



UC Berkeley EECS
Lecturer
Michael Ball

Computational Structures in Data Science



Wrap Up



Announcements

- Final Exam, Tuesday 8-11am slot
 - Alternate 7pm (Online + proctored)
 - We will email those with alternates/accommodations soon.
- <http://howamidoing.cs88.not.cs61a.org/>
- The grading info is all based on points you earned
- Sum everything up! (Everything except lecture self-checks are in howamidoing.)
 - » Basically everyone is getting 20/20 on the lecture self-checks. That's the point. 😊
 - » Correctness *does* count! Resubmit them, if you haven't gotten them right. (No late penalty!)
 - » There are 27 self-checks which means you could have skipped 7 lectures
 - » There's a few "bonus" ones on Gradescope, just from different semesters that are optional practice.



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Review and Wrap Up

CS88 Head TAs



Head Teaching Assistants



Matt Au [he/him]

Office Hours: Tuesday 5pm - 7pm,
Thursday 5pm - 6pm

mattau@berkeley.edu

Did you know Plentea gives free glass jars with their boba? I like boba + boba u4's.



Shreya Kannan [she/her]

Office Hours: Tuesday 11am - 12pm

shreyakannan@berkeley.edu

Hi everyone, I'm super thrilled to meet y'all this semester! In no particular order, I prefer musicals over concerts, cold over warm weather, dancing over singing, and sushi over tacos. Feel free to talk to me about great restaurants, cool study spots, and, of course, CS 88 :)

CS88 TAs

Teaching Assistants



Anjali Gurajapu [she/her]

Office Hours: Wednesday 4pm - 5pm
agura@berkeley.edu

Hi! I'm Anjali, and I'm a third year studying Chemistry and Data Science. In my free time, I've been drawing, baking, and trying to befriend the stray cat that sleeps on my porch. I'm excited to be a TA this semester, and looking forward to meeting you all! :)



Chi Tsai [she/her]

Office Hours: Tuesday 12pm - 1pm
chitsai@berkeley.edu

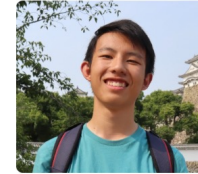
Hi! I'm Chi, and I'm from the LA area. I enjoy cooking and trying new food, playing minecraft, planning upcoming vacations, and watching Brooklyn 99 (Terry loves yogurt). Come talk to me about anything, happy to meet you!



Jessica Lin [she/her]

Office Hours: Monday 10am - 11am
linjessica@berkeley.edu

Hi friends! I'm a second year CS major from Southern California. I enjoy dancing, reading, doing crosswords, and making random peace signs. Feel free to reach out to me for anything (:



Lukas Chang [he/him]

Office Hours: Monday 11am - 12pm
lukasc@berkeley.edu

Hi everyone I'm Lukas, a 3rd year CS major from the south bay area. This is my third semester TAing for CS88 and I'm excited to meet you all! A little about me—in my free time I love making/listening to music, thrifting, and watching anime. I hope I can share my love for CS with you all!



Minnie Chen [she/her]

Office Hours: Tuesday 6pm - 7pm
chn_minnie_22@berkeley.edu

Hi! I'm Minnie, a 4th year Civil Engineering major and minoring in EECS and Sustainability. I like to cook when I'm not too lazy and enjoy active sports when I'm not too tired or lazy :D I'm trying to get back into reading so please let me know if you have any book recs! I also recently studied abroad last semester, so feel free to ask me about that. Excited to meet everyone!



Tommy Joseph [he/him]

Office Hours: Tuesday 1:30pm - 2:30pm
tommy11jo@berkeley.edu

Hi I'm a third-year CS major from Southern California, and this is my third time TAing for CS 88. Right now, some things I like are bread, blogs, and tv shows (highly recommend The Wire and Silicon Valley). Feel free to reach out about anything



CS88 Tutors



Amit Sant [he/him]

Office Hours: Thursday 4pm - 5pm,
Friday 12pm - 1pm

amitsant2000@berkeley.edu

Hello, my name is Amit, and I am a third year CS major at UC Berkeley. My hobbies include gapping League of Legends esports, chess, anime, andosu! Aside from that I love to code, teach, and work on stuff related to making our planet somewhat more livable.



Hetal Shah [she/her]

Office Hours: Wednesday 3pm - 4pm,
Friday 11am - 12pm

hetal.shah@berkeley.edu

Hello! I am a 3rd year CS major from Southern California. I love the beach and the sun. In my free time, I like working out, reading, hiking, and traveling. Feel free to reach to me!



Karim Kaylani [he/him]

karimkaylani@berkeley.edu

Hi everyone! My name is Karim and I'm a 2nd year CS major from Southern California. I'm super passionate about all things music whether it's playing guitar, collecting vinyls, or going to shows. I also love taking film photos, hiking, wordle, and ghibli movies. I'm very excited to be a tutor this semester and meet you all, never hesitate to reach out to me about anything anytime! :)



Kevin Gu [he/him]

Office Hours: Tuesday 1pm - 2pm,
Thursday 6pm - 7pm

kevinjgu@berkeley.edu

Hi everyone! I'm Kevin, a 5th year Master of Information and Data Science student in the UC Berkeley School of Information. I'm so excited to be a tutor and am looking forward to meeting all of you during office hours! Outside of academics, I love to listen to music (mainly classical, but I can appreciate any genre), take walks, travel (unfortunately not during Covid, but in general), and learn languages (just not enough time to do it, but am willing to practice speaking French), so feel free to reach out to me regarding any of these. :D



Sebastian Zhao [he/him]

sebbyzhao@berkeley.edu

Hiya! I'm a first year intended CS and DS major from Erie, Pennsylvania (a small town right below the lake). I'm a huge fan of cooking, digital art, video games, and manga. Feel free to talk to me about anything, I am a huge believer in conversations about random stuff!





COME JOIN COURSE STAFF!

UC Berkeley | Computer Science 88 | Michael Ball | <http://cs88.org>



THANK YOU!



THANK YOU!



The One Big Thing...



Abstraction

- Detail removal
“The act of leaving out of consideration one or more properties of a complex object so as to attend to others.”
- Generalization
“The process of formulating general concepts by abstracting common properties of instances”
- Technical terms: Compression, Quantization, Clustering, Unsupervised Learning



Henri Matisse “Naked Blue IV”



The Power of Abstraction, Everywhere!

- **Examples:**

- **Functions (e.g., $\sin x$)**
- **Hiring contractors**
- **Application Programming Interfaces (APIs)**
- **Technology (e.g., cars)**

- **Amazing things are built when these layer**

- **And the abstraction layers are getting deeper by the day!**

We only need to worry about the interface, or specification, or contract
NOT how (or by whom) it's built

Above the abstraction line

Abstraction Barrier (Interface)
(the interface, or specification, or contract)

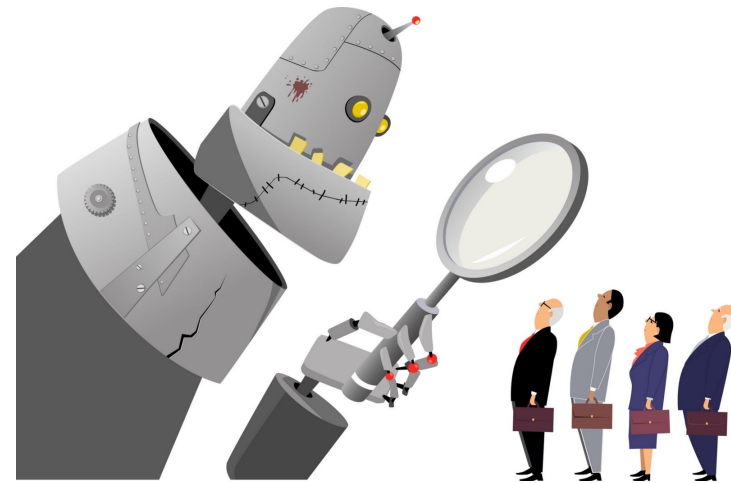
Below the abstraction line

This is where / how / when / by whom it is actually built, which is done according to the interface, specification, or contract.



Abstraction: Pitfalls

- **Abstraction is not universal without loss of information (mathematically provable). This means, in the end, the complexity can only be “moved around”**
- **Abstraction makes us forget how things actually work and can therefore hide bias. Example: AI and hiring decisions.**
- **Abstraction makes things special and that creates dependencies. Dependencies grow longer and longer over time and can become unmanageable.**





Is Your Brain Full Yet?

Python Tools:

- Data type: values, literals, operations,
 - Expressions, Call expression
 - Variables
 - Assignment Statement, Tuple assignment
 - Sequences: tuple, list
 - Dictionaries
 - Function Definition Statement
 - Conditional Statement
 - Iteration: list comp, for, while
 - Lambda function expr.
- Higher Order Functions
 - Functions as Values
 - Functions with functions as argument
 - Assignment of function values
 - Function factories – create and return functions
 - Higher order function patterns
 - Map, Filter, Reduce
 - Recursion
 - Abstract Data Types
 - Mutation
 - Class & Inheritance
 - Exceptions
 - Iterators & Generators
 - SQL / Declarative Programming



Keep on Programming



Where to go from here?

DATA8

DATA8 CS88

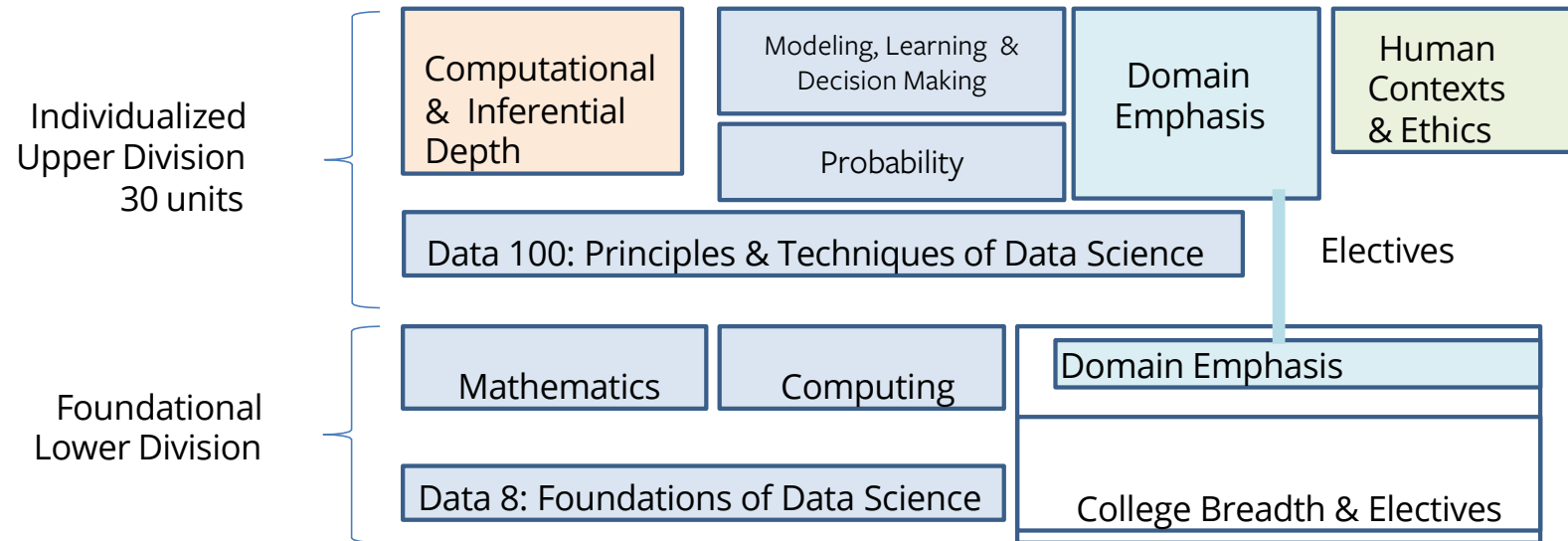
DATA8 CS88 CS61B

CS Major Options (But this hard to declare:

DATA8 CS88 CS47A CS61B

DATA8 CS88 CS61A CS61B

The Data Science Major



Data Science Info: <https://data.berkeley.edu/2020-cal-week> (Recordings)

There's also a minor!



LOTS of Courses to Follow Up!

- Explore all the DS connectors
 - Data 88E (Econ)
 - Stat 88
- Data 100:
- Data 101: Data Engineering
- Data 102
- Data 103
- Data 104
- INFO – Course Schedule Varies!
 - INFO C103 in Spring: “History of Information”
 - Some Database courses, web development, etc.



CS Courses

- CS61B: (conventional) data structures, statically typed production languages.
- CS61C: computing architecture and hardware as programmers see it.
- CS70: Discrete Math and Probability Theory.
- CS170, CS171, CS172, CS174: “Theory” —analysis and construction of algorithms, cryptography, computability, complexity, combinatorics, use of probabilistic algorithms and analysis.
- CS161: Security
- CS162: Operating systems.
- CS164: Implementation of programming languages
- CS168: Introduction to the Internet
- CS160, CS169: User interfaces, software engineering
- CS176: Computational Biology



CS Courses Part 2

- ★ CS182, CS188, CS189: Neural networks, Artificial intelligence, Machine Learning
- CS184: Graphics
- CS186: Databases
- CS191: Quantum Computing
- CS195: Social Implications of Computing
- EECS 16A, 16B: Designing Information Systems and Devices
- EECS 126: Probability and Random Processes
- EECS149: Embedded Systems
- EECS 151: Digital Design
- CS194: Special topics. (E.g.) computational photography and image manipulation, cryptography, cyberwar.
- Plus graduate courses on these subjects and more.
- And please don't forget CS199 and research projects.



EE Courses Are There Too

- EE105: Microelectronic Devices and Circuits.
- EE106: Robotics
- EE118, EE134: Optical Engineering, Photovoltaic Devices.
- EE120: Signals and Systems.
- EE123: Digital Signal Processing.
- EE126: Probability and Random Processes.
- EE130: Integrated Circuit Devices.
- EE137A: Power Circuits.
- EE140: Linear Integrated Circuits (analog circuits, amplifiers).
- EE142: Integrated Circuits for Communication.
- EE143: Microfabrication Technology.
- EE147: Micromechanical Systems (MEMS).
- EE192: Mechatronic Design



And there's lots more to Python!



What can you do with Python?

- Almost anything!
- Webapp backends
- Web scraping
- Natural Language Processing
- Data analysis
- Machine Learning
- Scientific computing
- Games
- Procedural generation - L Systems, Noise, Markov



What can you do with Python?

- Almost anything! Thanks to libraries!
- Webapp backends (Flask, Django)
- Web scraping (BeautifulSoup)
- Natural Language Processing (NLTK)
- Data analysis (Numpy, Pandas, Matplotlib)
- Machine Learning (FastAi, PyTorch, Keras)
- Scientific computing (SciPy)
- Games (Pygame)
- Procedural generation - L Systems, Noise, Markov



Ask Is Anything!



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THANK YOU!

(Again!)