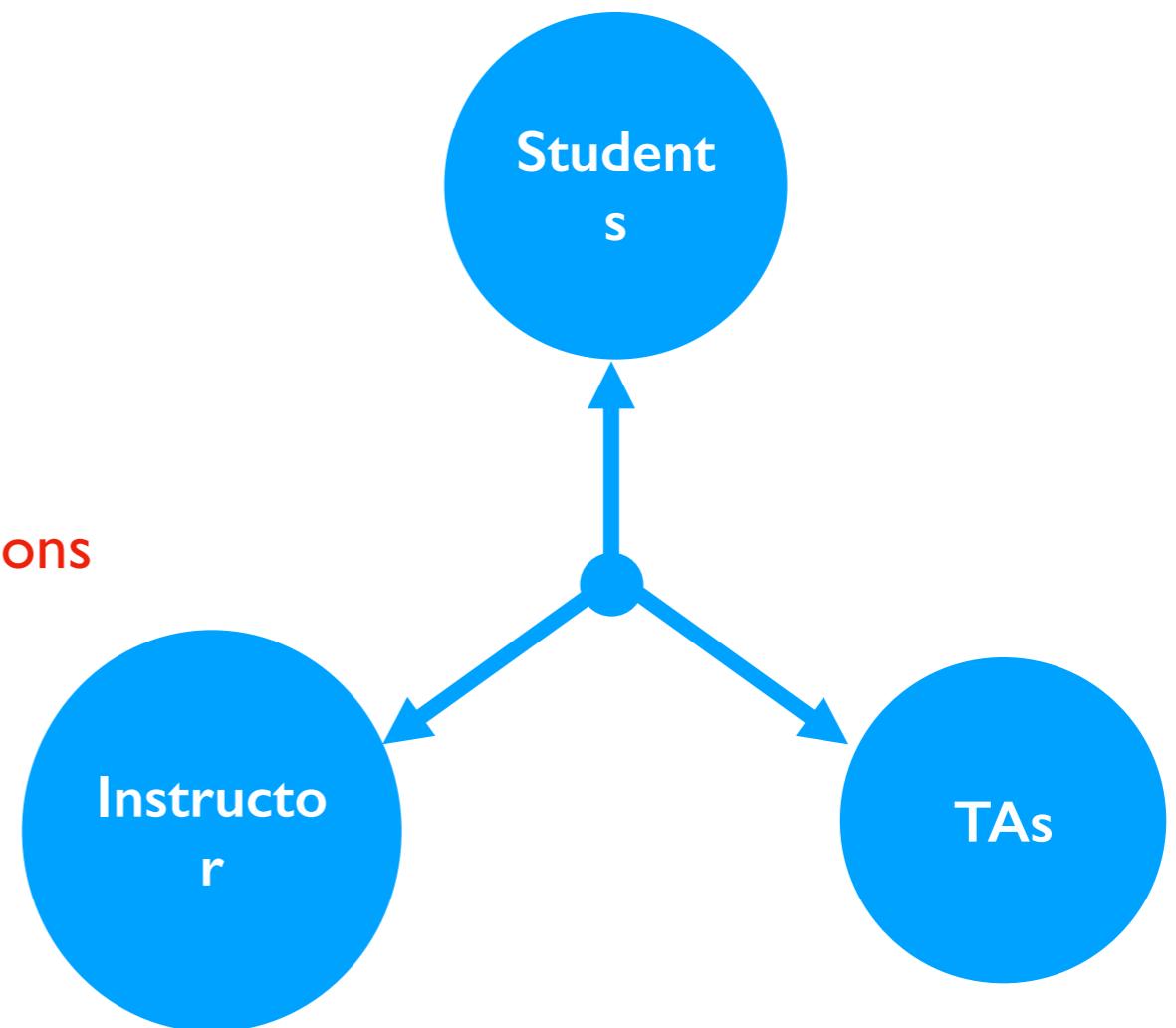
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Rule 1: don't post more than 5 lines of code

Rule 2: check other posts and project corrections
to avoid repeat questions

Note: we'll keep a pinned post of current
office hours here



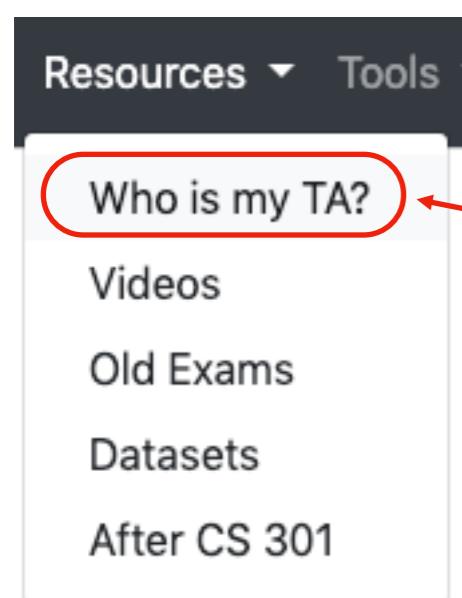
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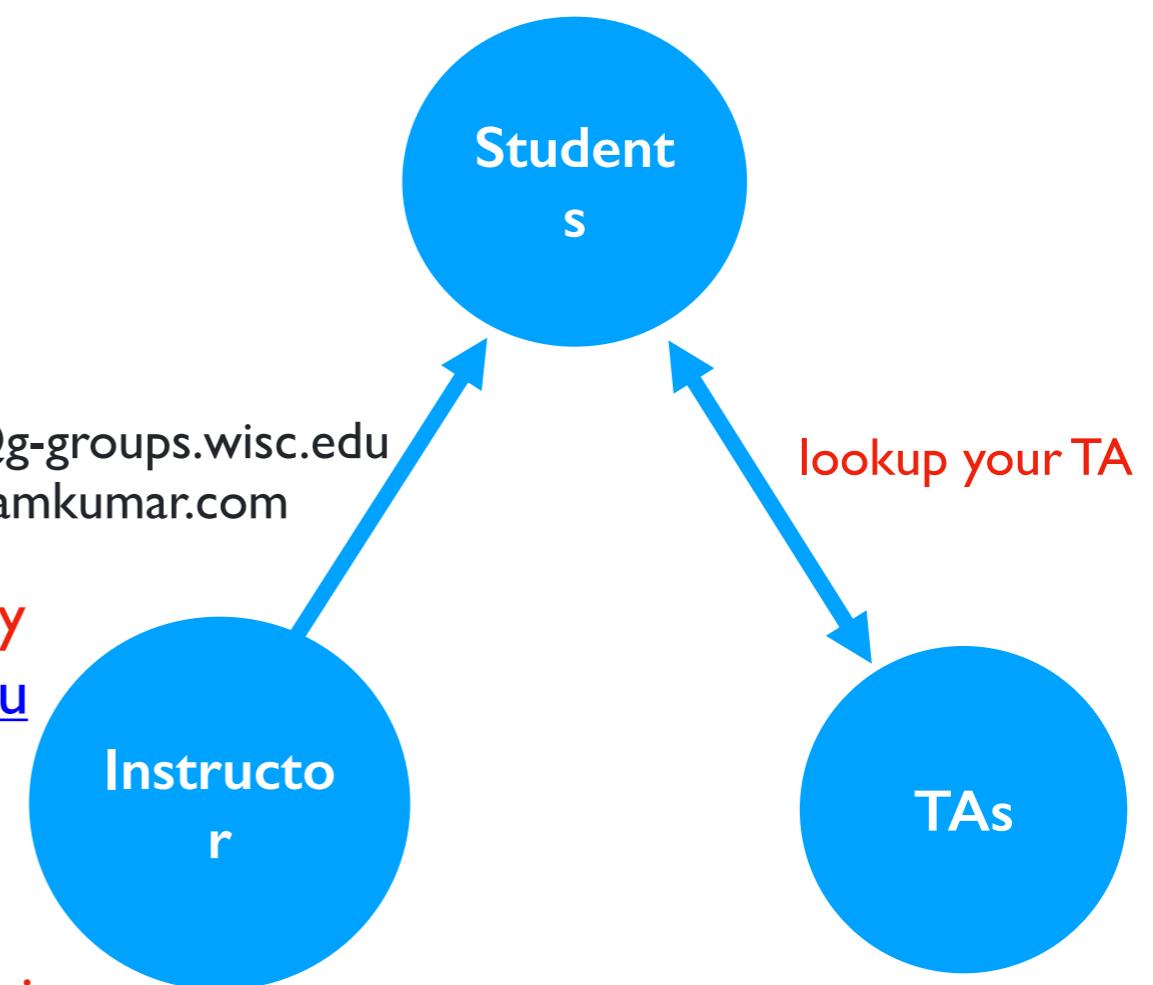


compsci220-<SEC>-f20@g-groups.wisc.edu
no-reply@msyamkumar.com

please email your TA and copy
cs220-fall20-help@cs.wisc.edu

CC me at ms@cs.wisc.edu
mdoescher@wisc.edu

if you don't get a response within
48 hours.



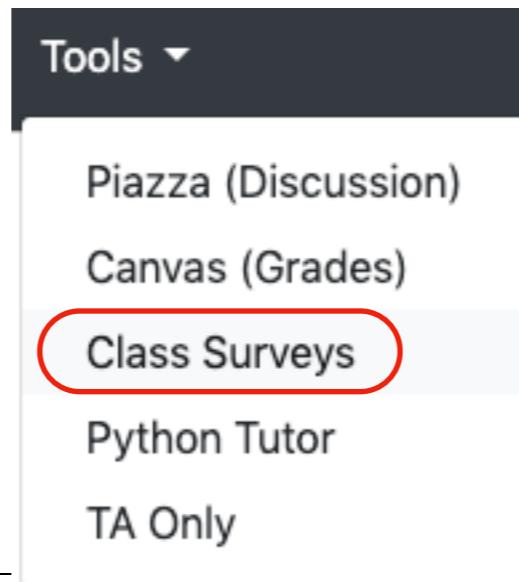
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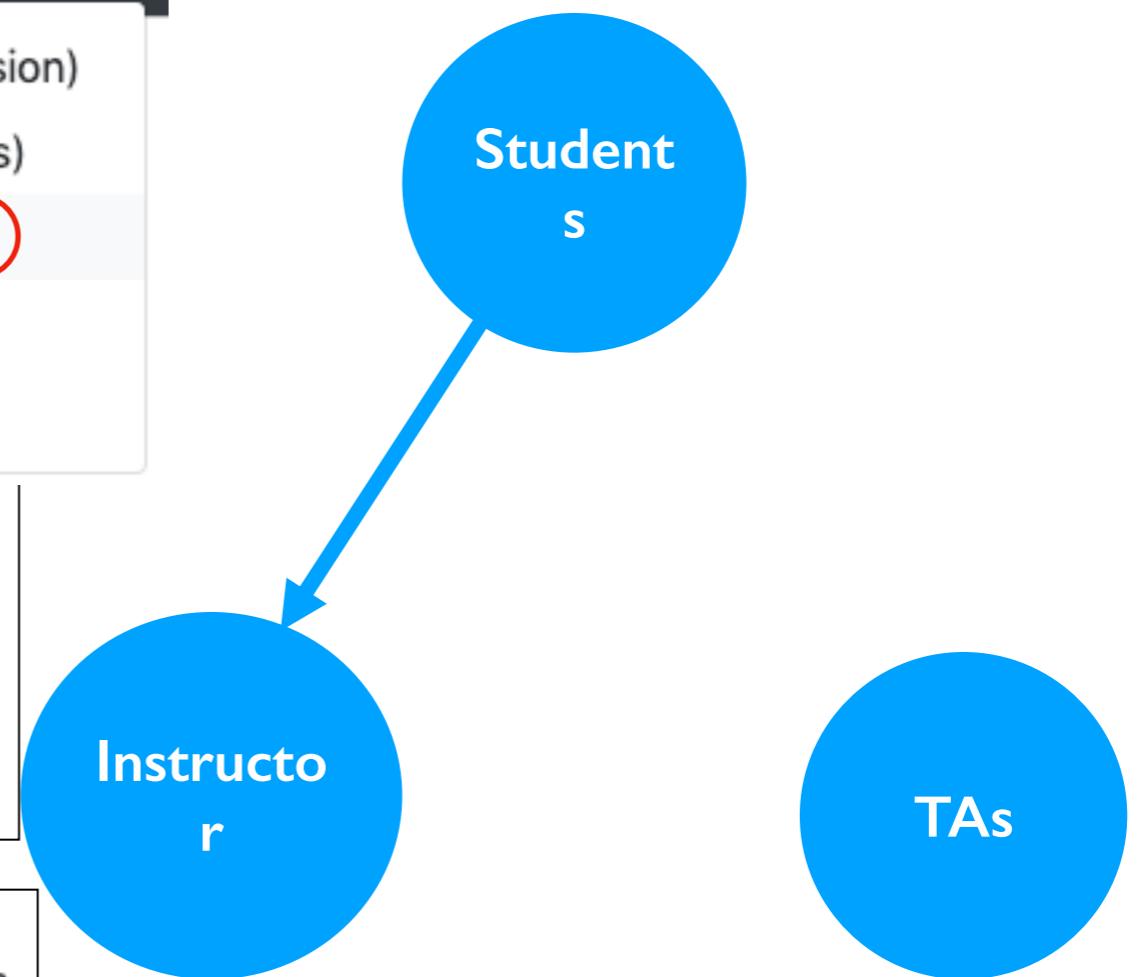
Besides direct email, we'll use five communication tools

- Piazza
- Email
- **Feedback Forms**
- Project Submission
- Canvas



2. Feedback Form. If you have any issues with the class or suggestions for improvement, please let us know sooner rather than later; we may be able to make changes more rapidly than you might imagine. This is optionally anonymous, but it's always nice to know who you are (sometimes it makes sense to have followup conversations).

4. Thank You! Has a TA or mentor provided exceptional help, during office hours, Shelf hours, lab, etc? Thank them by filling out this form, and I'll pass along the feedback.



Communication is CS 220

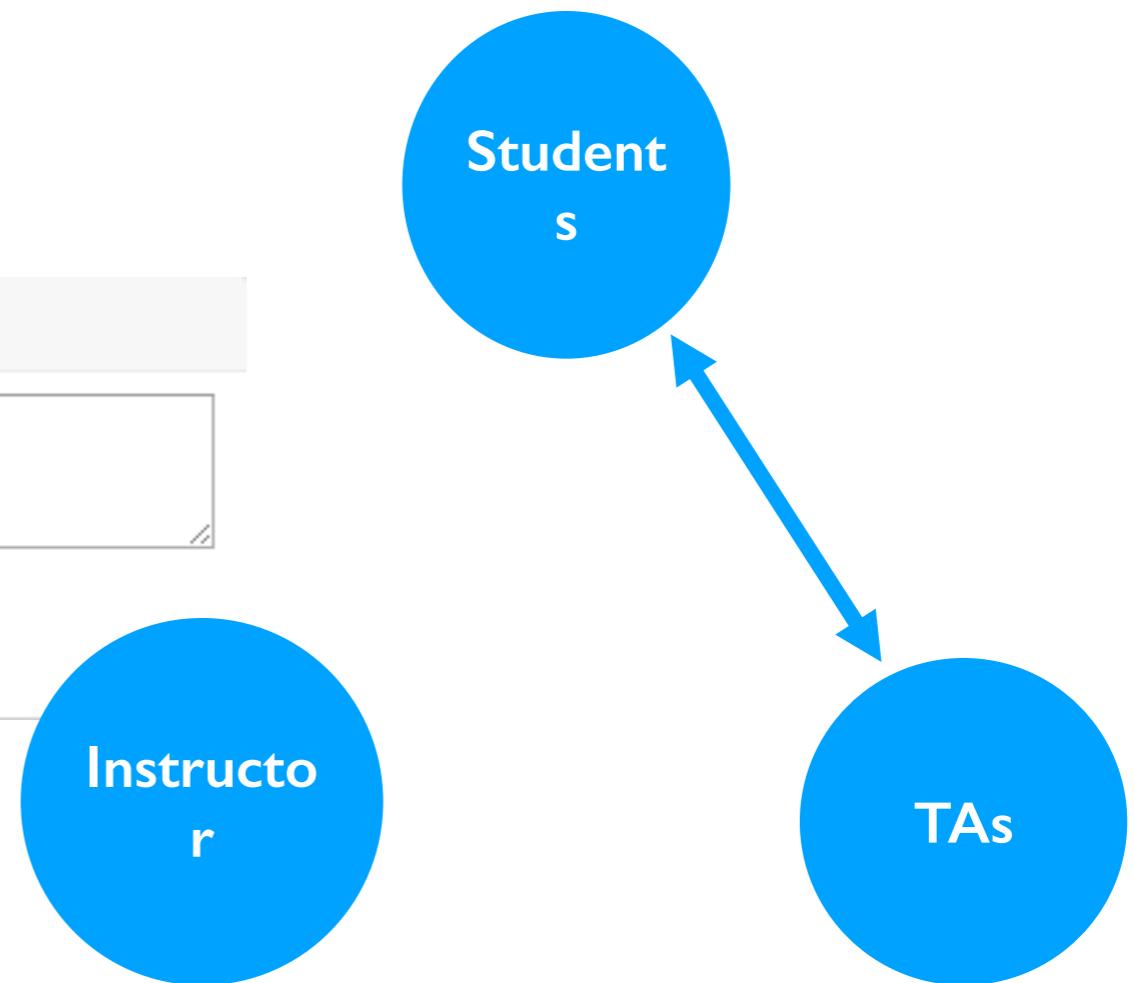
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A screenshot of a web-based project submission interface. At the top, there's a navigation bar with 'Syllabus', 'Projects' (which is highlighted with a red oval), and 'Resources'. Below the navigation, there's a 'Comment' section containing the text 'Good work'. Underneath the comment are three buttons: 'OK', a thumbs-down icon, and a thumbs-up icon. Further down, there's a file upload field labeled 'Choose File' with the placeholder 'No file chosen'. At the bottom, a question asks 'is any specific kind of feedback you're interested in?'.



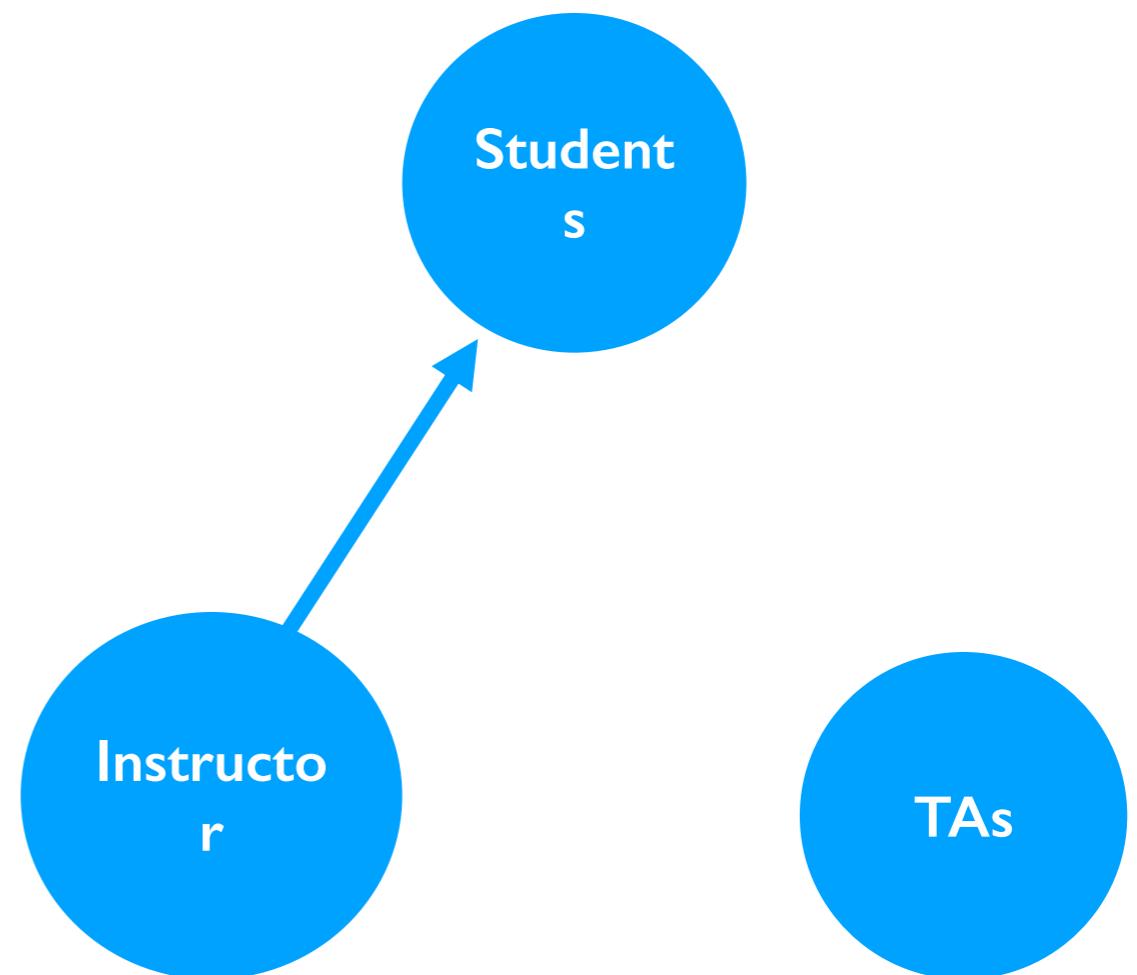
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- **Grades**
- Projects
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Computer hardware basics

Website

Grades

49% - programming projects

- **13 projects**, evenly weighted except for p1
- we'll share grading tests with you - **avoid surprise**
- learning to program is the most import part of the course

20% - quizzes

- 12 quizzes (drop 2 lowest scores)

30% - exams

- 10% midterm 1 (24 hour window)
- 10% midterm 2 (24 hour window)
- 10% final (24 hour window)
- details coming soon

1% - extra credit

- Boost your borderline grade

1% - participation

- filling surveys, following directions, other

The Final Curve

The curve will be set at the end of the semester, based on sum of all points earned.

I try to keep the grade distribution similar across semesters:
<https://registrar.wisc.edu/grade-reports/>

I'll tweak to minimize students on the margin.

Guarantees:

- at least 95% guarantees an A
- at least 85% guarantees a B (or better)
- at least 70% guarantees a C (or better)
- at least 60% guarantees a D (or better)

Grades

49% - programming projects

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- learning to program is the most import part of the course

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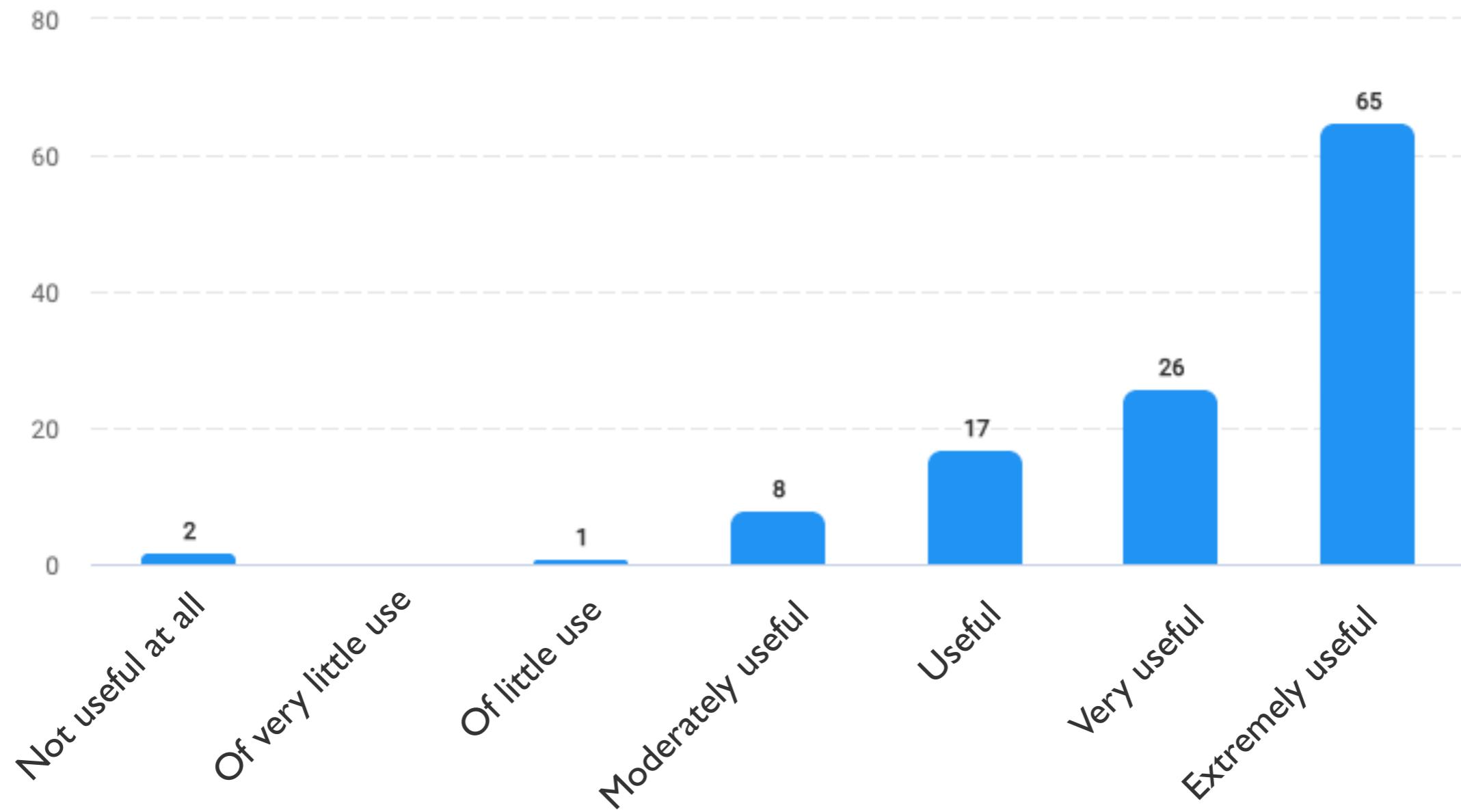
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Prior student reaction to projects

Projects: How useful were projects to your learning?



Project Overview

Nearly all projects will relate to some dataset

Timeline

- Projects will be due most weeks, on **Wed, at midnight**
- You get 7 late days, use them wisely!
- Contact us about any issues

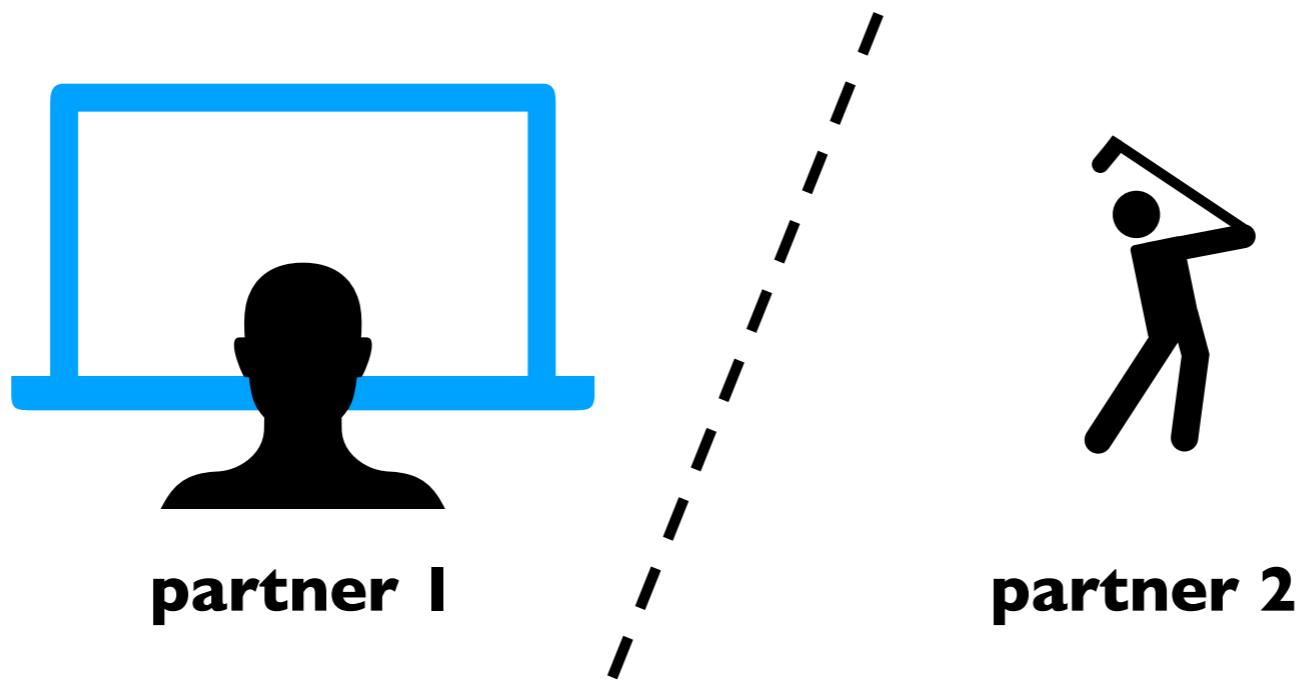
Getting help

- Piazza
- Lecture Q/A sessions
- Lab sessions
- Instructor or TA office hours
- Email (least preferred)

Pair Programming

You can optionally work in pairs of two

- Partnerships across sections allowed
- Switch partners between projects (or keep with same partner)

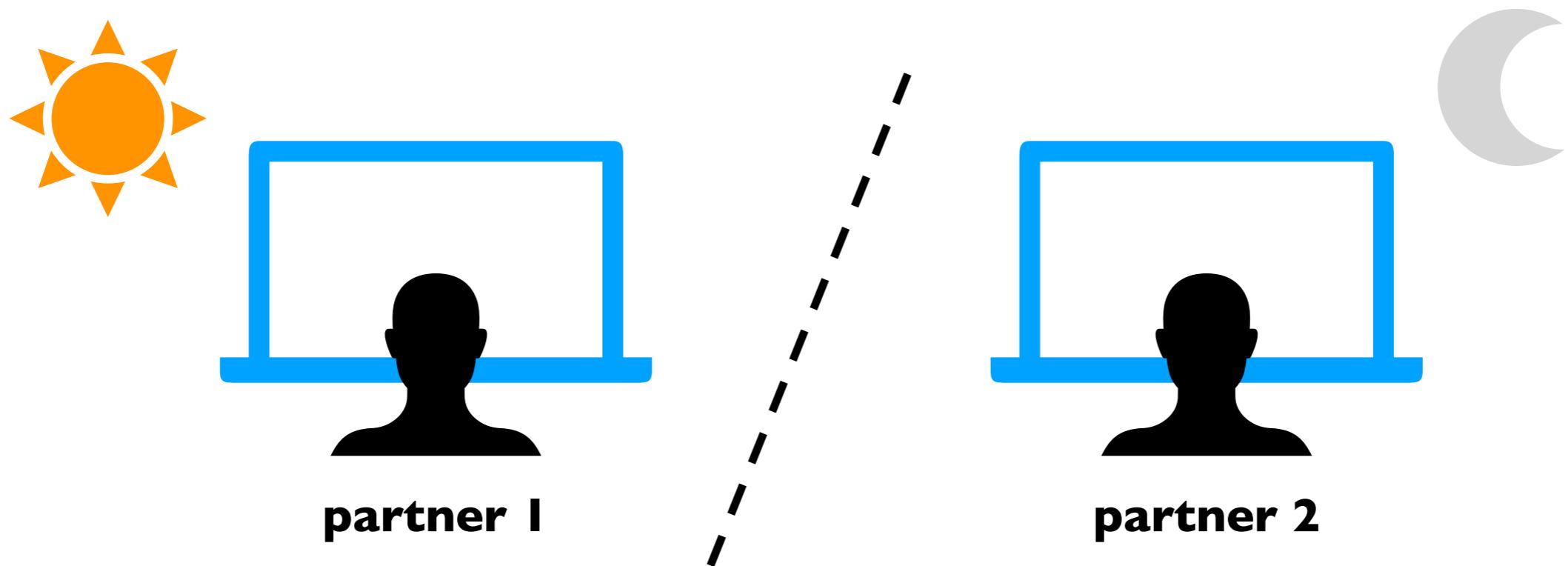


bad: partners don't share work

Pair Programming

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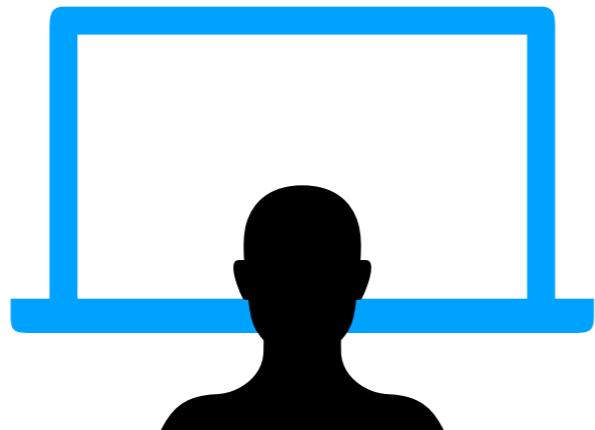


bad: working on different parts at different times

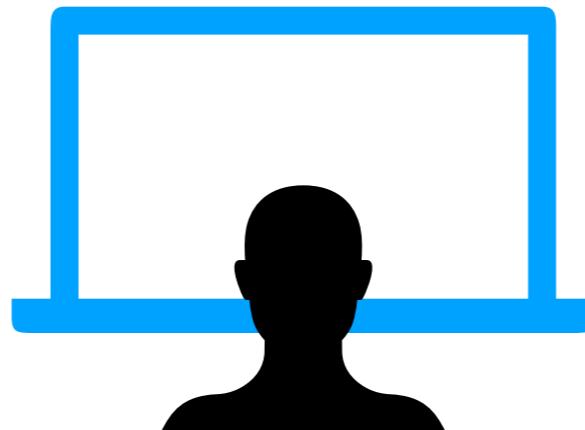
Pair Programming

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partner 1



partner 2

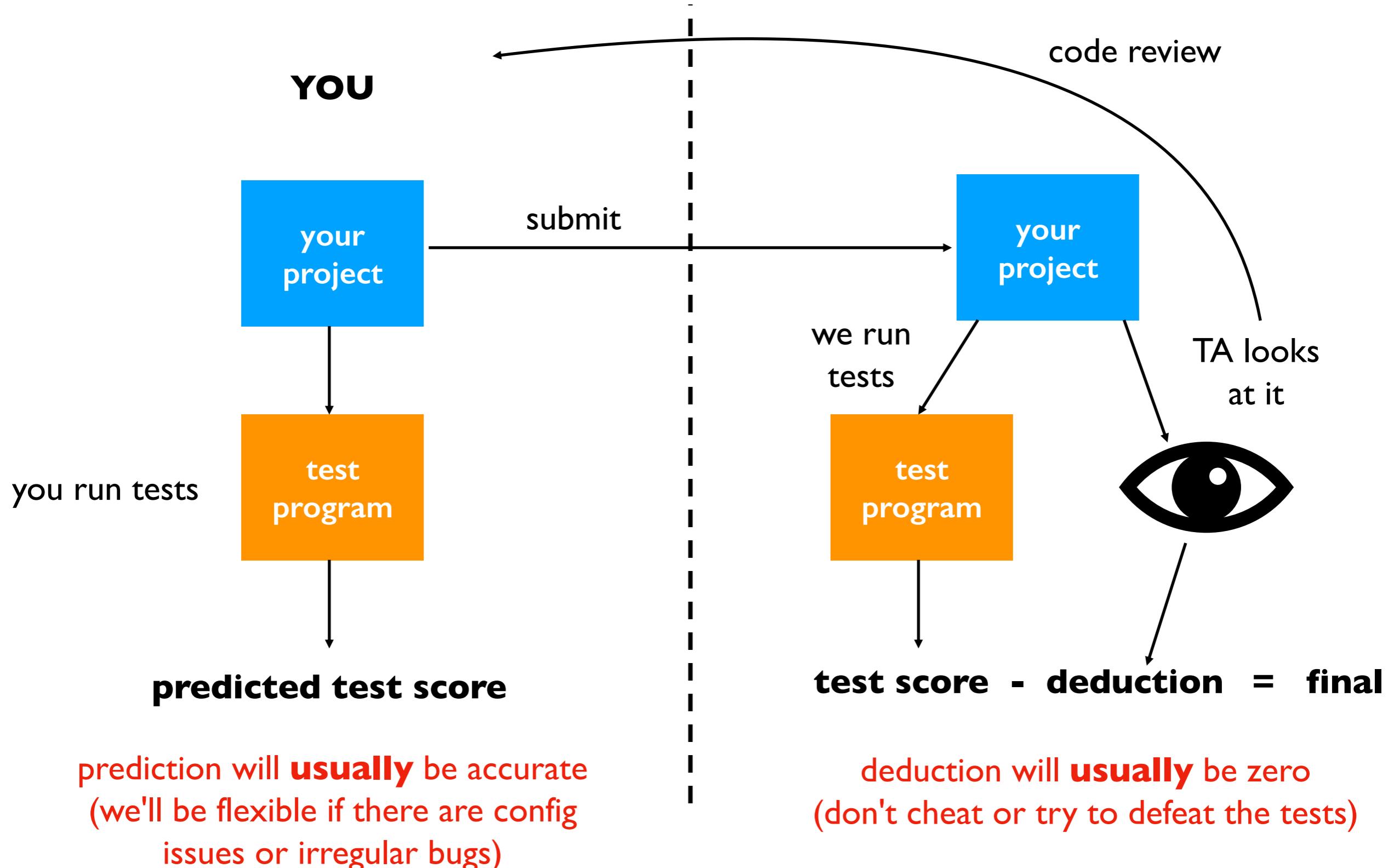
best: working alongside each other

Suggestions

- Use BBC / Google Meet or some other platform for collaboration

Project Grading

feedback is mostly about how to do things better or more simply (valuable even if you score 100%)



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Quizzes and Exams

Quizzes

- Weekly
- Keeps track of your progress in this course

There will be two midterms and one final

- Multiple choice
- Details coming soon

projects ≈ **writing code**

Exams & quizzes ≈ **reading code**

Today's Topics

Introductions

Course overview

Computer hardware basics

- Input/Output
- CPU
- Memory
- Storage
- Networking

Website

Today's Topics

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Computer hardware basics

- Input/Output
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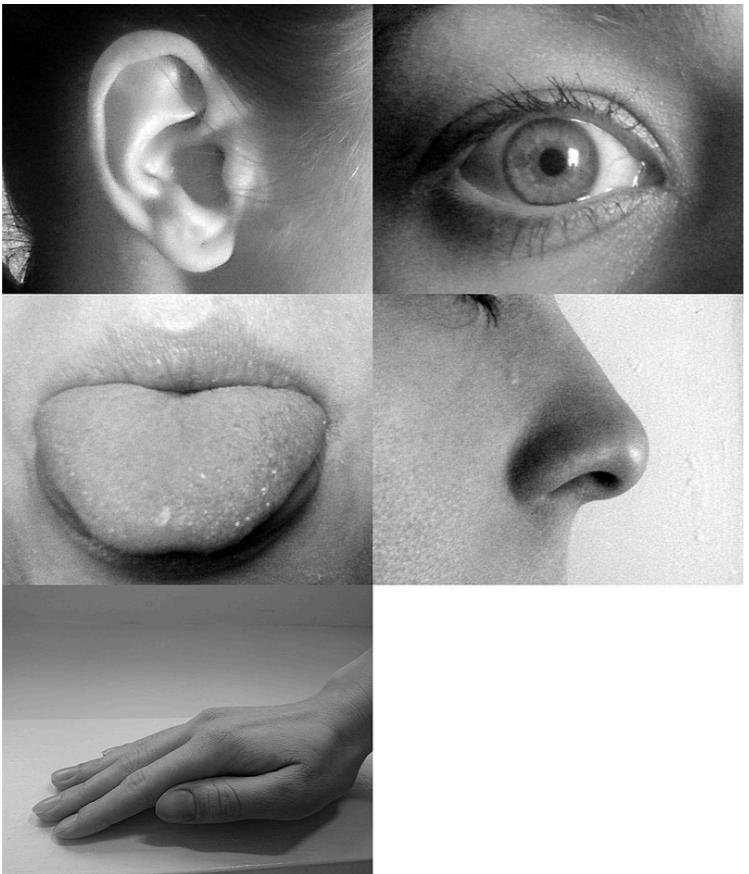
Website

Input/Output

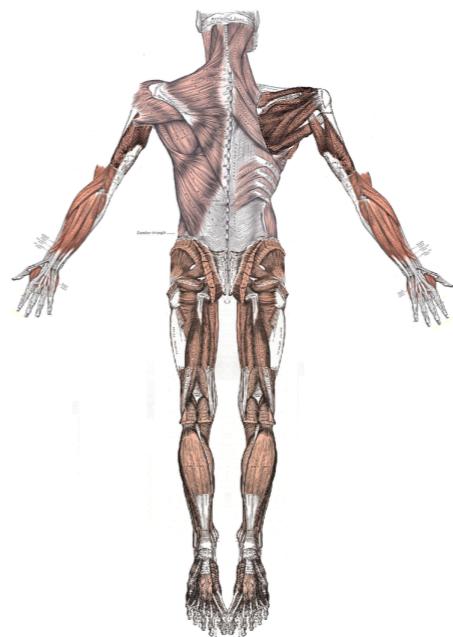
I/O (stands for input/output)

- What are examples for human?

input: senses



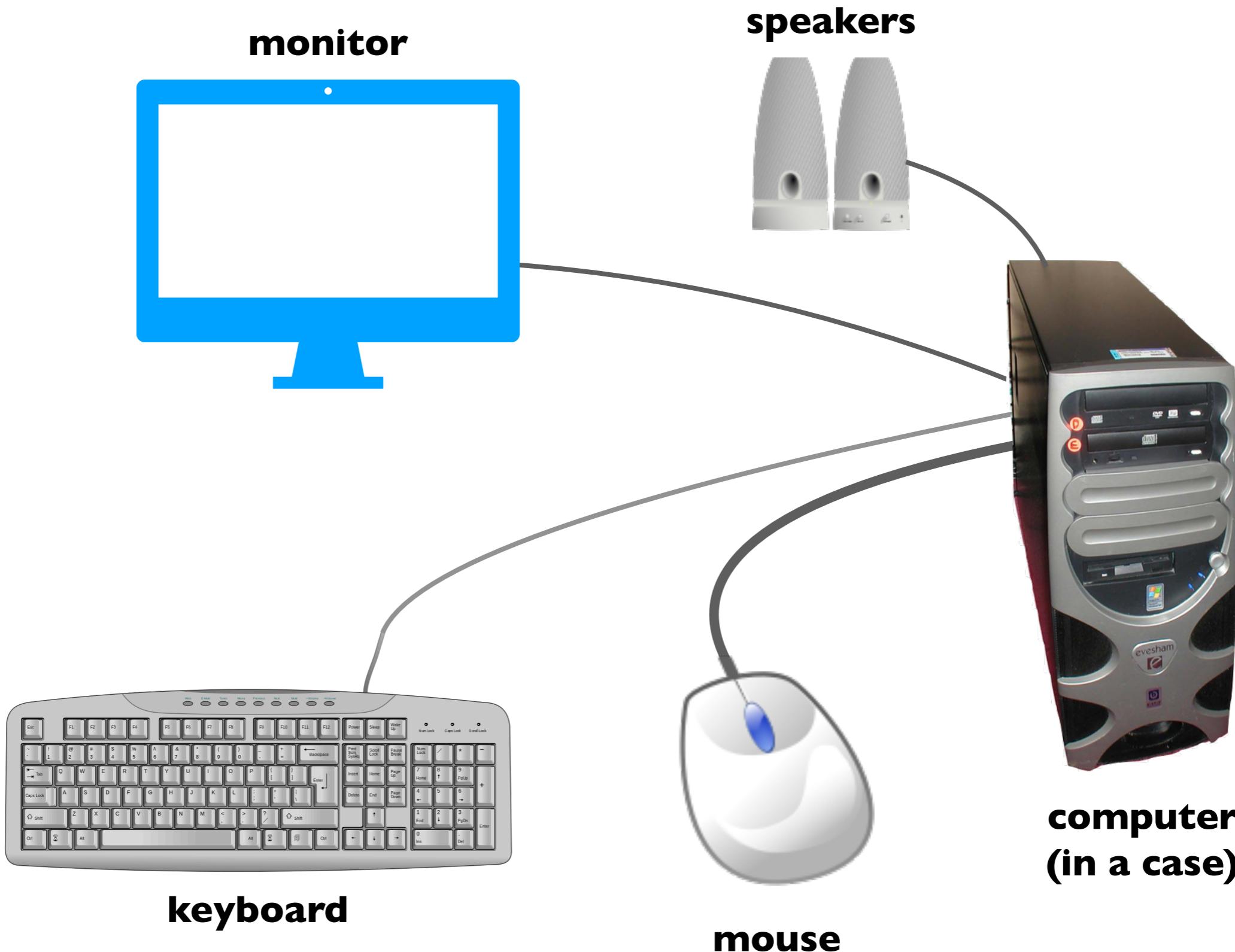
output: muscles, voice



<https://jasperproject.github.io/>

Computer Input/Output

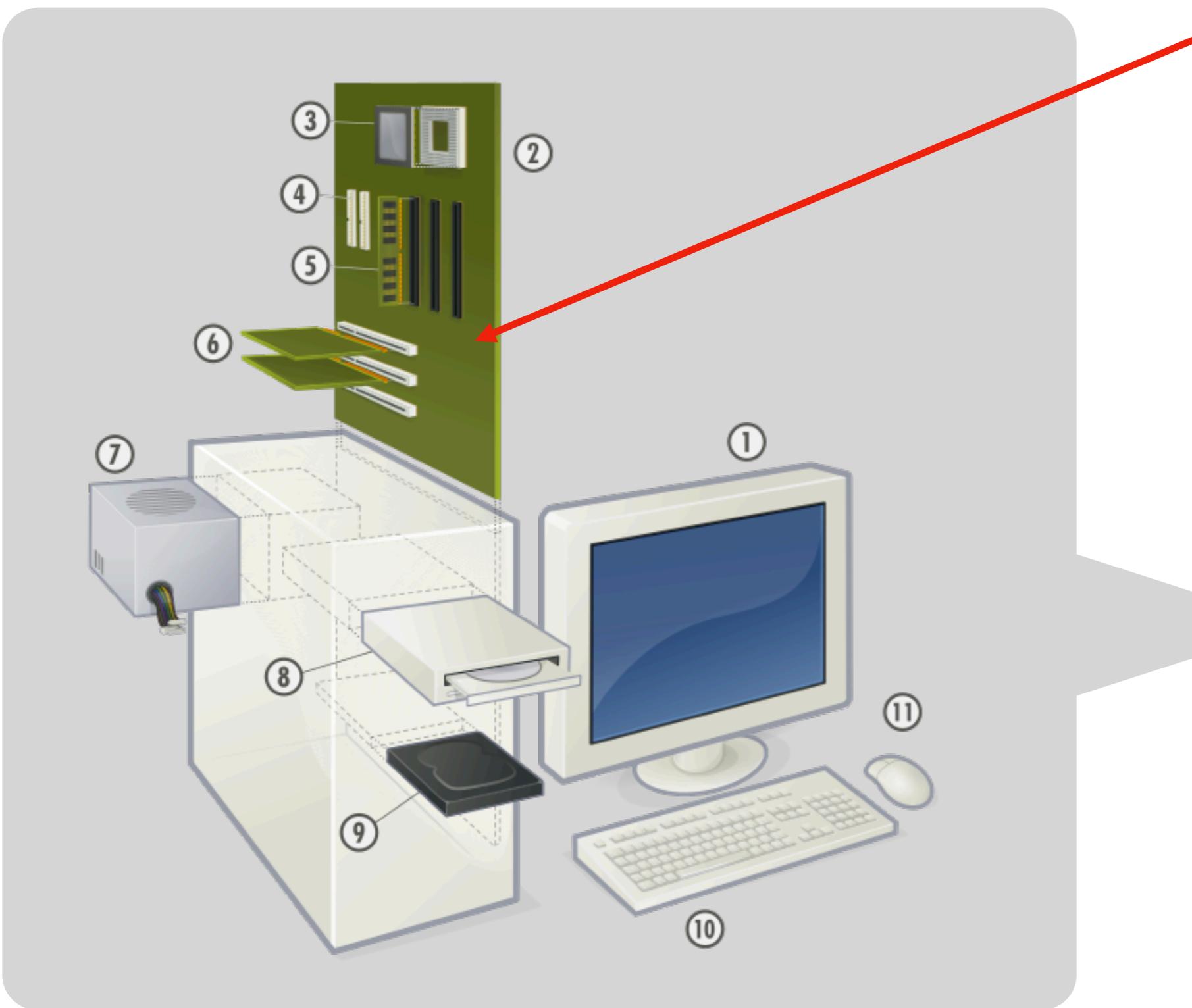
I/O devices attach via “ports” (e.g. USB) in back of computer



Computer Input/Output



Computer Internals



Motherboard: main circuit board to which other components connect, via sockets/slots



Today's Topics

Introductions

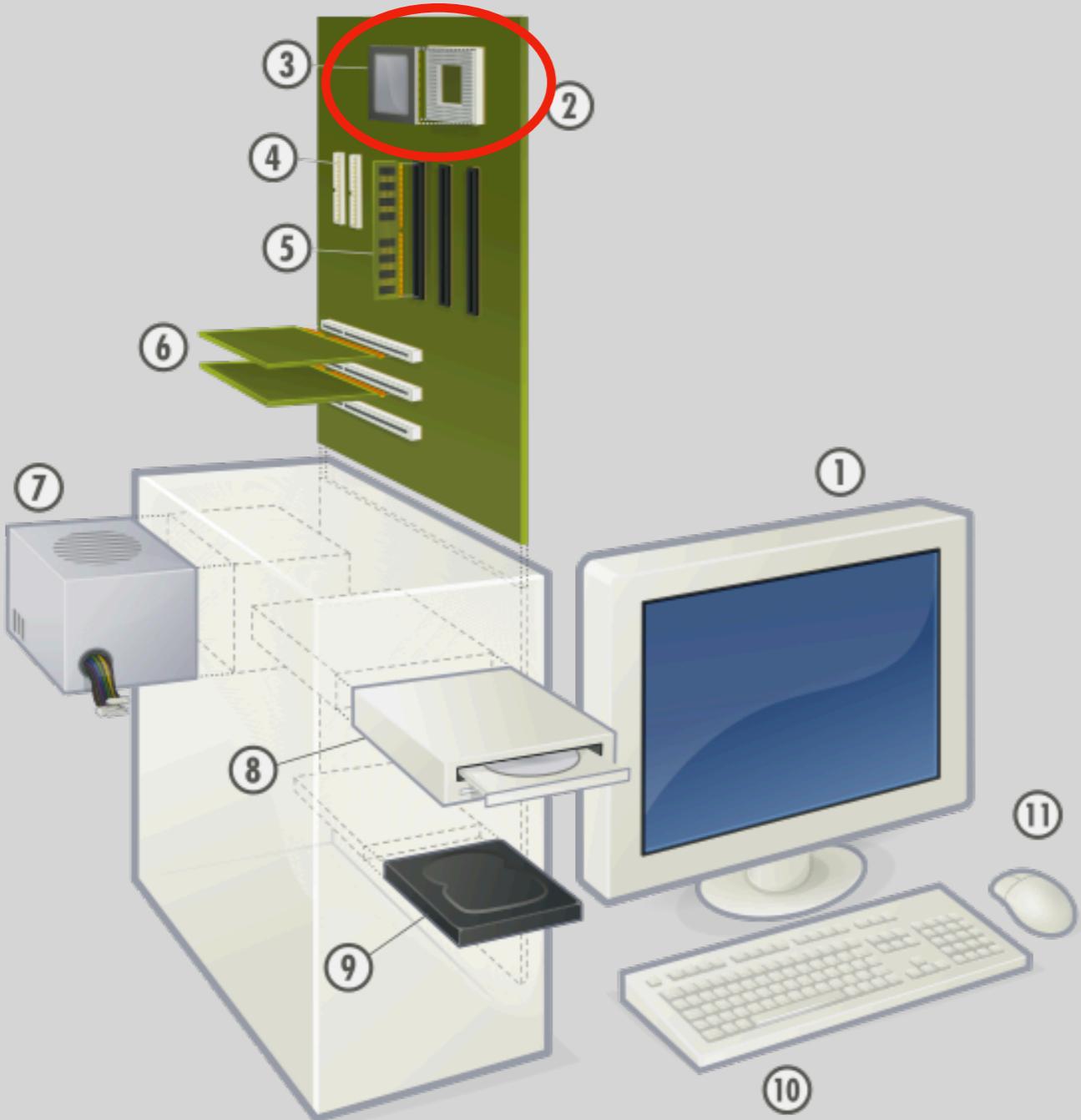
Course overview

Computer hardware basics

- Input/Output
- CPU
- Memory
- Storage
- Networking

Website

Central Processing Unit (CPU)



CPU

Responsible for computation

- Runs code
- Performs addition, other math
- Compares numbers, text
- Receives input, sends output
- Some compare it to a “brain”



Runs on a clock

- Typically a couple GHz (i.e., billions of ticks per second)
- High-speed makes CPUs hot, require fans/cooling

Computers often have multiple CPUs

- Motherboard may have multiple sockets
- Single chip may contain multiple CPUs
- Allows computers to do more things simultaneously

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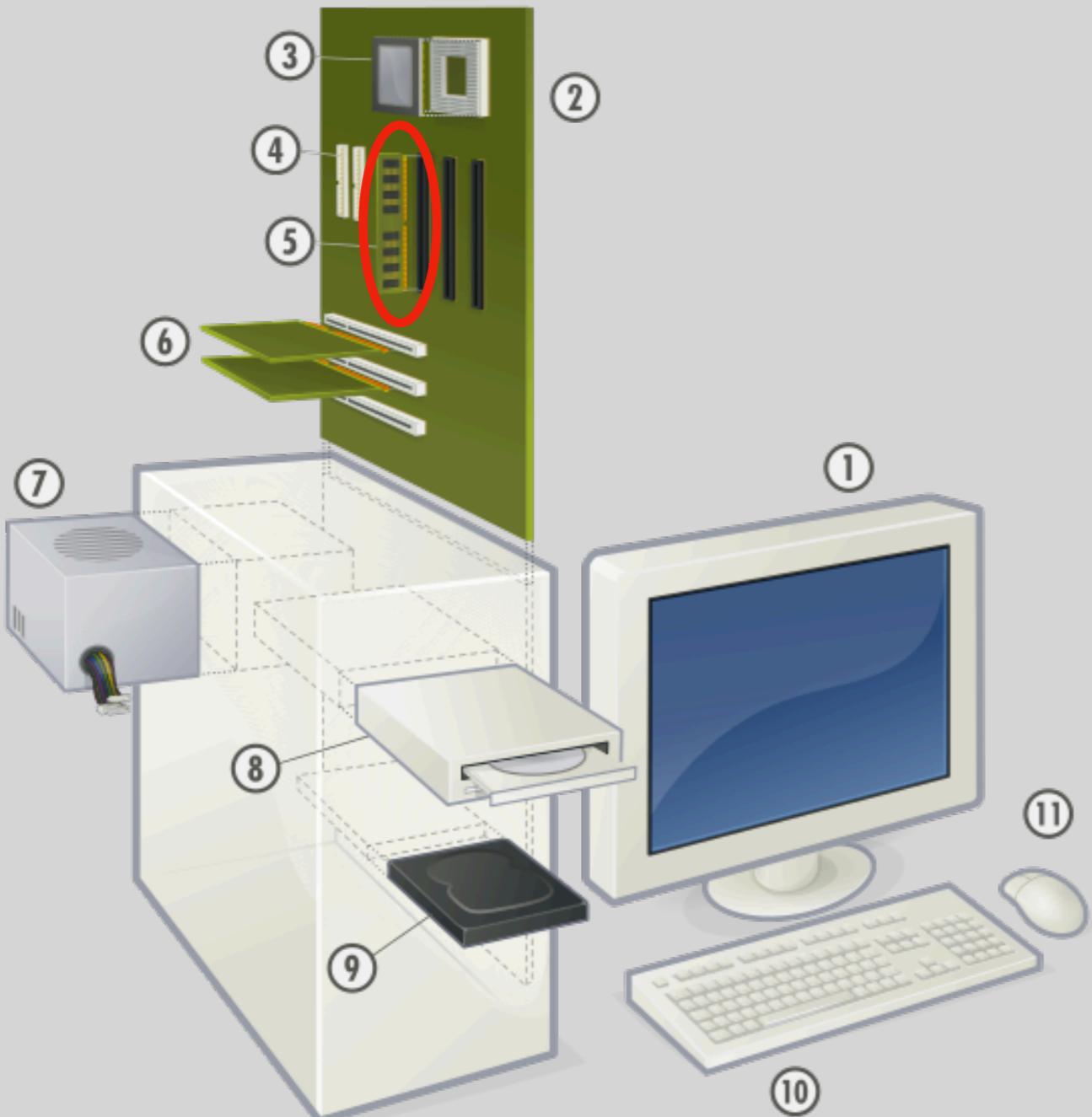
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Random Access Memory (RAM)



Memory

Memory stores data for short term

- RAM is most common form today (don't worry about specifics)
- CPU sends data to/from memory
- Accessing it is very fast
- It is “volatile” — meaning you lose this data when you power off your computer
- You don't save “files” in memory, otherwise they would be gone!

Stores bytes of data

- One byte ≈ **one letter**
- The text “hello” requires 5 bytes
- Typical personal computer has few to tens of gigabytes (billion bytes) of memory



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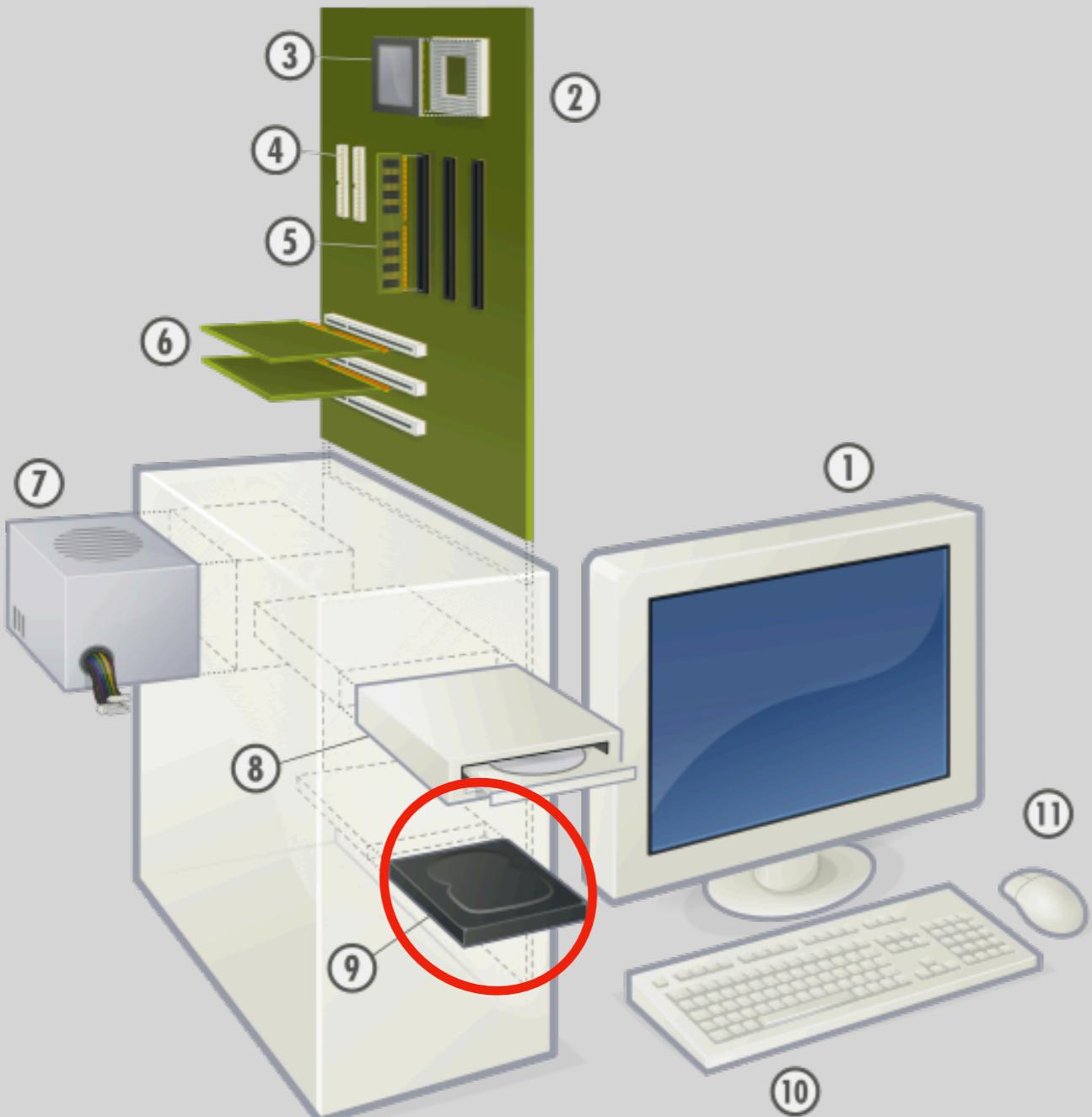
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Storage Drives



Storage Drives

Two common devices

- HDD (hard disk drive), has moving parts, cheap, slow
- SSD (solid state drive), no moving parts, expensive, fast
- Both much slower than RAM...

Storage devices used to save data after power down

- **Persistant** medium, in contrast to **volatile** RAM
- Typical capacity: hundreds of gigabytes

When you make a directory/folder or **save a file**, that data is ultimately getting recorded to your storage device

- Sometimes computers **save to RAM first, and only to the device later; power down cleanly to avoid losing your data!!!**

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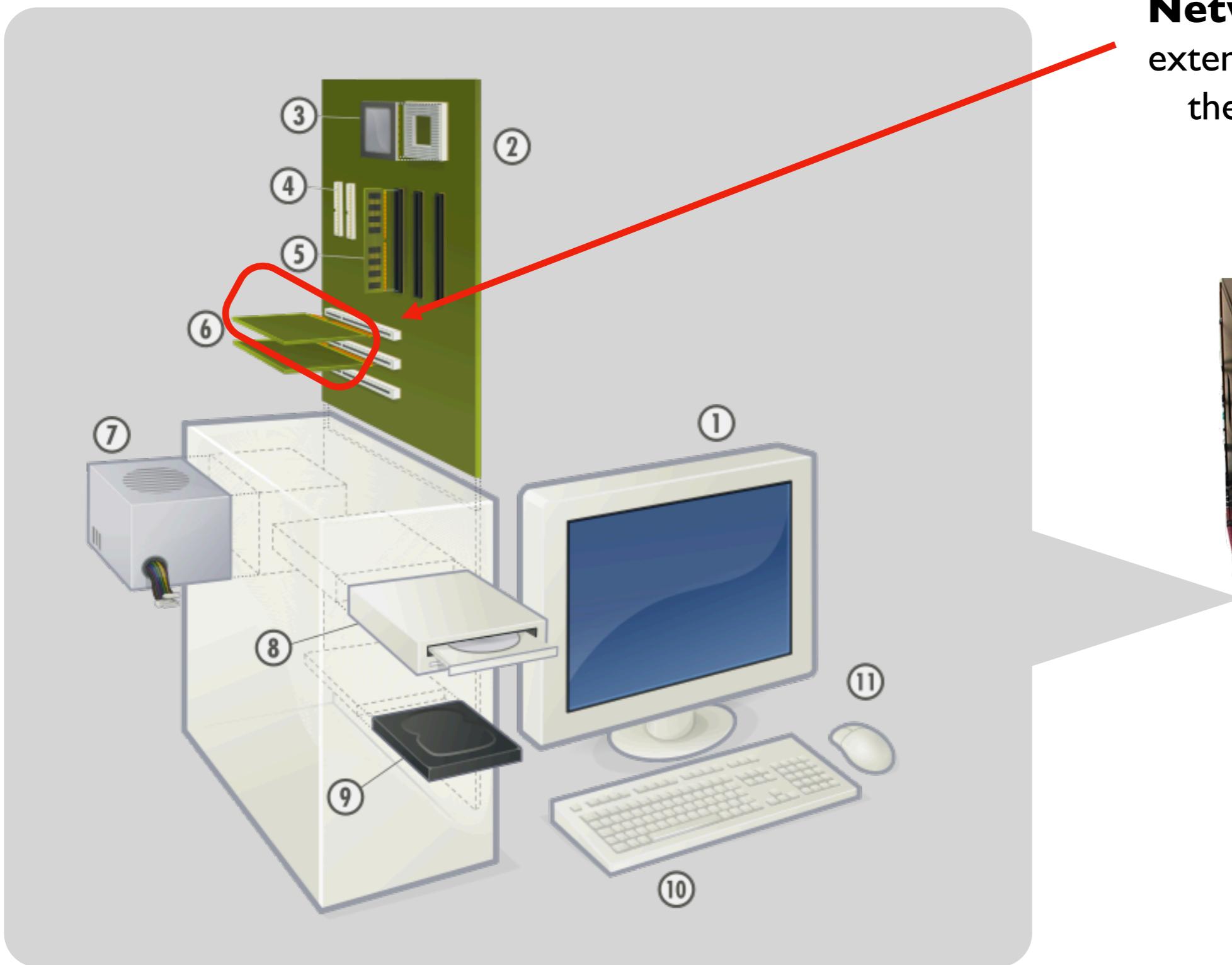
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Network Interfaces



Network: often based on extension card or built into the motherboard itself



Networking

NIC (Network Interface Controller)

- Provides computer communication to other computers, and the Internet



Wired vs. Wireless

- Wired ethernet is common for cable-based connection
- Wi-Fi is common for radio-based wireless connection



Terminology

- **Server**: program/computer that runs, waiting for incoming requests, to which it responds
- **Client**: program/computer that sends requests to a server

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Course Website

Shared website (sections 1+2+3):

<https://www.msyamkumar.com/cs220/f20/schedule.html>

Walk through...

Next steps...

- take the "Who are You?" survey:
<https://www.msyamkumar.com/cs220/f20/surveys.html>
- read syllabus carefully:
<https://www.msyamkumar.com/cs220/f20/syllabus.html>
- setup Python on your computer (with videos) and do Lab-PI:
<https://github.com/msyamkumar/cs220-f20-projects/tree/master/lab-pi>
- start PI (Project I), due next Wed:
<https://github.com/msyamkumar/cs220-f20-projects/tree/master/pi>