

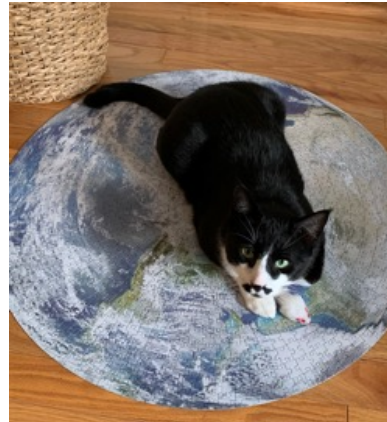
CompSci 201, First Day

What is Computer Science?

Introductions: Professor Fain



I **teach** algorithms (201, 330, 333) and data science.



My **research** is in the theory of algorithms, especially for problems in algorithmic game theory, multi-agent AI/ML, and algorithmic fairness.

More Introductions: The Teaching Team

- Co-Instructor: Kate O'Hanlon



- Undergraduate Teaching Assistants: Many! Will add pictures and names to website.

- Graduate Teaching Assistants:

- Rajas Pandey



and Han Gao



Who are you? What do you think about computer science?

Let's WOTO (WOrk TOgether)

Go to duke.is/4gy82
or scan the QR code



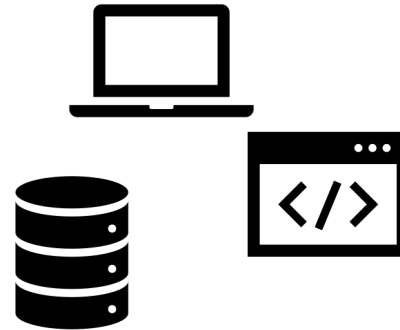
What is computer science?

Computers are machines...

That execute algorithms...

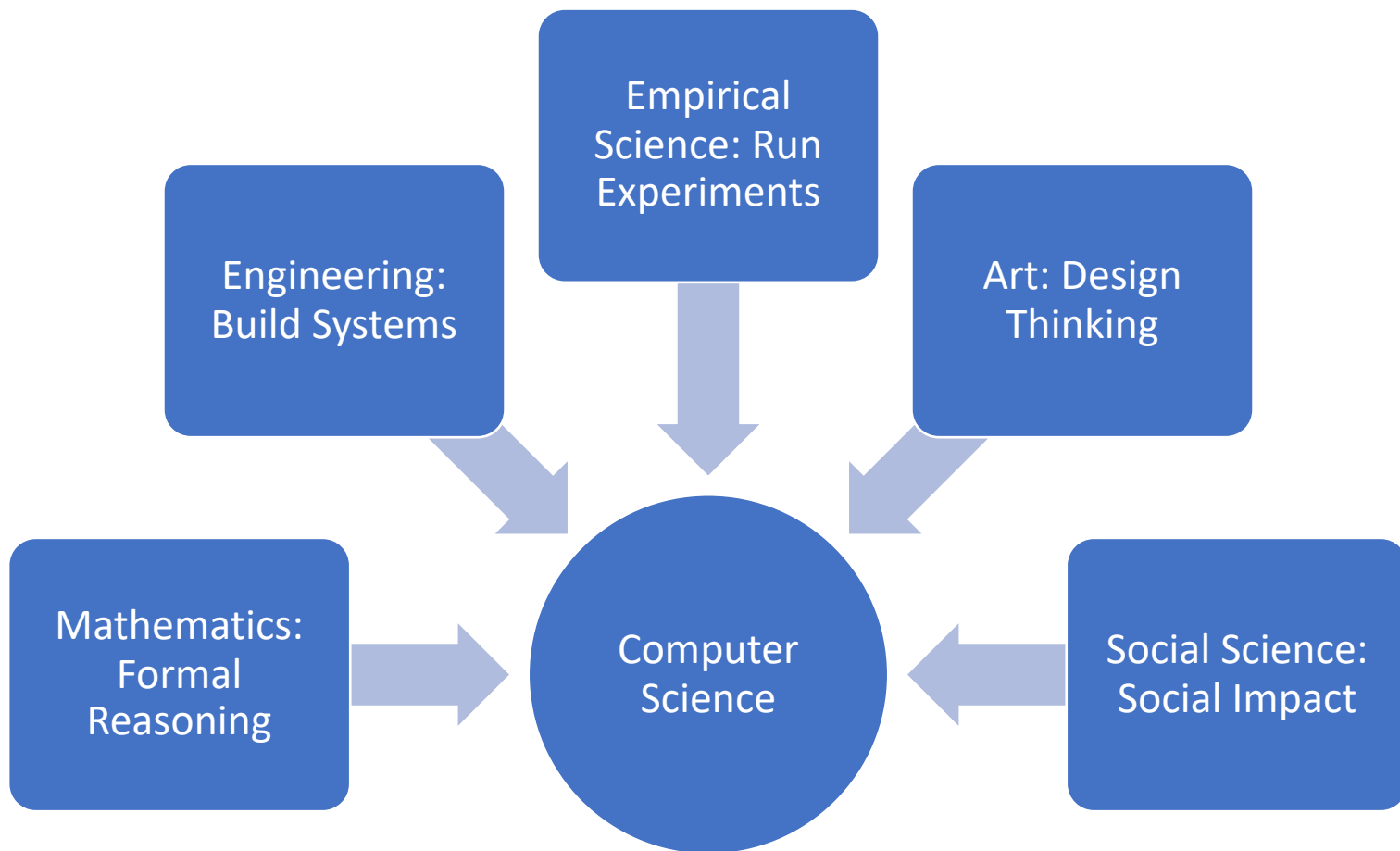
Using data...

To do...something?.



Computer Science is the systematic study of computer systems, algorithms, data, and applications/impacts.

Computer science is interdisciplinary.



Computer science in the real world?

amazon



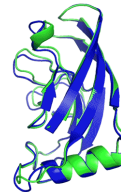
Google



NETFLIX

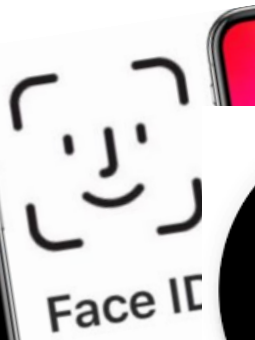


T1037 / 6vr4
90.7 GDT
(RNA polymerase domain)



T1049 / 6y4f
93.3 GDT
(adhesin tip)

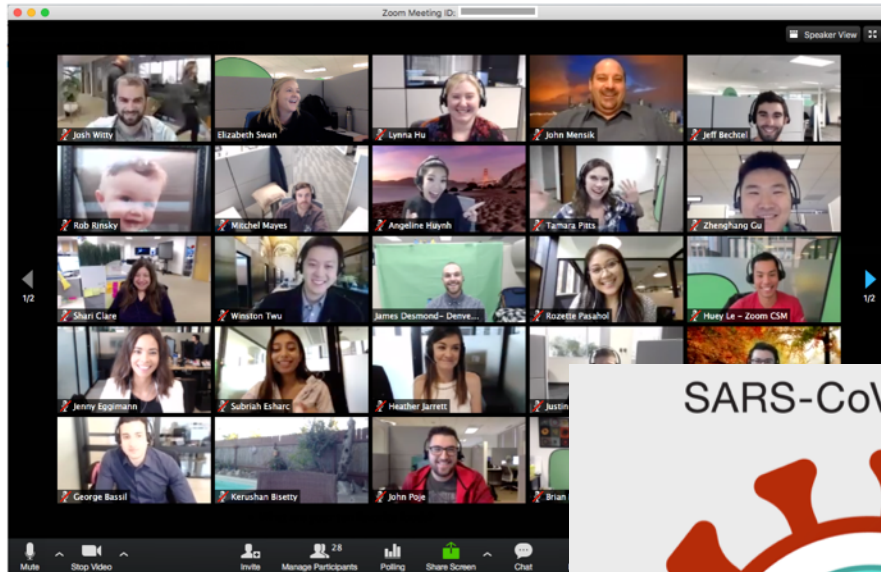
● Experimental result
● Computational prediction



Uber



What does computer science make possible?

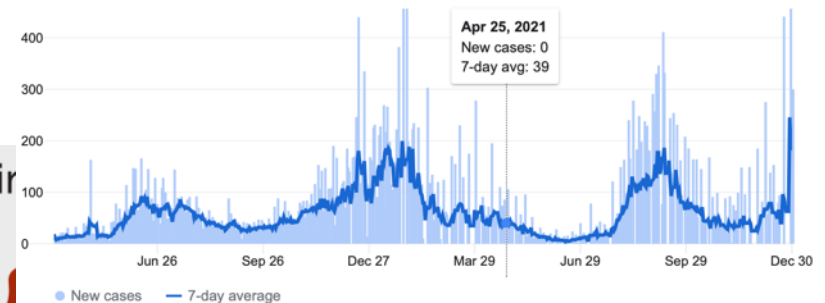


Statistics

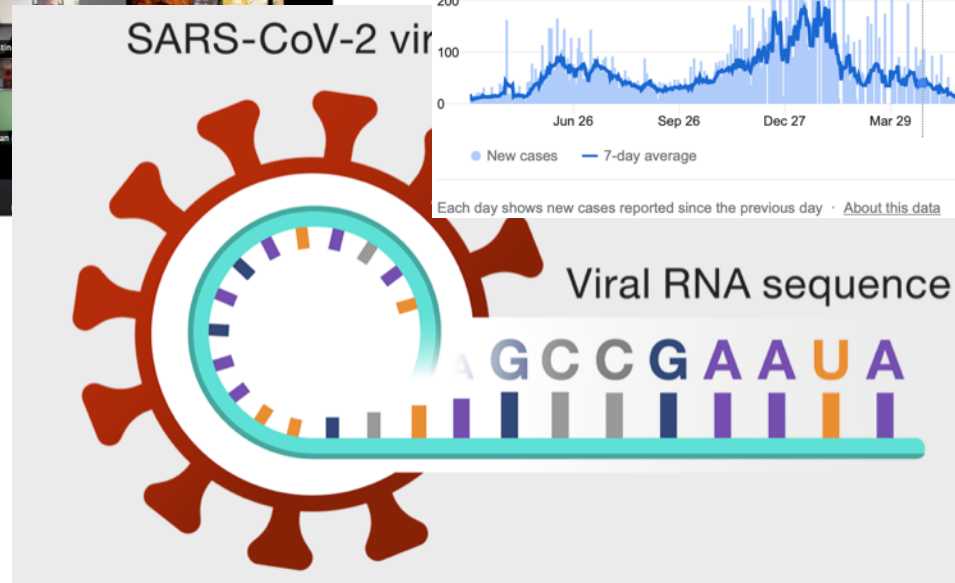
New cases Deaths

From [The New York Times](#) · Last updated: 23 hours ago

United States North Carolina Durham County All time



Each day shows new cases reported since the previous day · [About this data](#)



Why computer science?

“Our species needs, and deserves, a citizenry with minds wide awake and a basic understanding of how the world works.”

- Carl Sagan



Who is CS?

Person in CS: Latanya Sweeney

As Professor of Government and Technology in Residence at Harvard University, my mission is to create and use technology to assess and solve societal, political and governance problems, and to teach others how to do the same.



Former CTO of the FTC,
First African-American Woman to earn CS PhD from MIT (2001)

Person in CS: Latanya Sweeney

I am a computer scientist with a long history of weaving technology and policy together to remove stakeholder barriers to technology adoption.

My focus is on "computational policy" and I term myself a "computer (cross) policy" scientist. I have enjoyed success at creating technology that weaves with policy to resolve real-world technology-privacy clashes.



Lies we tell ourselves

“Computer science is only for people who want to work in software engineering at tech companies.”

“Computer science is only for people who want to program for 8+ hours a day.”

“Some people are just ‘natural’ computer scientists.”

“If I struggle with computer science, it means I’m bad at this and will always be bad at this.”

Truths that bear repeating

Computer science often goes best when paired with other interests, in and out of “big tech.”

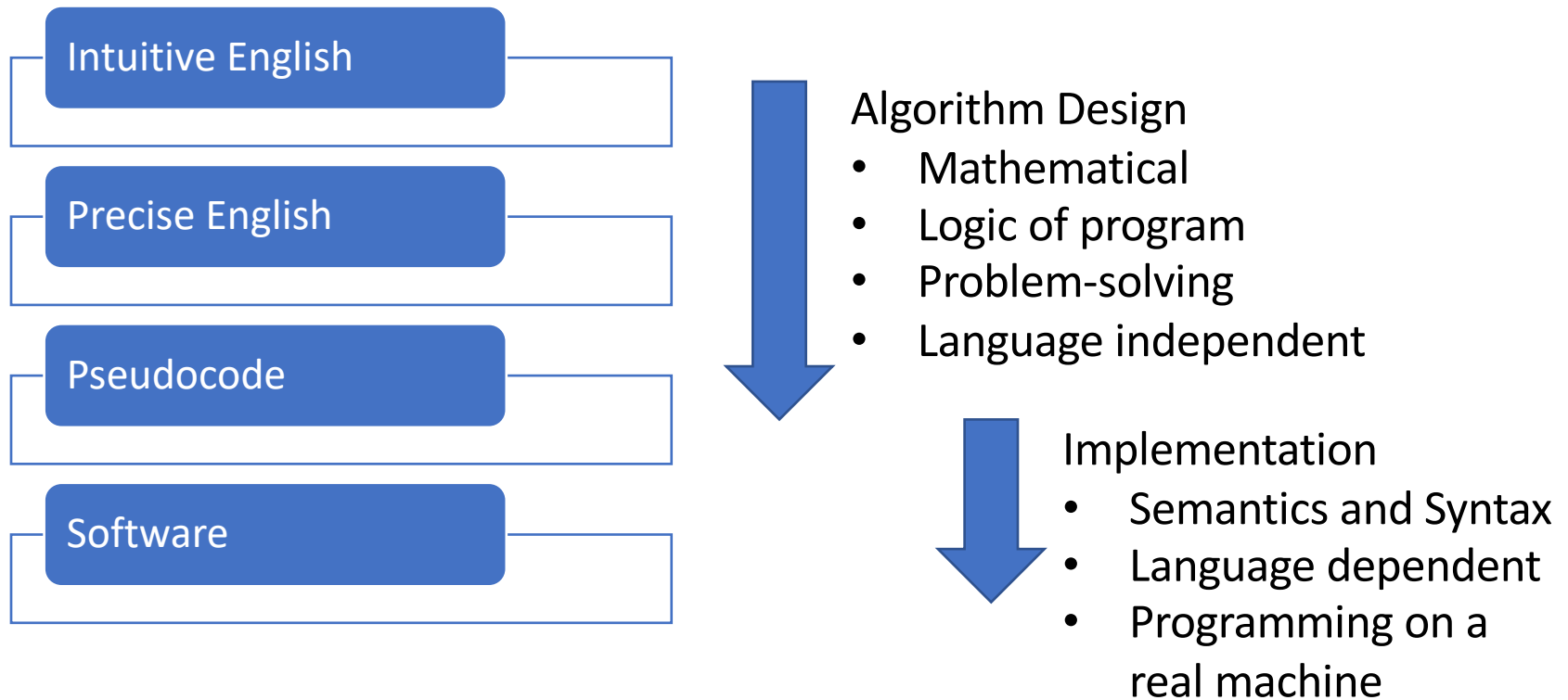
Computer science is a *fascinating* and *relevant* thing to learn, even if you don't want to code full-time.

Anyone can learn computer science! It's challenging, but not more so than mastering any other discipline.

Challenge is part of learning; remember that your future self will be more skilled than you can currently imagine.

What are algorithms?

Loosely speaking: A precise sequence of unambiguous steps that effectively compute an output given an input.



What is code?

In order to execute an algorithm on a real computer, we must write the algorithm in a formal language. An algorithm so written is a **program**.

In this class we explore both:

Theory

- Design an algorithm
- Analyze performance
- Data structure tradeoffs

Practice

- Write a Java program
- Debug/test
- Measure performance

What are data structures?

Different data structures store different kinds of information in different ways, with algorithmic tradeoffs.

Often relates to how **efficiently** you can access or transform data during the operation of a program. For example, in Java:

- **Array**: Stores a *fixed* number of entries of a single type (e.g., integers). Fast lookup (e.g., get value of the 4th entry) and low memory use, but must know total number of entries in advance.
- **List**: Stores a *dynamic* number of entries of a single type. Uses more runtime or more memory than an array.

Why does efficiency matter?

- You wrote the next big social media app:
 - Will it work if it has 1 billion users?
 - What about on a phone with limited memory?
- In the sciences, discovery depends on computing with big data:
 - Sequencing the human genome
 - Surveying millions of images in astronomy
 - Processing data logs from the CERN collider
- Pushing the limits of current technology:
 - Virtual / augmented reality?
 - Deep neural networks for large scale machine learning?

Efficiency? Data Structures?

Live Coding



Learning goals for the course

- Given a problem statement & a real data source, design, develop, debug, and test a Java program that uses appropriate standard libraries to efficiently solve the problem.
- Write programs that effectively implement and use data structures such as: arrays, maps, linked lists, stacks, queues, trees, and graphs.
- Evaluate the time and space complexity of iterative and recursively-defined algorithms using empirical and mathematical analysis.

Some specifics you will learn

Data Structures

- Arrays
- Lists: ArrayList and LinkedList
- Sets: HashSet and TreeSet
- Maps: HashMap and TreeMap
- Stacks, Queues, Priority Queues / Heaps
- Trees: Binary Search Trees
- Graphs

Software

- Java API
- Objects, Classes

Algorithms

- Iterative
- Hashing
- Big O Asymptotic Analysis
- Recursive
- Sorting
- Greedy

- Interfaces, inheritance
- Testing, Debugging

Expected background for the course

- Introductory programming experience at the level of Computer Science 101 or equivalent.
- Following should be familiar:
 - source code, development environment, running code
 - integers, floats/doubles, characters, strings
 - printing and output
 - if/else statements and conditions
 - iteration with For/While loops
 - functions/methods, parameters, arguments, returns
 - debug your program

Do I need to know Java?

Java experience helpful but not required.

- Many of you studied Java
- Many of you never studied Java

This course about data structures and algorithms.

- We will implement them in Java,
- and you will learn about Java,
- but we could have used a different language.

What if I am new to Java?

[Website Setup and Resources Page](#)

- Will spend the next couple of classes and the first APTs and project reviewing introductory Java, but not a full course!

Want more resources?

- “Java from Python Resources” section on webpage
 - Optional chapters 1-7 of ZyBook
 - Free online [“Java4Python” extended intro to Java](#)
 - And get help! More on Ed and helper hours later.

Informal goals for the course

- Make or deepen a friendship with someone else passionate about computer science.
- Develop a new appreciation of computing phenomena you see in the real world.
- Experience joy when your program *works*, even if it took a while to get it there.
- WOTO: WOrking TOgether

Some Administrivia

Compsci 201 Website

All material online, accessible from the website
cs.duke.edu/courses/fall22/compsci201

which redirects to ...

sites.duke.edu/compsci201s23/

Or you can see it embedded on the Sakai overview.

Setup & Resources

- ZyBook: Online interactive textbook
 - Reading schedule on course website schedule
- Java 17 Open JDK
 - Programming language for the course
- Visual Studio Code (VS Code) + Extensions
 - Development environment, edit and run code
- Git
 - Version control + use for project submission workflow

Follow directions from the [website setup and resources page](#) to get started as soon as possible.

Install Fest

- Need/want help in-person for setup and installation?
- Where: [Duke Technology Engagement Center \(TEC\)](#)
- When:
 - January 12, 1 - 7 pm
 - January 13, 10 am - 3 pm
 - January 17, 1 - 7 pm

Assignments and Grades

Large multi-file programming projects; explore object-oriented programming and algorithmic tradeoffs.

3 midterms and final exam

Small programming practice problems

Programming quiz with small problems

Participation and forms during lecture and discussion

Exams	45%
Projects	30%
APT Quizzes	8%
APTs	7%
Discussion	5%
In Class WOTO Questions	5%

Getting Technical Help

[Website Getting Help page](#)

- Ed Discussion: (linked from Sakai)

ed COMPSCI 201 Sp22 – Discussion

- Helper/Office Hours: Sunday-Thursday evenings, drop-in via zoom. Starting next week.

- OIT Co-lab: Drop-in tech support (Java, Git, etc.)

colab.duke.edu/resources

Attendance Policy

[Course website policies page](#)

Generally expected, in-person.

- Can miss 6 lectures and 3 discussions with no penalties, no questions asked.
- Do not need to do anything for this, please do not email/STINF when you need to miss a class.
- Up to you to manage within this, we do not track excuses.

Late Work

[Course website policies page](#)

[Course website assignments and grades page](#)

- Assignments (APTs and Projects) have a grace period and then are accepted late with penalty.
- Sometimes there are extenuating circumstances: We will drop the lowest project and 2 APTs. This is automatic, you don't need to do anything or ask.
- No extensions beyond this built-in flexibility, and we don't track excuses.

Collaboration Policy

[Course website policies page](#)

Exams, APT Quizzes: **NONE**

Projects, regular APTs: Discuss ideas, but **the code must be your own.**

- Help each other out, discuss problems and ideas
- Do not directly share code with other students
- Do not write the code line by line together
- Don't deprive yourself or anyone else of the chance to learn by just telling someone the answer

What about taking code from the internet? chatGPT said it best:

BT

Do you think students should use chatgpt to do their homework?



I am an AI model and do not have personal opinions or preferences. However, I can tell you  

that using a tool like me or GPT-3 (chatGPT) to generate text or complete homework assignments is not recommended. This is because using such a tool would be considered plagiarism, as the work being submitted is not the student's own original work.

Additionally, homework and other assignments are designed to help students learn and develop their skills, so using a tool like me would not give the student an opportunity to gain the knowledge and understanding that is the main objective of the assignment.

Additionally, using such AI model to complete homework assignments could be counter-productive to the educational process, it is important to complete assignments on their own and ask questions to the teachers when the student have doubts. This way the student will have the opportunity to learn the material and develop their skills, rather than just relying on a tool to do the work for them.

What to do this week

- Go to [website setup and resources page](#)
 - Start setup/installation
 - Get the ZyBook
 - Start reviewing introductory Java as needed (chapters marked optional)
- See you at...
 - Class *next* Wednesday: Intro Java
 - (No class Monday for MLK Jr. Holiday)