

CS 220 / CS319

Introduction

Meena Syamkumar
Andy Kuemmel

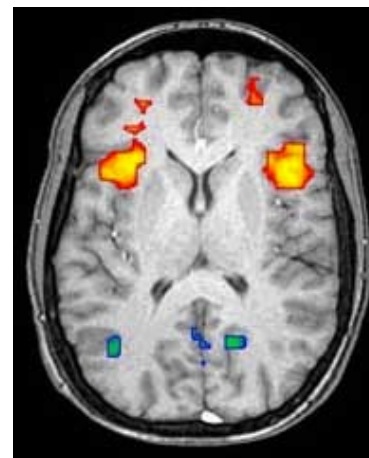
Welcome to Data Science Programming I!

Data is exploding in many fields

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



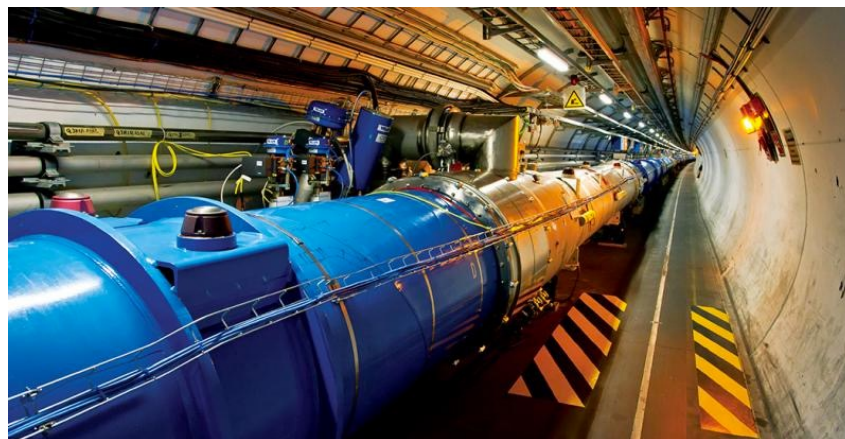
<https://fivethirtyeight.com/features/the-midwest-is-getting-drenched-and-its-causing-big-problems/>



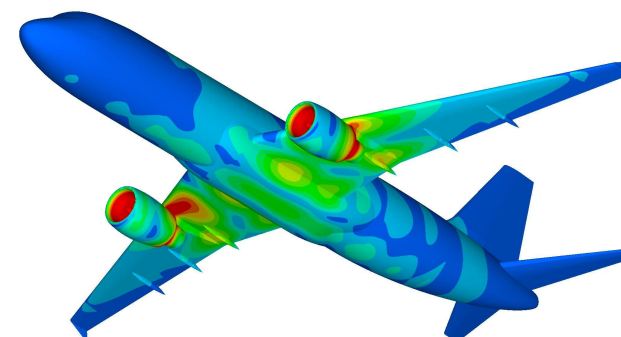
<https://en.wikipedia.org/wiki/Neuroimaging>



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



<https://home.cern/topics/large-hadron-collider>



<http://www.stressebook.com/finite-element-analysis-in-a-nut-shell/>

Welcome to Data Science 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 Science 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!**”*

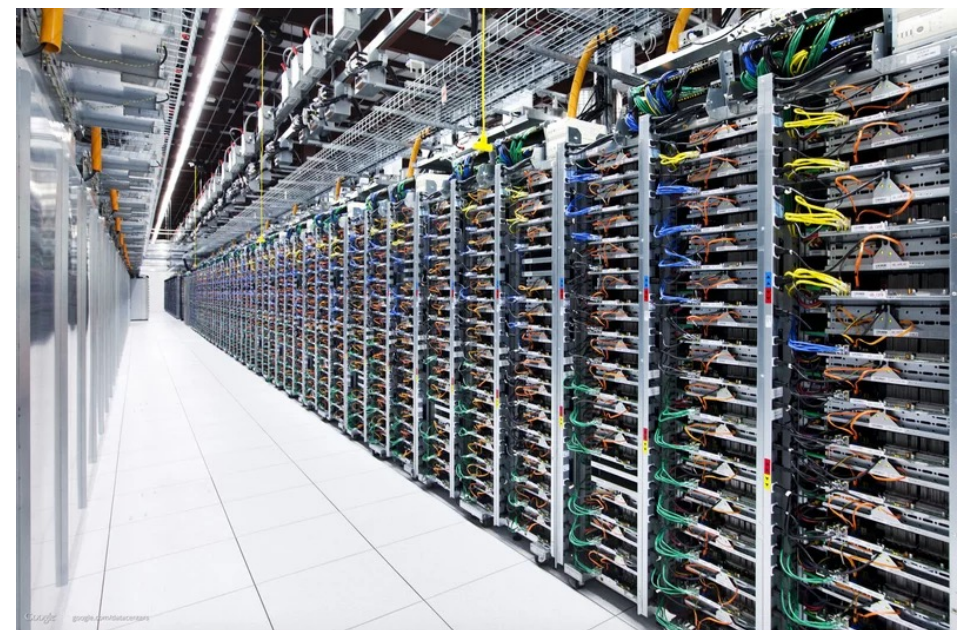
~ Larry Page

Approach 1: human computation



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Welcome to Data Science 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**

Approach 1: human computation



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

Approach 2: machine computation



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Welcome to Data Science Programming I!

CS 220 is about approach 2

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

Data Science:

- Combines inquiry, statistics, programming, and communication skills to provide actionable insights from data sets

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

Why CS 220?

50 Best Jobs in America for 2021

	Job Title	Median Base Salary	Job Satisfaction	Job Openings
#1	Java Developer	\$90,830	4.2/5	10,103
#2	Data Scientist	\$113,736	4.1/5	5,971
#3	Product Manager	\$121,107	3.9/5	14,515

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

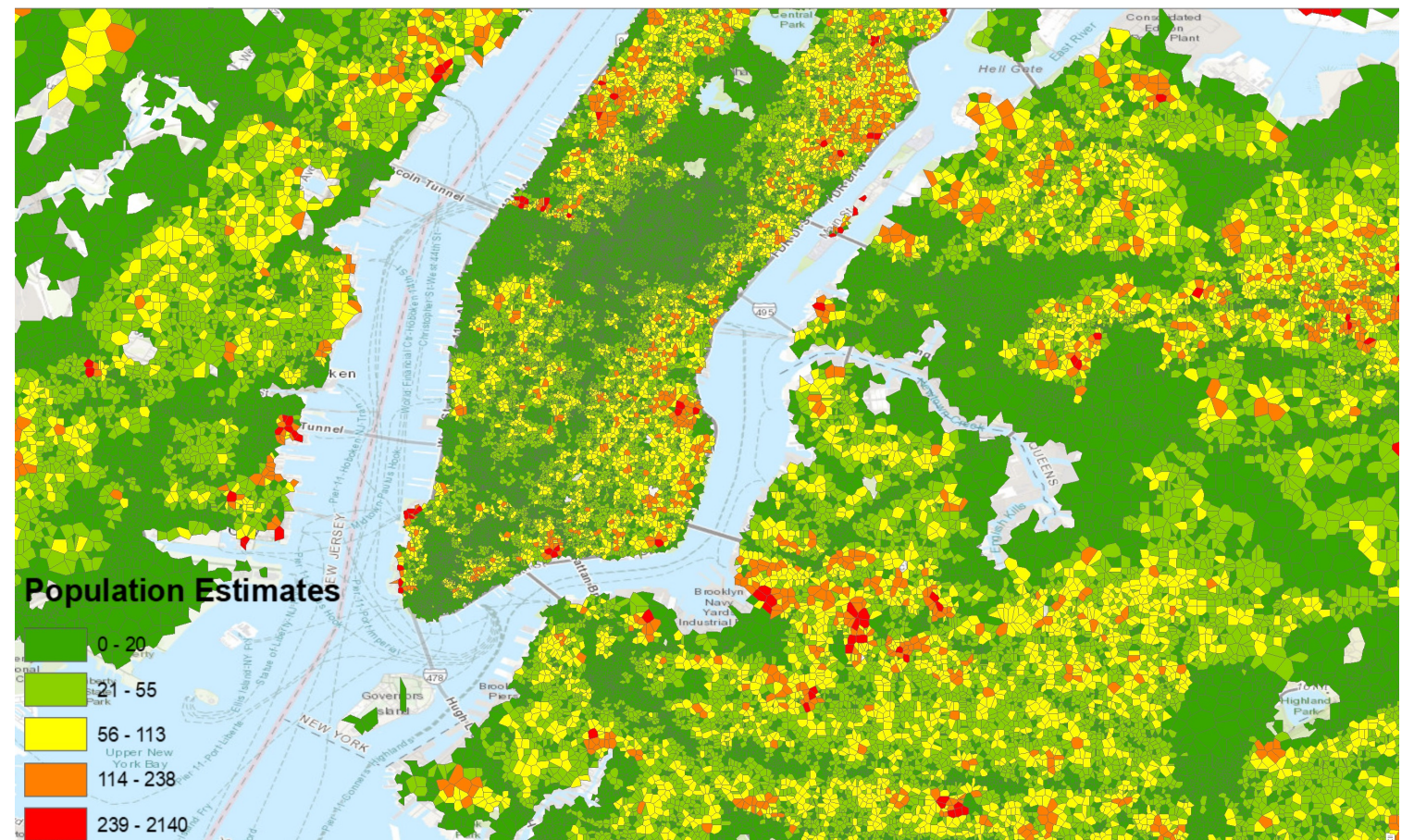
- Citrix, Cisco, and Microsoft
- CS300, CS220, CS367, guest lectures in CS640, CS740



Passion: Running



Research: Internet measurements + CS Education



Who am I?

Andy Kuemmel

- Email: kuemmel@wisc.edu
- Please call me “Andy”

Work Experience

- College Board – AP Exam Committee
- AP Computer Science teacher
- Microsoft curriculum writer
- UW Madison Faculty Associate

Interests

Men’s Barbershop Chorus



Running

Thanksgiving Day 10k • 5k run/walk

2021 **BERBEE DERBY**

Powering TECHNOLOGY EDUCATION FOUNDATION

Crazylegs
CLASSIC

**BRAT
FEST
BUN RUN**



Who am I?

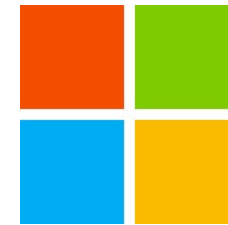
Tyler Caraza-Harter

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



Industry experience

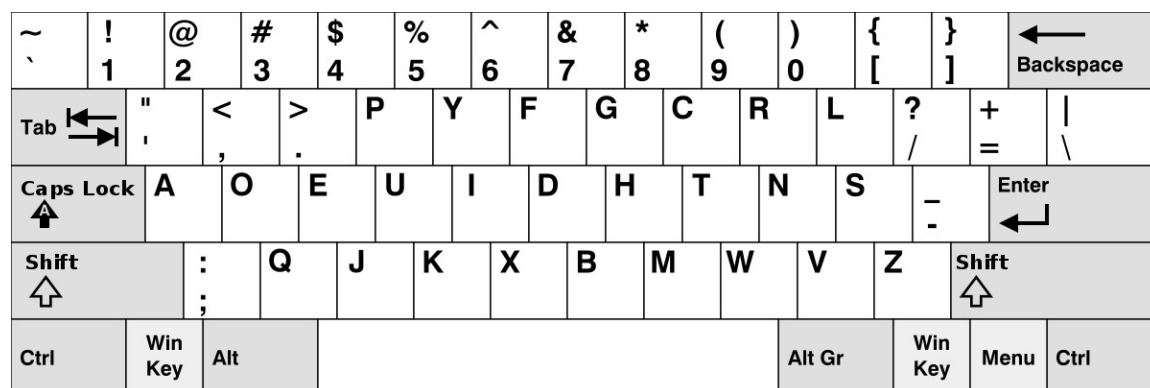
- Worked at Microsoft on SQL Server and Cloud
- Other internships/collaborations: Qualcomm, Google, Facebook, Tintri



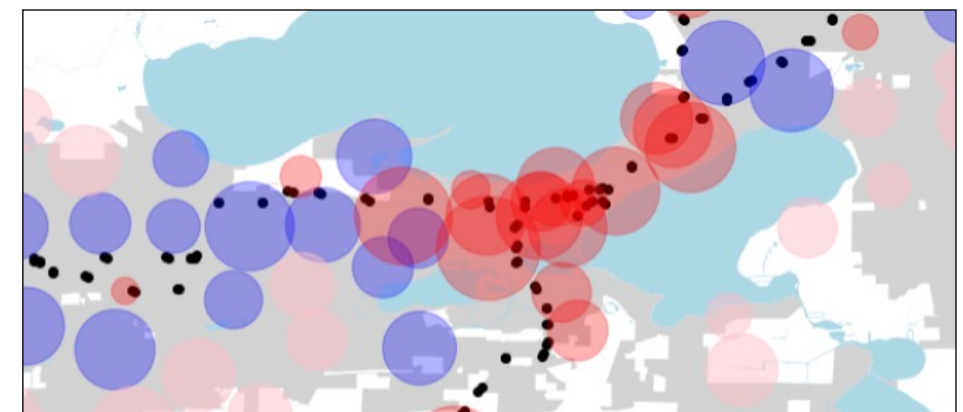
interests

typing efficiently

civic "hacking"



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



Plot by [Jin Woo Lee](#) (previous CS 30I student)

More: <https://wisc-ds-projects.github.io/fl9/>

Student Information Survey (graded)

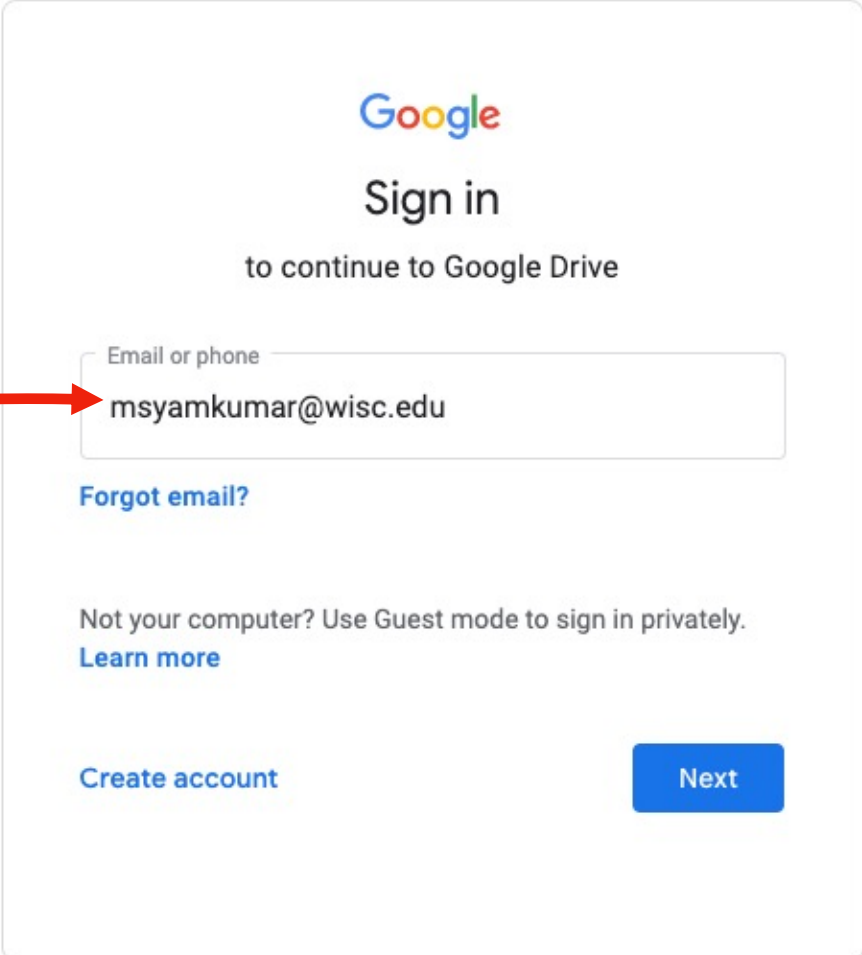
Please help us get to know you (not anonymous):

<https://forms.gle/duP9eEDcZ6eDtvoj6>

Purposes:

- gauge class interest for office hours
- collecting data to demonstrate Data Science

be sure to use your
campus email!



Google

Sign in

to continue to Google Drive

Email or phone

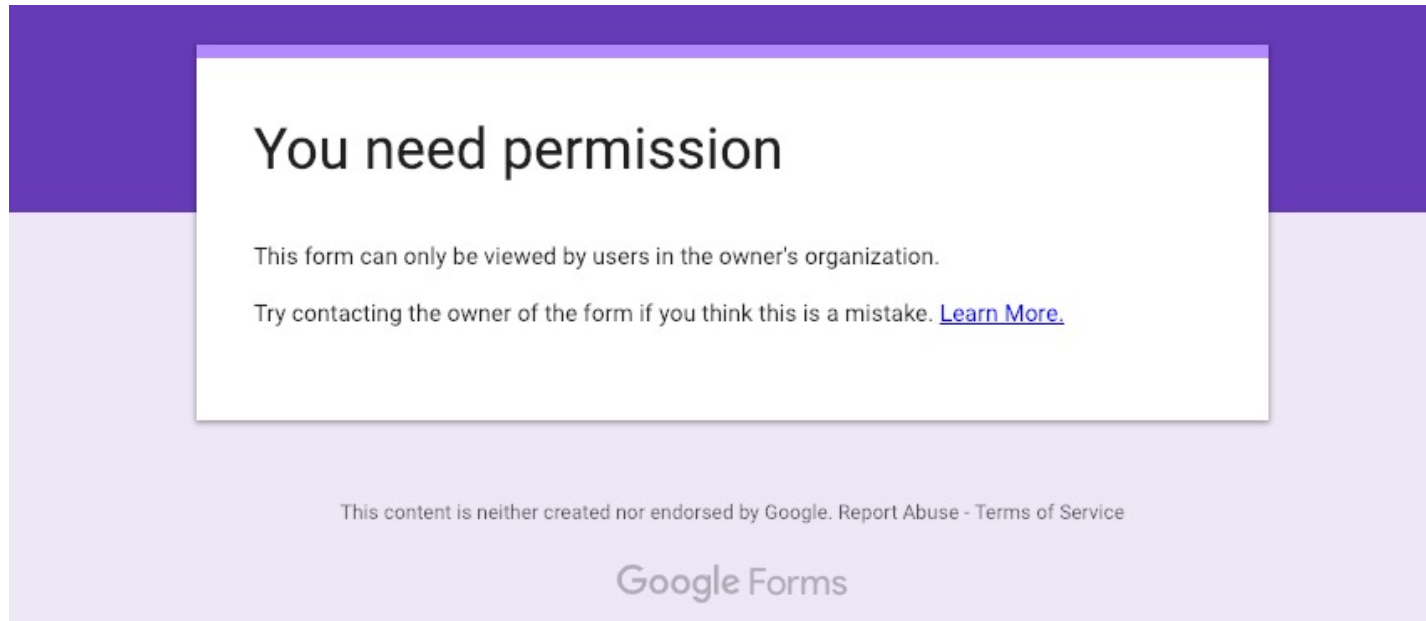
msyamkumar@wisc.edu

[Forgot email?](#)

Not your computer? Use Guest mode to sign in privately.
[Learn more](#)

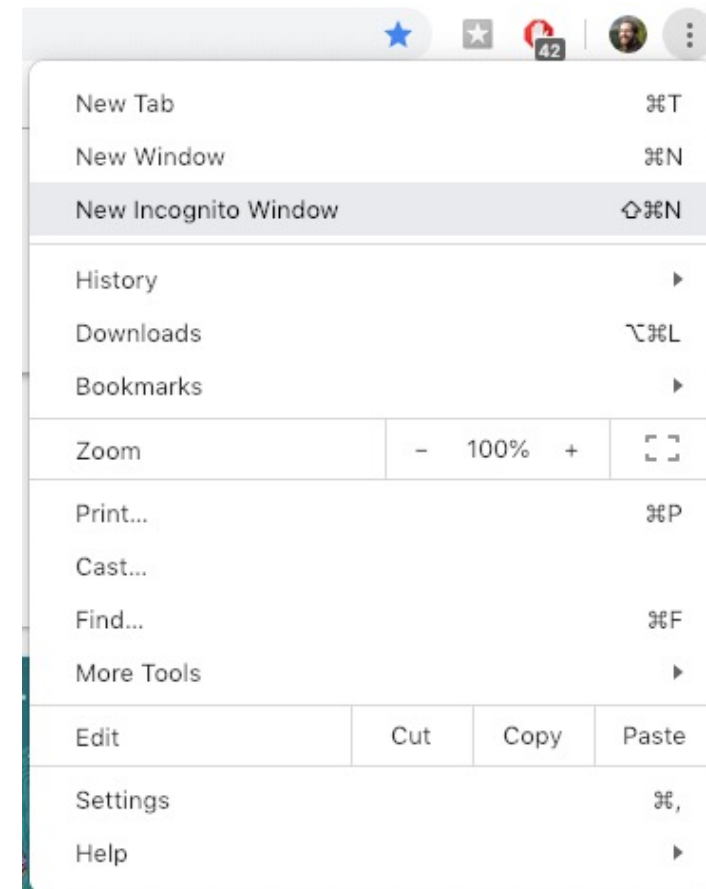
[Create account](#) [Next](#)

Survey: Common Technical Issues



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

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



Today's Topics

Introductions

Course overview

- **Topics**
- Lecture
- Lab
- Readings
- Class communication
- Grades
- Projects
- Exams & quizzes

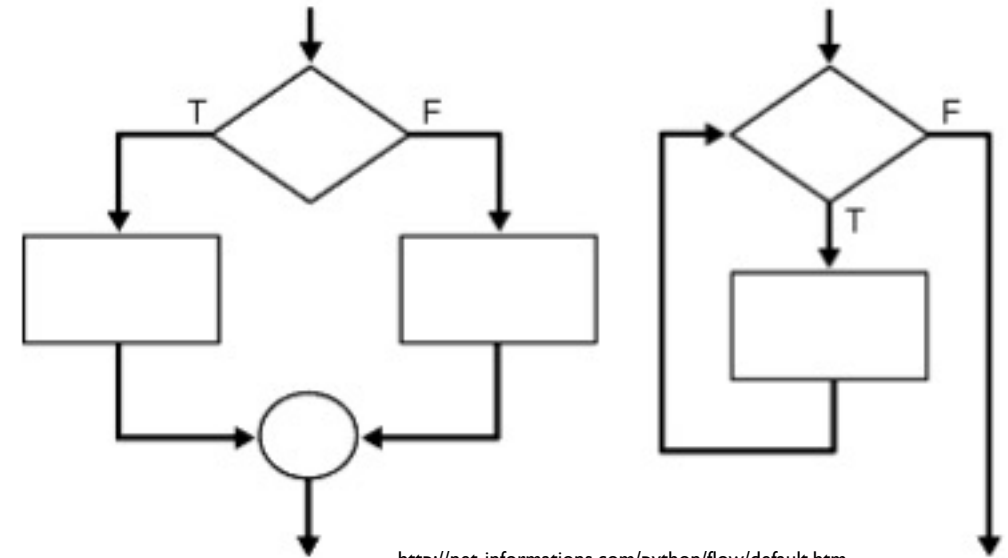
Computer hardware basics

Website

220 Topics

Part 1: 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>

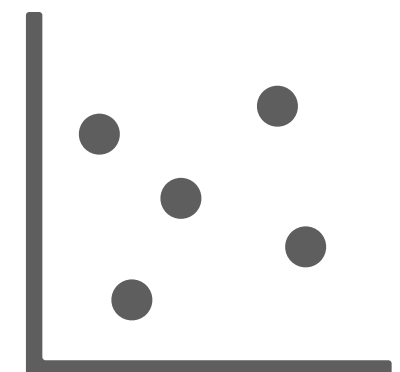
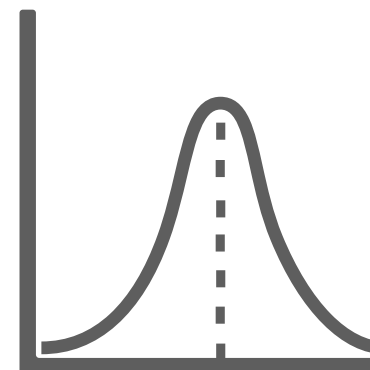
Part 2: State

- 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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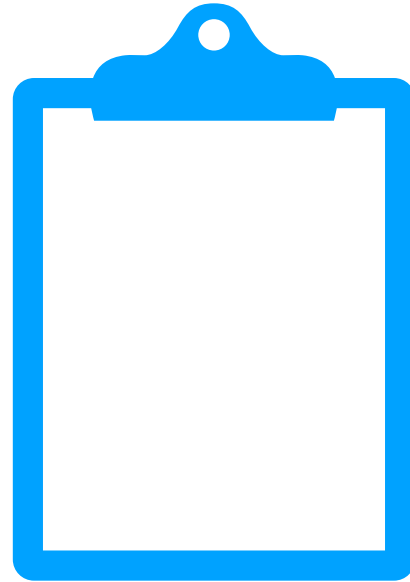
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Lecture Style



general concepts



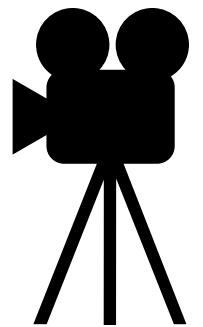
worksheet practice



live coding

Your role

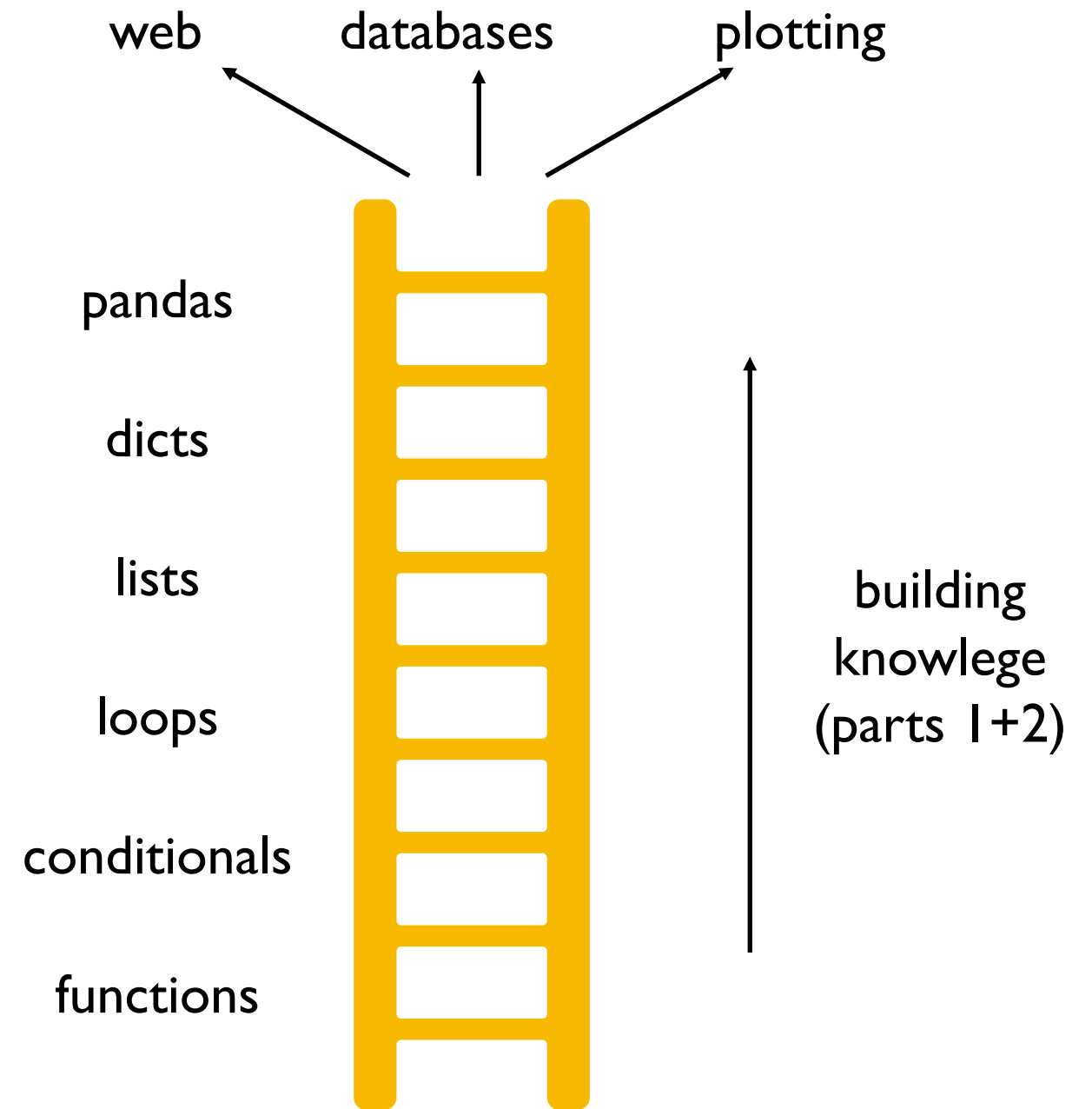
- do **readings** before or after
- I love to get **questions**, ask me during the live-stream + Q/A sessions



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



see Salman Kahn...



Today's Topics

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Computer hardware basics

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Labs

Format

- 75 minutes on Wed, Thu or Fri, leave when you're done
- led by TA / peer mentor or self-guided, not graded
- lab document will be posted each week
- do the lab before starting the project!

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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Computer hardware basics

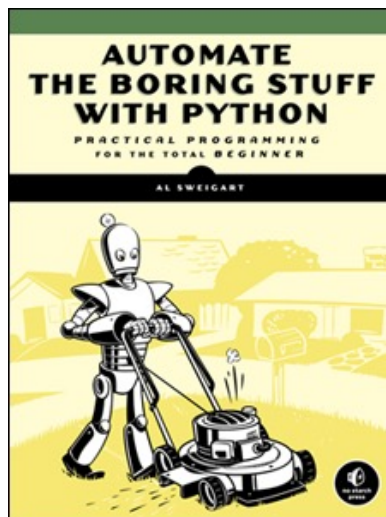
Website

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

CS 220
Notes

Course Notes

- 220 instructors
- Mostly for data science part of class

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Communication in CS 220

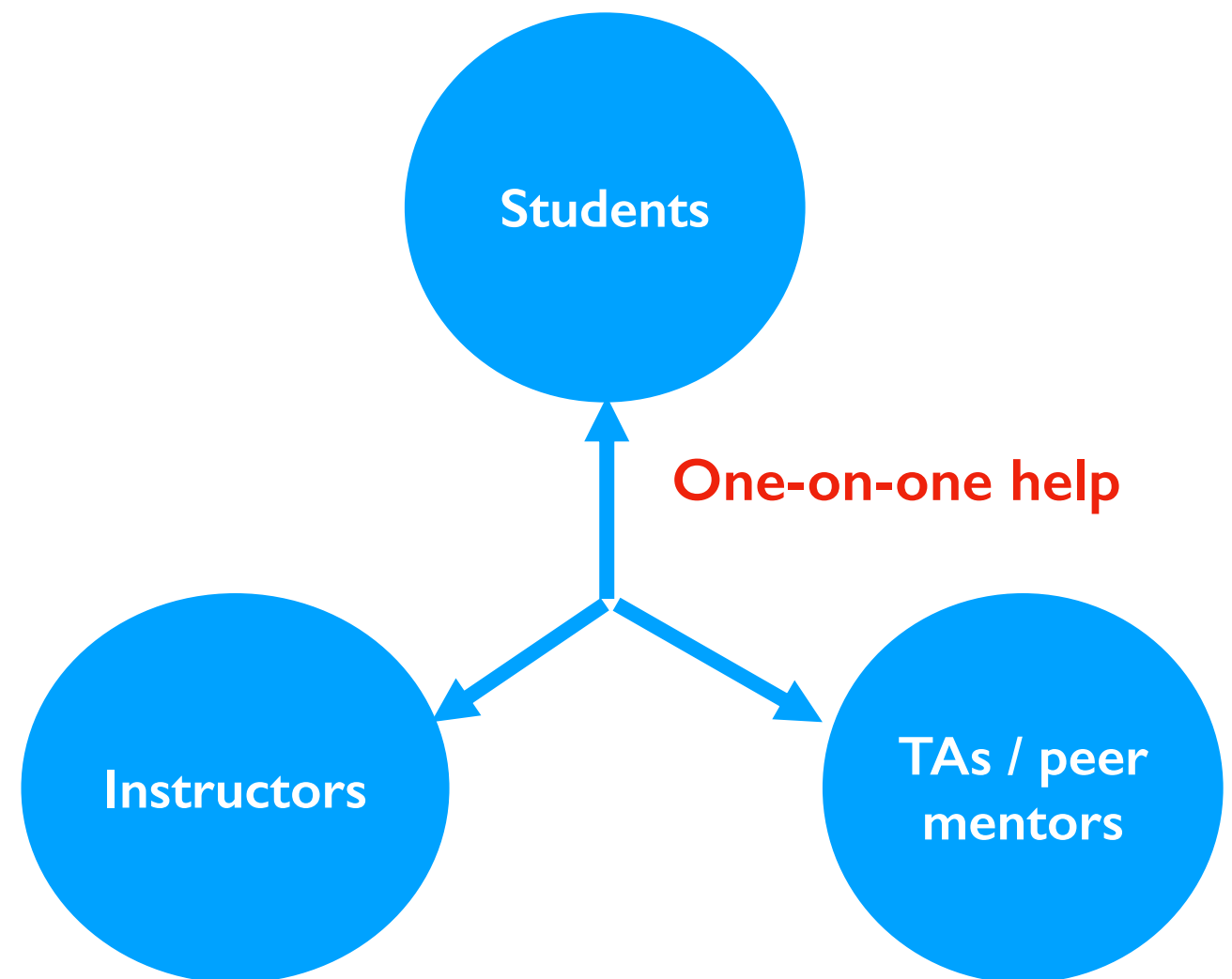
Good communication is critical for a class of this size

- Who needs to communicate? students, TAs + mentors, instructors

Communication tools

- Office hours (CSI302)
- Piazza
- Email
- Class Forms
- Project Submission
- Canvas

See: [Piazza post](#)



Communication in CS 220

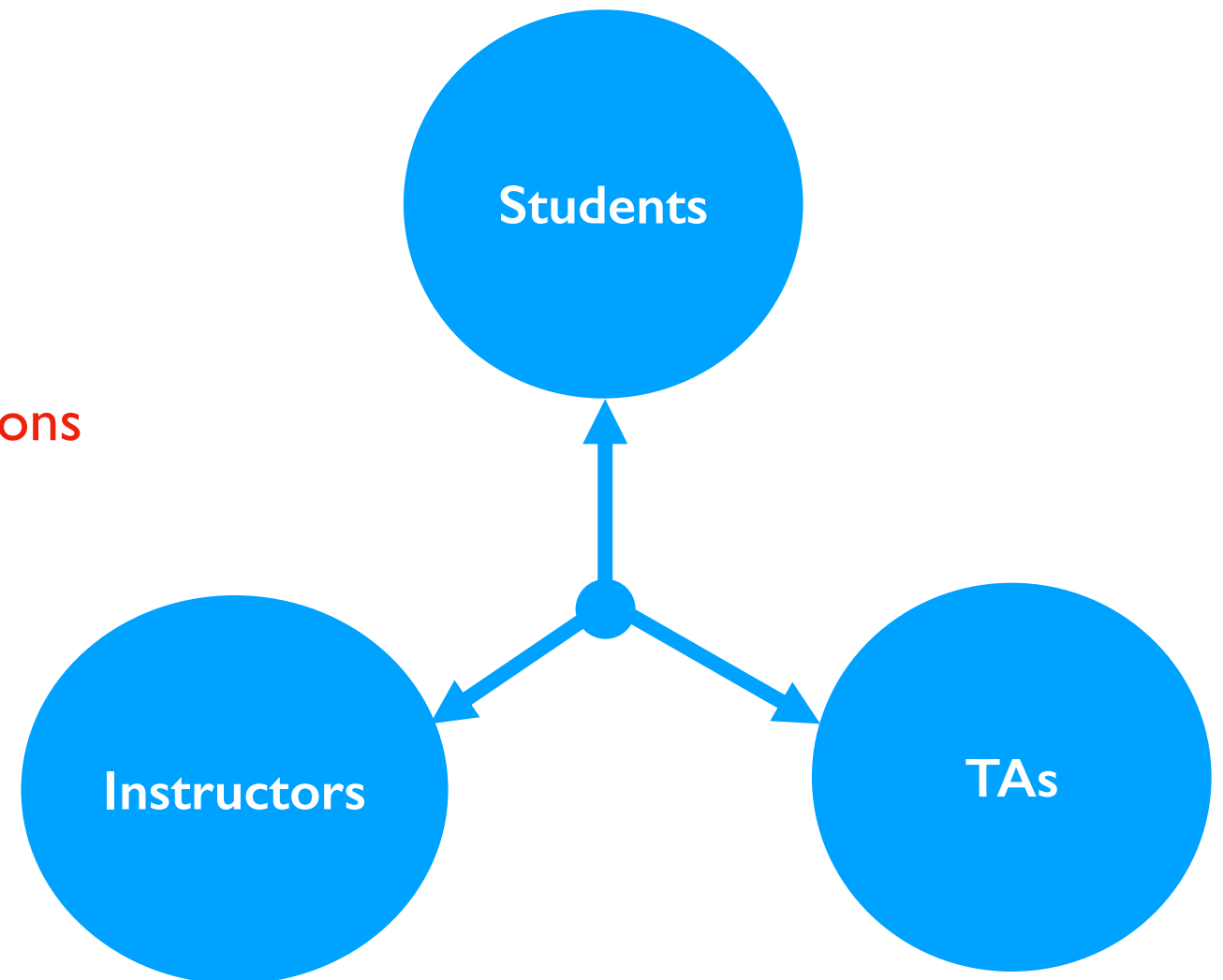
Communication tools

- Office hours (CSI302)
- **Piazza**
- Email
- Class Forms
- Project Submission
- Canvas

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

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

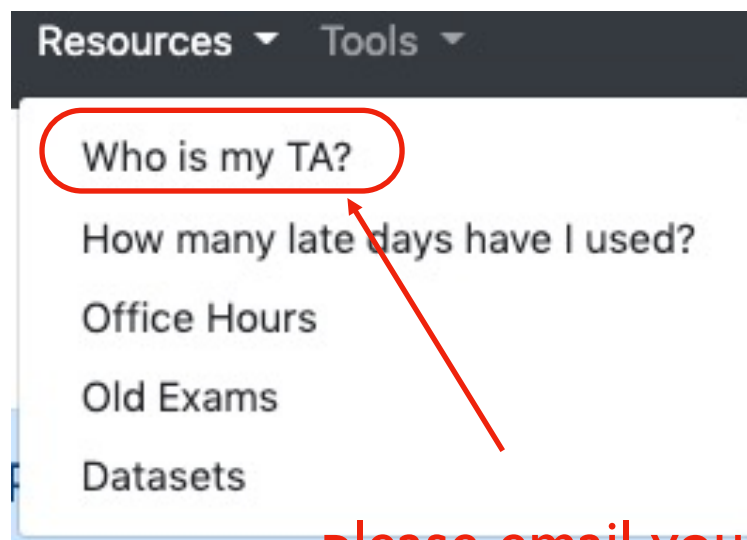
Note: we'll keep a pinned post of current office hours here



Communication in CS 220

Communication tools

- Office hours (queuing system + BBCollaborate Ultra)
- Piazza
- **Email**
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- Project Submission
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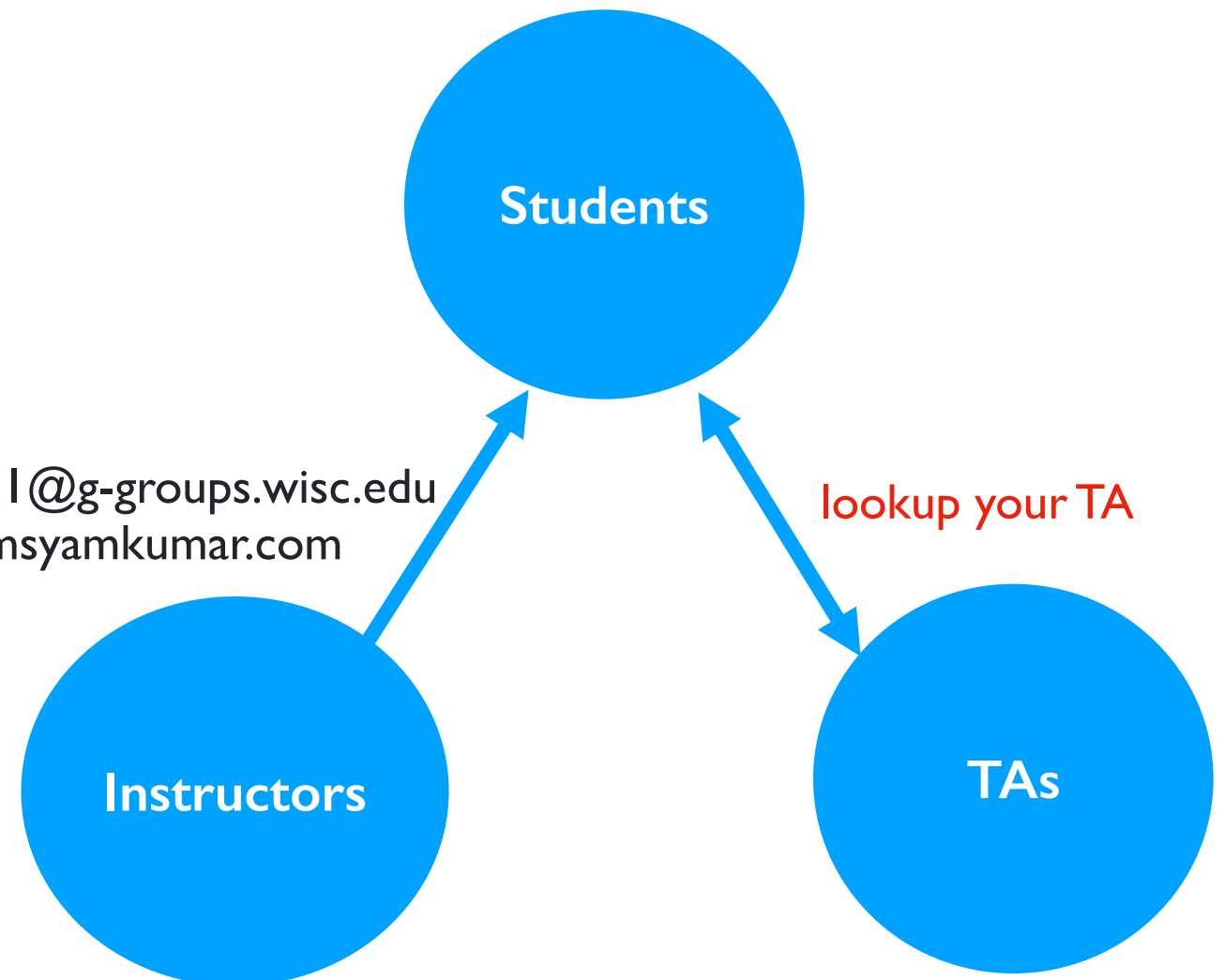


please email your assigned TA

CC instructor at
ms@cs.wisc.edu
kuemmel@wisc.edu

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

compsci220-~~SEC~~-f2l@g-groups.wisc.edu
no-reply@msyamkumar.com



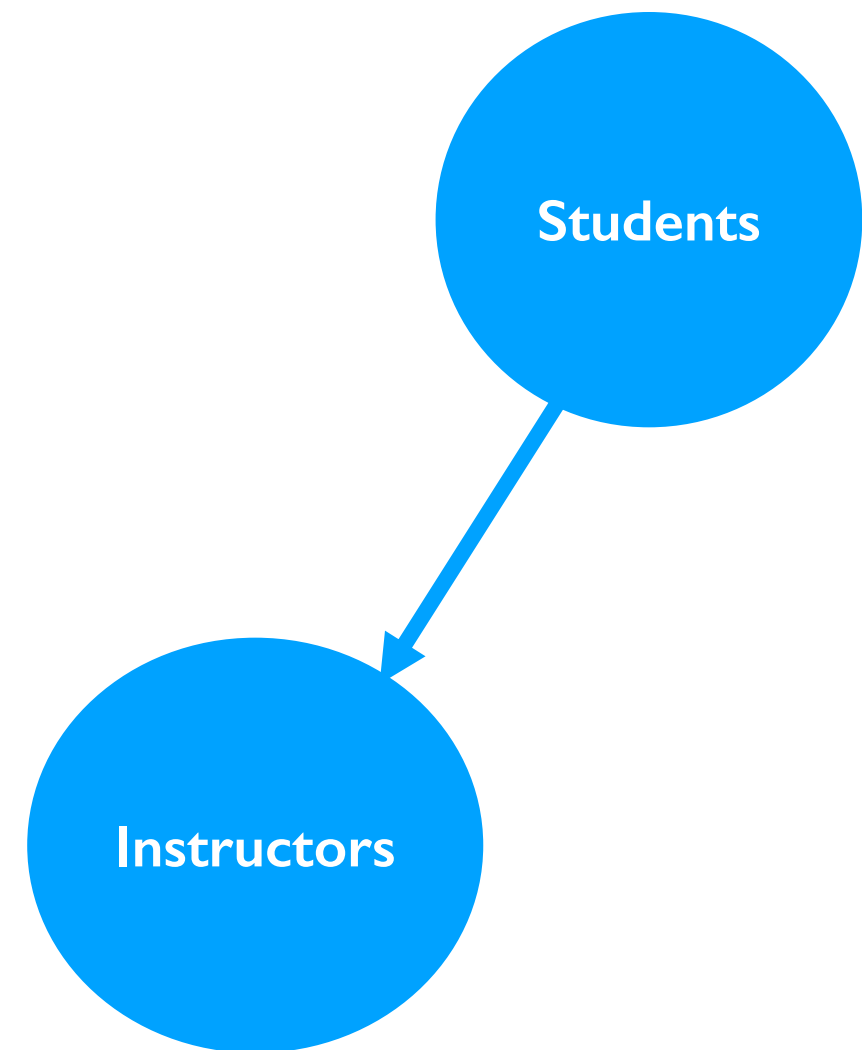
Communication in CS 220

Communication tools

- Office hours (queuing system + BBCollaborate Ultra)
- Piazza
- Email
- **Class 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).

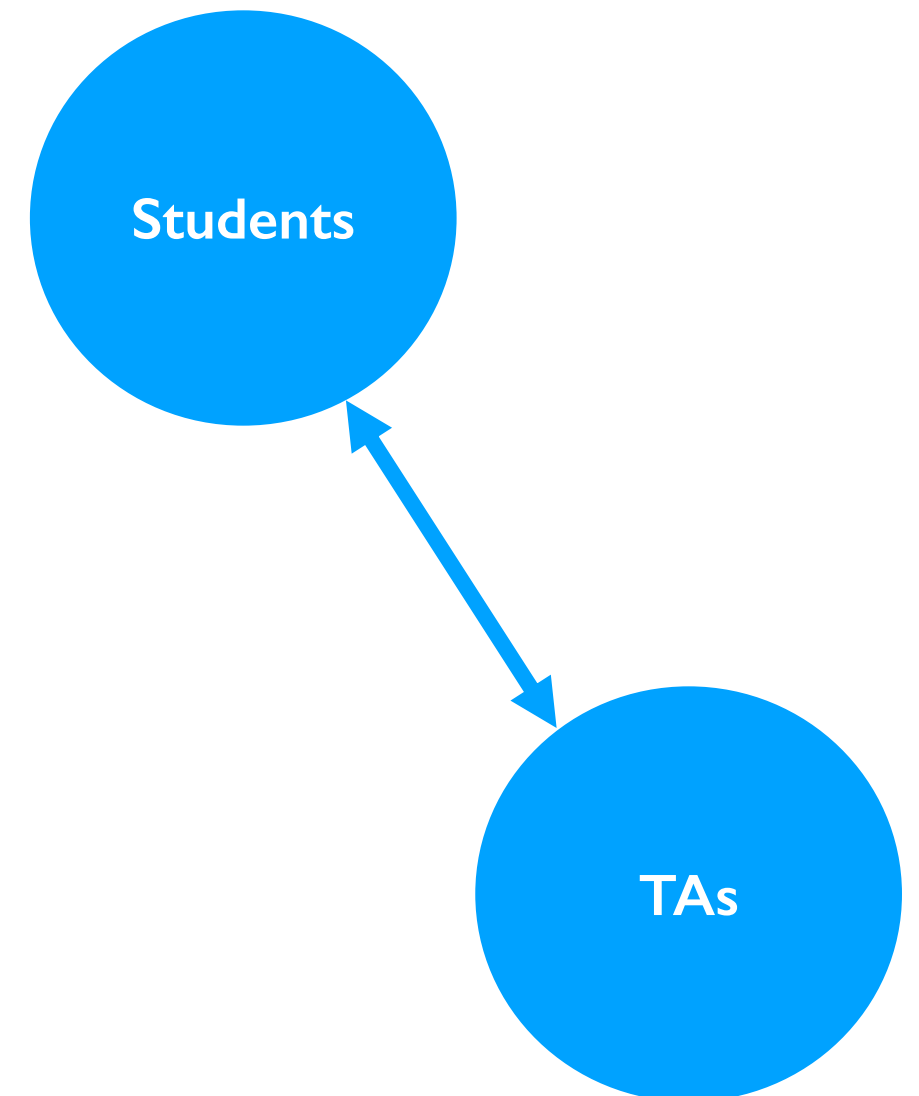
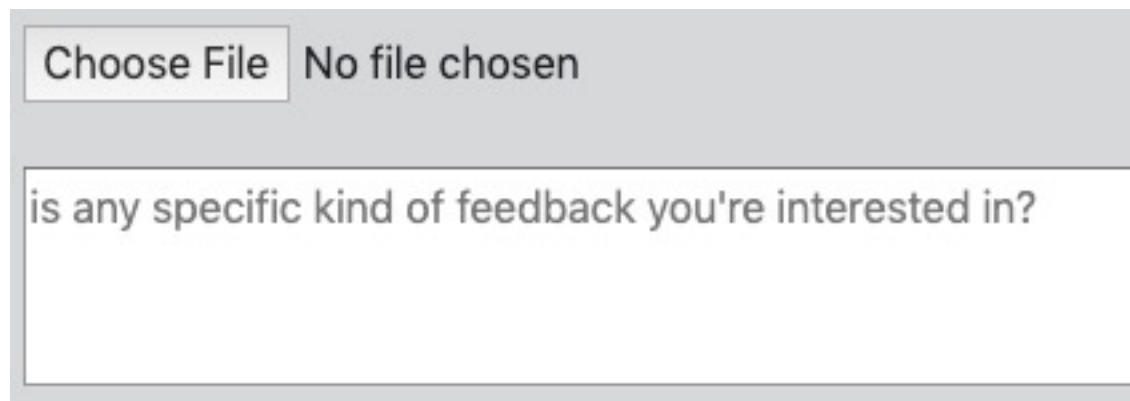
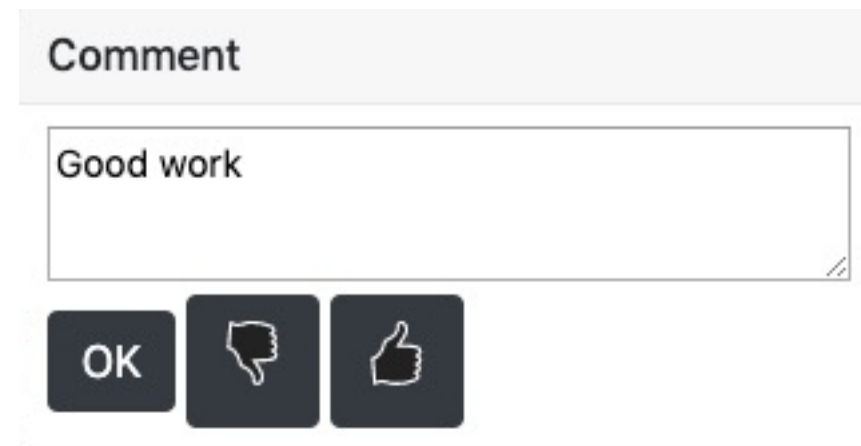
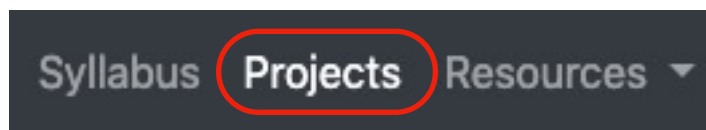
4. Thank You! Has a TA or mentor provided exceptional help, during office hours, Shelf hours, lab, etc? Thank them by filling out this form, and I'll pass along the feedback.



Communication in CS 220

Communication tools

- Office hours (queuing system + BBCollaborate Ultra)
- Piazza
- Email
- Class Forms
- **Project Submission**
- Canvas

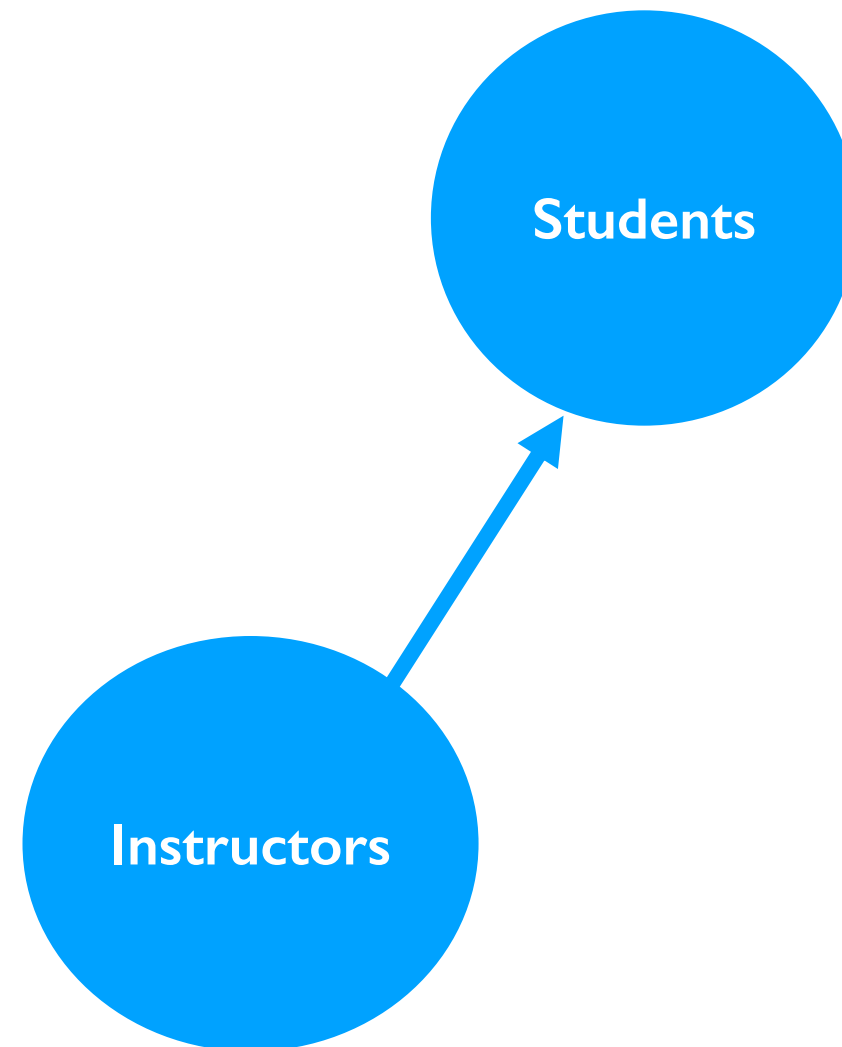


Communication in CS 220

Communication tools

- Office hours (queuing system + BBCollaborate Ultra)
- Piazza
- Email
- Class Forms
- Project Submission
- **Canvas**

Quizzes, grades



Communication in CS 220 – Demic app

Download Demic

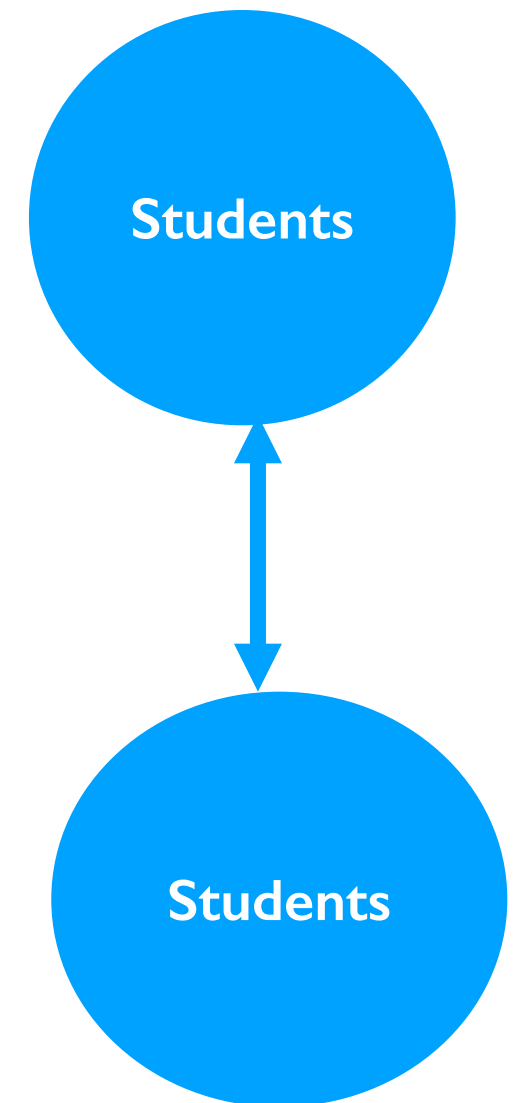
iOS



Android



See: [Piazza post](#)



demic

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Computer hardware basics

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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 important part of the course

20% - quizzes

- 12 quizzes (drop 2 lowest scores)

30% - exams

- 10% midterm 1
- 10% midterm 2
- 10% final

1% - communication

- filling surveys, Piazza sign up, other

Letter Grades

- Your final grade is based on sum of all points earned.
- Your grade does not depend on other students' grade.

Grade cut-offs

- 95% - 100%: **A**
- 90% - 94.99%: **AB**
- 85% - 89.99%: **B**
- 80% - 84.99%: **BC**
- 70% - 79.99%: **C**
- 60% - 69.99%: **D**

Today's Topics

Introductions

Course overview

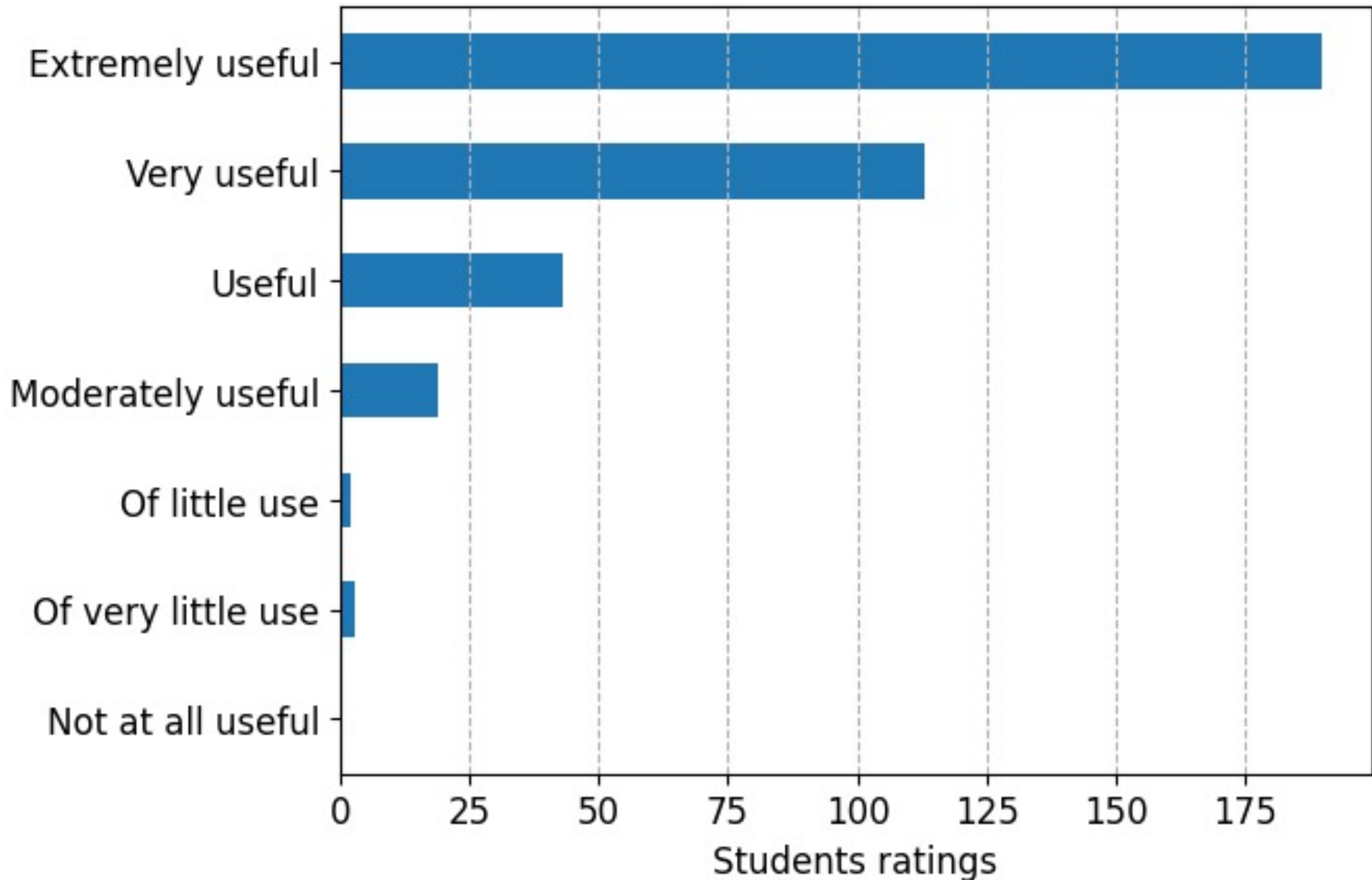
- Topics
- Lecture
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- Grades
- **Projects**
- Exams & quizzes

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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 10 late days, use them wisely!
- Contact us about any issues

Getting help

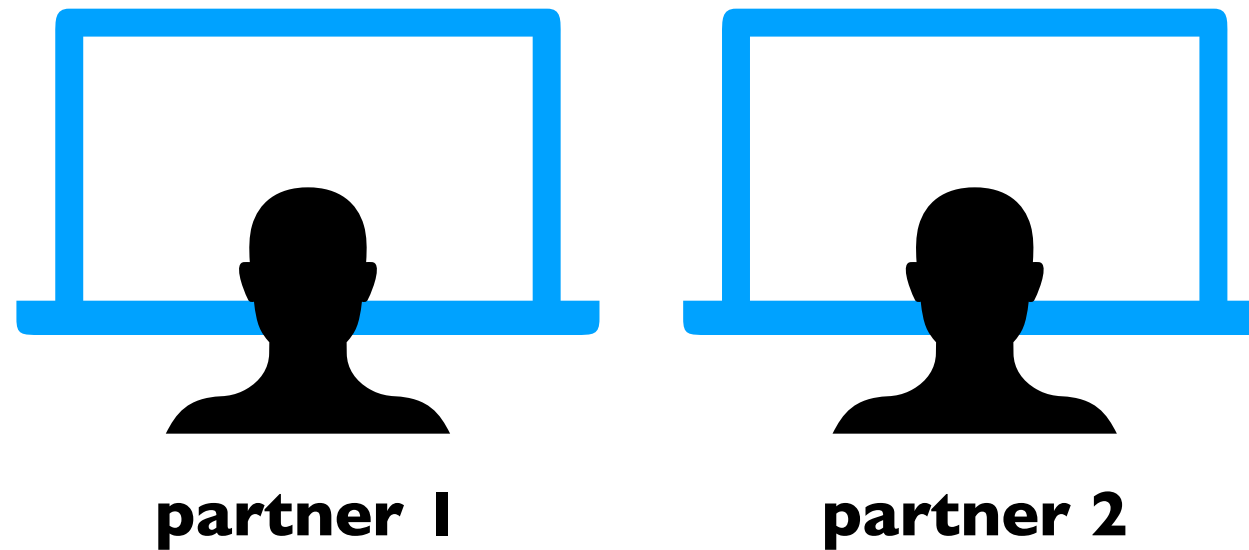
- Piazza
- Instructor or TA office hours
- Lab sessions
- Email (least preferred)

Pair Programming

You can optionally work in pairs of two

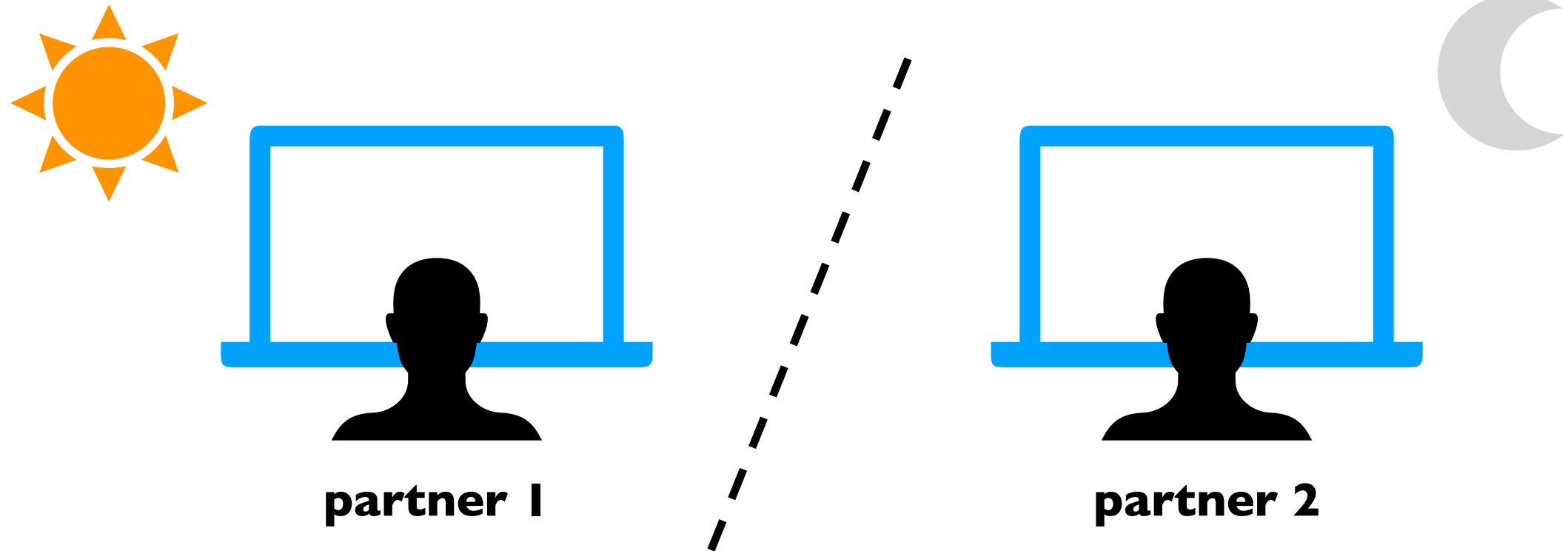
- Partnerships across sections allowed (including LEC005)
- Switch partners between projects (or keep with same partner)
- CS220 students can partner with any CS220 students, immaterial of section
- CS319 students can partner with any CS319 students

Pair Programming



Best practice: working alongside each other

Pair Programming

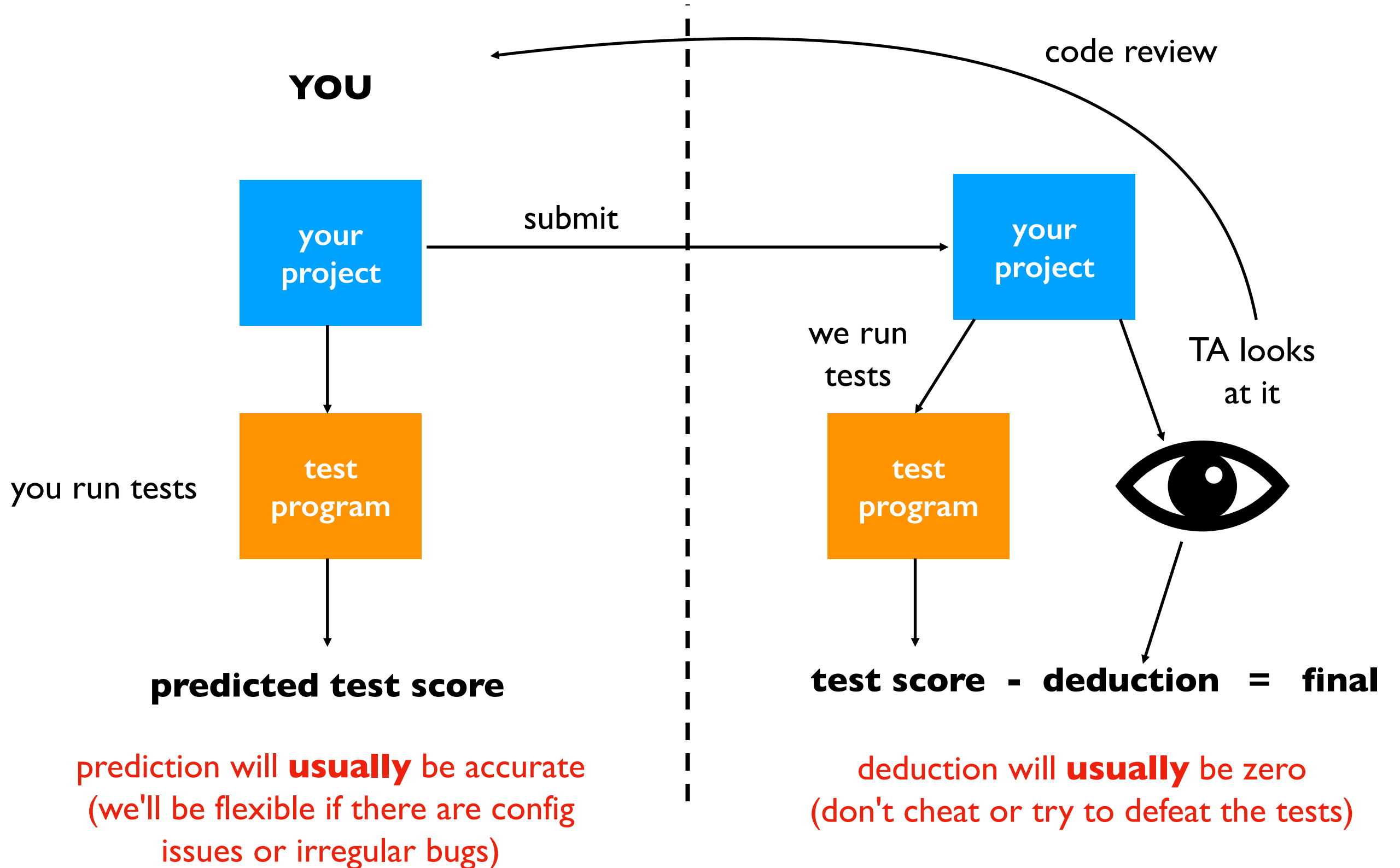


Breaks syllabus rules: working on different parts at different times

Breaks syllabus rules: working on alternate projects individually

Project Grading

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



Today's Topics

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- Topics
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Quizzes and Exams

Quizzes

- Will be due most weeks, on **Fri, at midnight** (exception: quiz 4, due @ noon!)
- Keeps track of your progress in this course

Exams: two midterms and one final

- Multiple choice
- 2 hours
- Given in a large lecture hall

projects → writing and testing code with a computer

quizzes → reading and interpreting code with a computer

exams → reading and interpreting code **without** a computer

Today's Topics

Introductions

Course overview

Computer hardware basics

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

Website

Today's Topics

Introductions

Course overview

Computer hardware basics

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

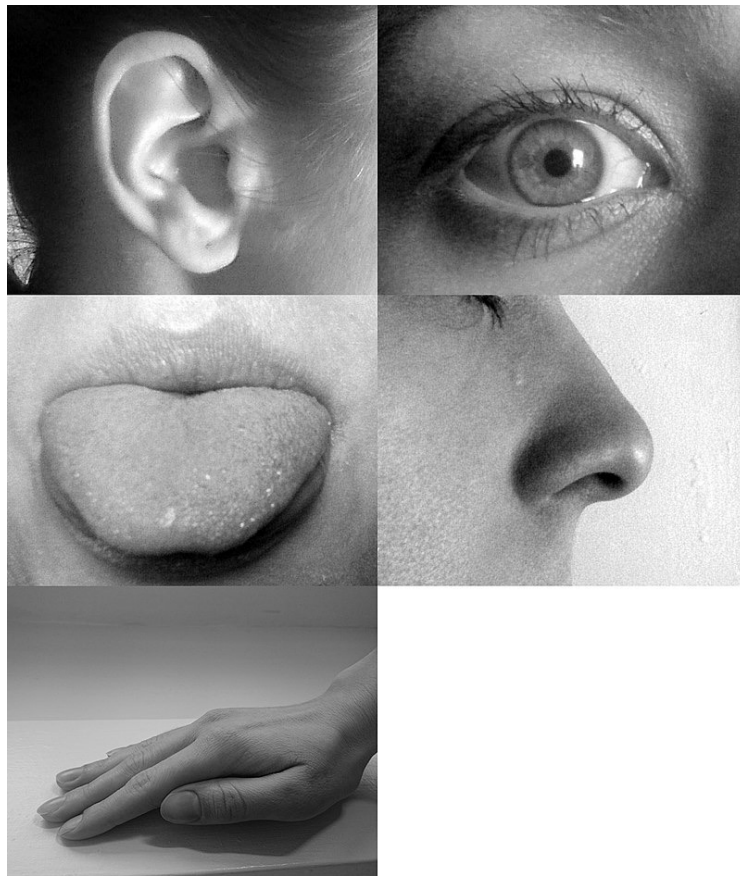
Website

Input/Output

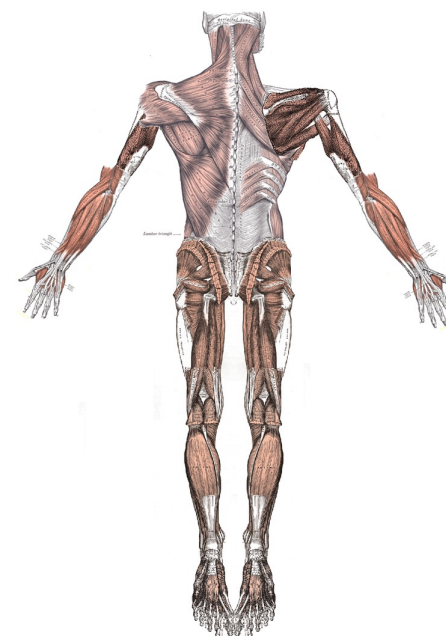
I/O (stands for input/output)

- 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

monitor



speakers



keyboard



mouse



**computer
(in a case)**

Computer Input/Output

monitor



speakers



**What's inside a
computer case?**



keyboard



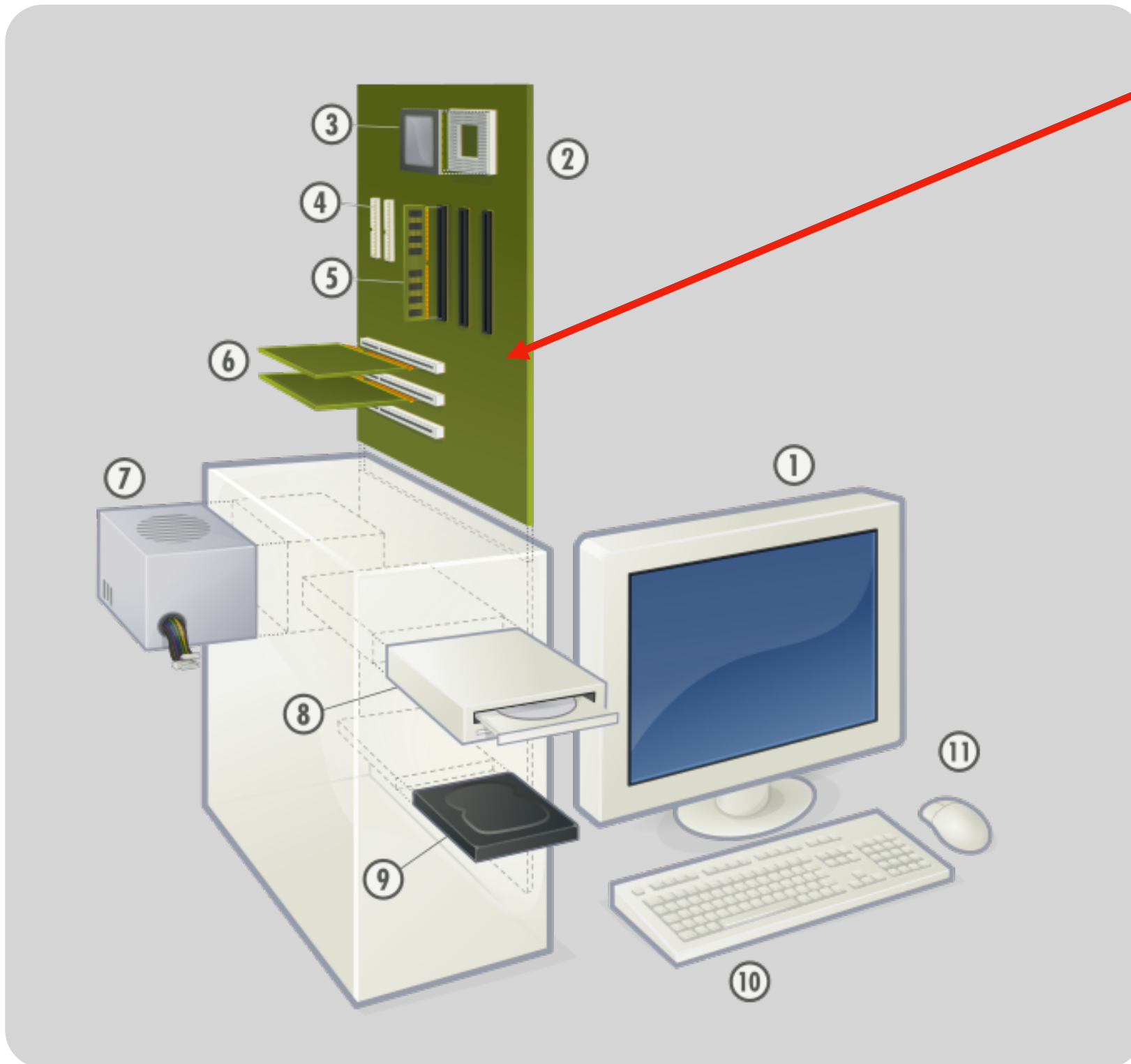
mouse



**computer
(in a case)**

Computer Internals

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



Today's Topics

Introductions

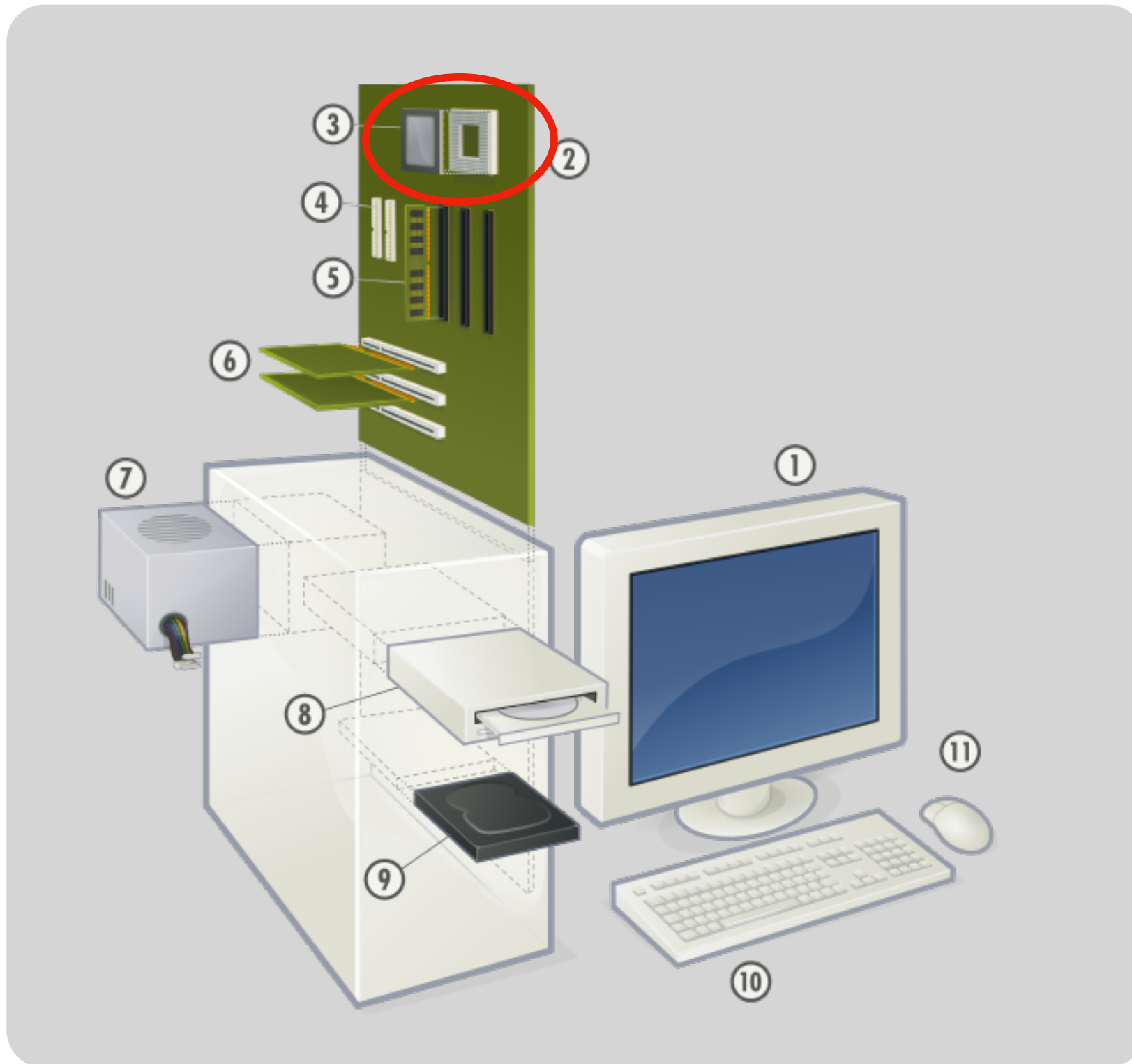
Course overview

Computer hardware basics

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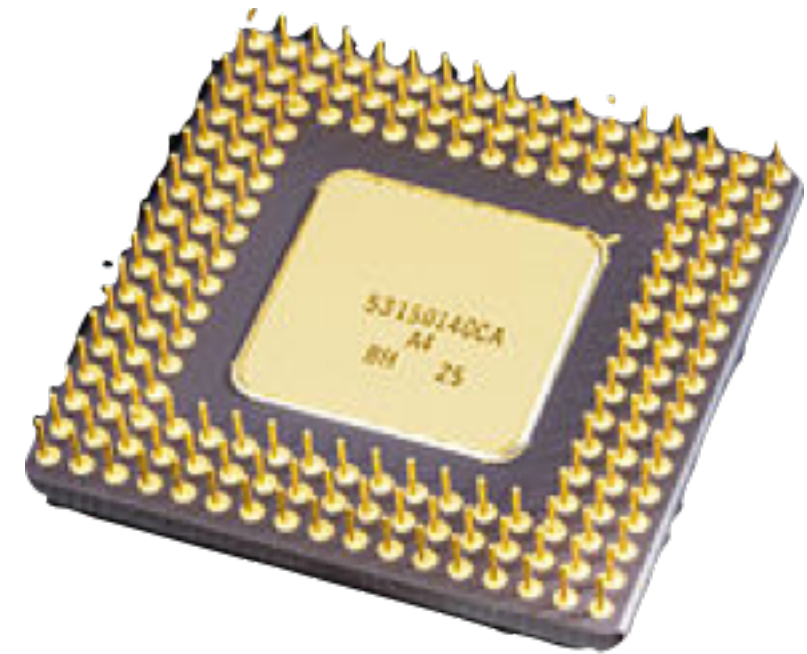
Central Processing Unit (CPU)



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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Introductions

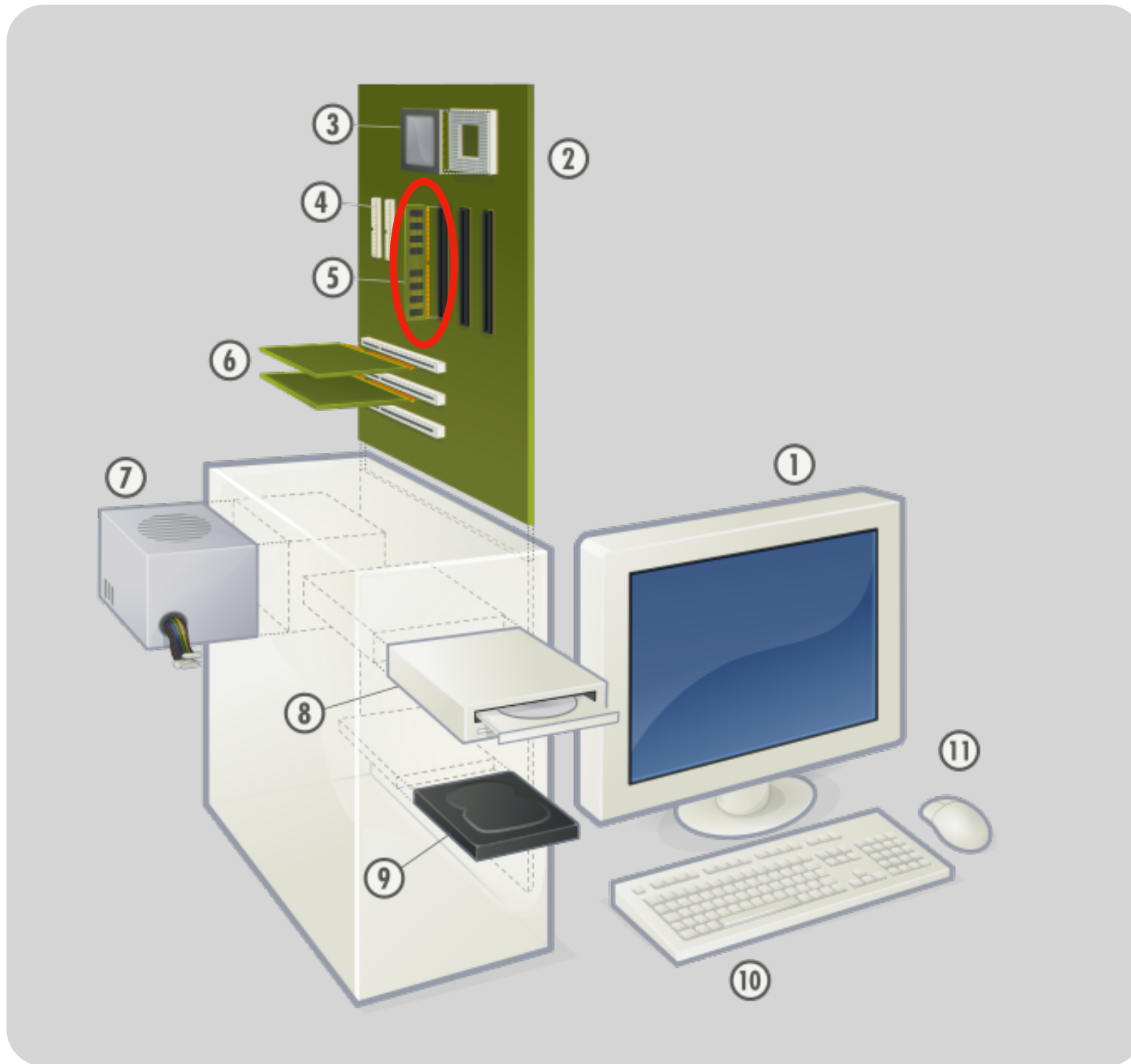
Course overview

Computer hardware basics

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

Website

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 \approx **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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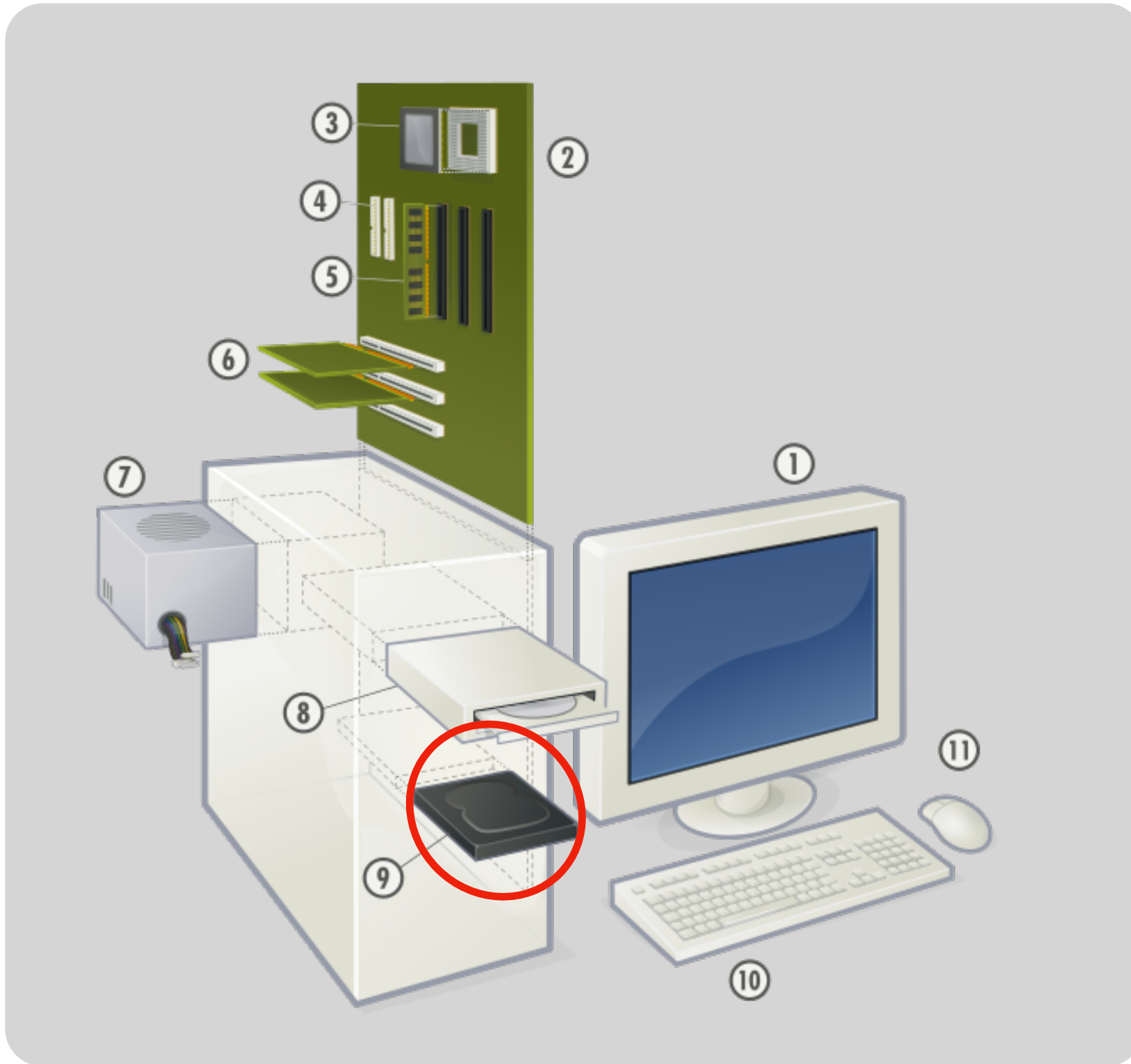
Course overview

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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

- **Persistent** 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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Introductions

Course overview

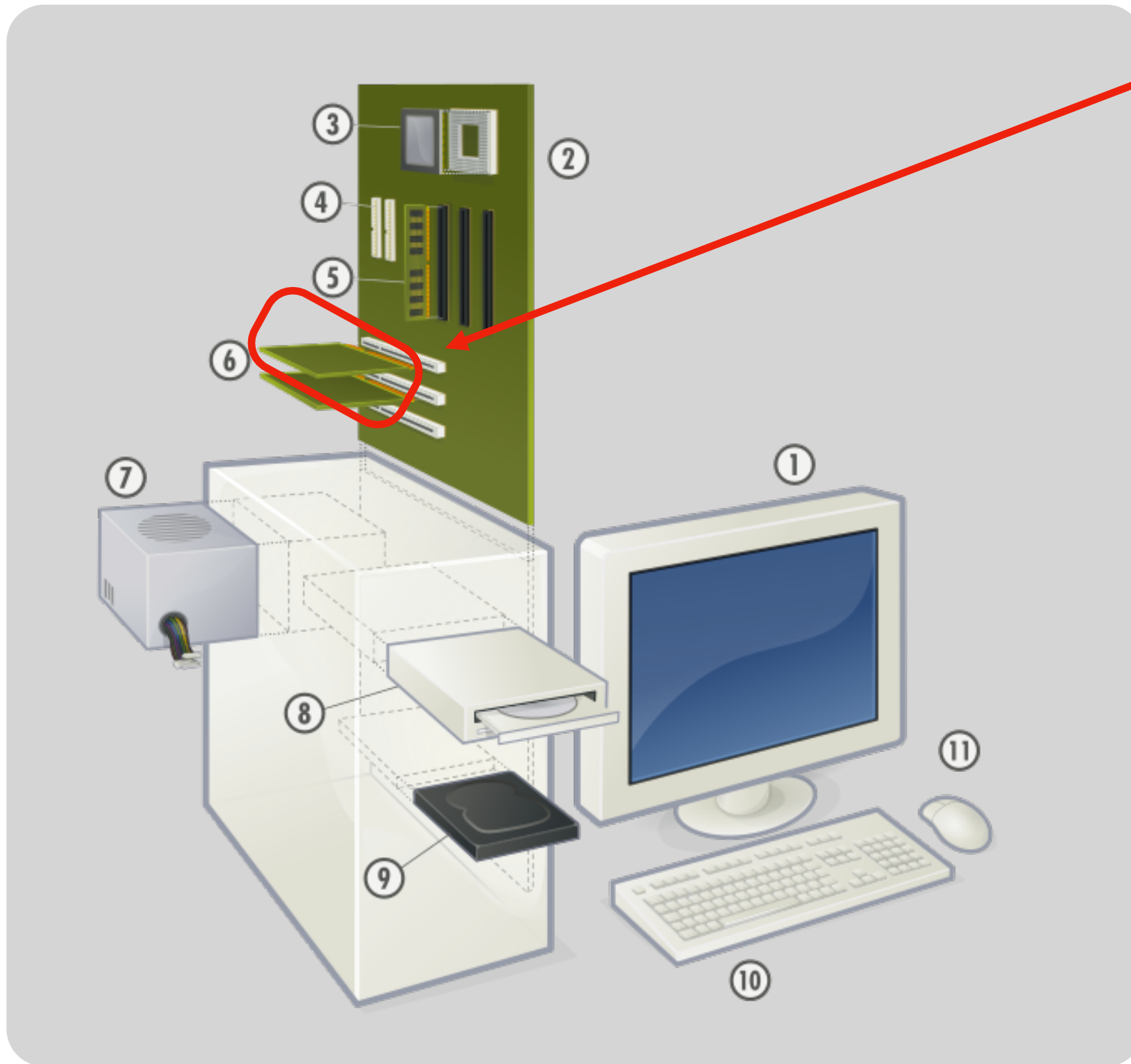
Computer hardware basics

- Input/Output
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- **Networking**

Website

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 for incoming requests, to which it responds
- **Client**: program/compute that sends requests to a server



Today's Topics

Introductions

Course overview

Computer hardware basics

Website

Course Website

Shared website (sections 1 through 5):

<https://www.msyamkumar.com/cs220/f21/schedule.html>

Walk through...

Next steps...

- take the "Student Information Survey" survey:
<https://www.msyamkumar.com/cs220/f21/surveys.html>
- read **syllabus** carefully:
<https://www.msyamkumar.com/cs220/f21/syllabus.html>
- setup **Python** on your computer and do **Lab-PI**:
<https://github.com/msyamkumar/cs220-f21-projects/tree/main/lab-p1>
- start **PI (Project I)**, due next Wed:
<https://github.com/msyamkumar/cs220-f21-projects/tree/main/p1>