Learning goals

Technical Skepticism

Multiple Representations

"I think you should be more explicit here in step two."
The team - instructor

• Prof. Shachar Lovett

• A bit about me: I study algorithms, how to make them run faster, and why sometimes we cannot (complexity theory)
The team - TAs

- Yihang Cheng
- Yuanjun Huang
- Gaurav Mahajan
- Ritwik Vatsyayan
The team - tutors

- Nirmal Agnihotri
- Benny Cai
- Rachel Cai
- Stefanie Dao
- Yinxuan Du
- Roger Ji
- Ethan Lan
- Yiming Zhao
Logistics

Weekly activities:
Pre-class reading + Class + Discussion Section + Reading quizzes + Homework

Textbook: Rosen 7th Edition other editions ok; on reserve

Exams
2 Midterms
Final

Website: Lecture slides, homework
Canvas: reading quizzes
Gradescope: Homework submission, HW & exam return
Piazza: Q&A and discussion
Office hours: instructor, TAs and tutors
Grading

• All exams are asynchronous, within a 24-hour window
• Final: 30%
• Midterms: 30%, best out of 2
• Homework: 30%, can be done in groups, challenging!
• Reading quizzes: 10%, individual, easier
Tools

- Live demonstration!

- **Website:** [https://cseweb.ucsd.edu/classes/fa20/cse20-a/](https://cseweb.ucsd.edu/classes/fa20/cse20-a/)
  (even though this class is now cse20-b, we still use the original URL; the cse20-b one points to the cse20-a one)

- **Piazza:** [https://piazza.com/class/kfisjnv0it35d5](https://piazza.com/class/kfisjnv0it35d5)

- **Gradescope:** [https://www.gradescope.com/courses/192406](https://www.gradescope.com/courses/192406)

- **Canvas:** [https://canvas.ucsd.edu/courses/20941](https://canvas.ucsd.edu/courses/20941)
Class structure

• First two weeks: exploring **examples**
  • Netflix ratings and machine learning
  • RNA and DNA: genomics and bioinformatics
  • Codes: secret messages and error correction
  • “Under the hood” of computers (e.g. circuits, color representation, data structures)

• Rest of the quarter: learning the **math language** needed to understand these
I don’t know if you noticed…

• But I have a strong accent
• Nothing I can do about it, but it might make it harder for you to understand me (in particular as the topics we learn will be new to you)

BUT:
• Educational research shows that students who have a professor with a strong accent actually learn better (maybe because they need to focus more)

• Lectures are recorded, so you can always go back watch them

• If you don’t understand something, don’t wait – come to office hours. Sometimes one small clarification can make all the difference.
Introductions

I try not to make fun of people for admitting they don't know things.

Because for each thing "everyone knows" by the time they're adults, every day there are, on average, 10,000 people in the US hearing about it for the first time.

- Fraction who have heard of it at birth = 0%
- Fraction who have heard of it by 30 = 100%
- US birth rate = 4,000,000/year
- Number hearing about it for the first time = 10,000/day

If I make fun of people, I train them not to tell me when they have those moments. And I miss out on the fun.

"Diet Coke and Mentos thing? What's that?"

"Oh man! Come on, we're going to the grocery store. Why? You're one of today's lucky 10,000."
Today's learning goals

- Practice with some **definitions** and **notation**

- Explore mathematical **definitions** related to a specific **application** (Netflix)
What data should we encode about each Netflix account holder to help us make effective recommendations?
n-tuples, preferences, and Netflix

\[ (x_1, x_2, x_3) \quad \text{The 3-tuple of } x_1, x_2, \text{ and } x_3 \]
\[ (3, 4) \quad \text{The 2-tuple or ordered pair of 3 and 4} \]

<table>
<thead>
<tr>
<th>Person</th>
<th>Fyre</th>
<th>Frozen II</th>
<th>Picard</th>
</tr>
</thead>
<tbody>
<tr>
<td>(P_1)</td>
<td>(\times)</td>
<td>(\bullet)</td>
<td>(\checkmark)</td>
</tr>
<tr>
<td>(P_2)</td>
<td>(\checkmark)</td>
<td>(\checkmark)</td>
<td>(\times)</td>
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<tr>
<td>(P_3)</td>
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<td>(\checkmark)</td>
<td>(\checkmark)</td>
</tr>
<tr>
<td>(P_4)</td>
<td>(\bullet)</td>
<td>(\times)</td>
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\(\times\) Did not like
\(\bullet\) No preference
\(\checkmark\) Liked
n-tuples, preferences, and Netflix

An $n$-tuple is represented by $(x_1, x_2, x_3)$, which stands for the 3-tuple of $x_1$, $x_2$, and $x_3$. The 2-tuple or ordered pair of 3 and 4 is $(3, 4)$.

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<tbody>
<tr>
<td>$P_1$</td>
<td>×</td>
<td>●</td>
<td>✓</td>
<td>$(-1, 0, 1)$</td>
</tr>
<tr>
<td>$P_2$</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>$(1, 1, -1)$</td>
</tr>
<tr>
<td>$P_3$</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>$(1, 1, 1)$</td>
</tr>
<tr>
<td>$P_4$</td>
<td>●</td>
<td>×</td>
<td>✓</td>
<td></td>
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- Did not like: represent with -1
- No preference: represent with 0
- Liked: represent with 1
How similar are people’s preferences?

Which of $P_1$, $P_2$, $P_3$ has movie preferences most similar to $P_4$?

A: P1
B: P2
C: P3
D: There is a tie

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One approach: functions

function definition $f(x) = x + 4$

function application $f(7)$

$\begin{align*}
  f(z) \\
  f(g(z))
\end{align*}$

Define $f$ of $x$ to be $x + 4$

$f$ of 7 or $f$ applied to 7 or the image of 7 under $f$

$f$ of $z$ or $f$ applied to $z$ or the image of $z$ under $f$

$f$ of $g$ of $z$ or $f$ applied to the result of $g$ applied to $z$

Page 2 of worksheet:

This page has some useful notation that will be used throughout the course. Find the definitions for each of these terms by looking in the index of the course textbook.
Define the following functions whose inputs are ordered pairs of 3-tuples each of whose components comes from the set \{-1, 0, 1\}

\[
d_1\left((x_1, x_2, x_3), (y_1, y_2, y_3)\right) = \max_{1 \leq i \leq 3} |x_i - y_i|
\]

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<td>×</td>
<td>✓</td>
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\[
d_1(P_4, P_1)
\]

roster method \{43, 7, 9\} The set whose elements are 43, 7, and 9
Define the following functions whose inputs are ordered pairs of 3-tuples each of whose components comes from the set \{-1, 0, 1\}.

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\[
d_2((x_1, x_2, x_3), (y_1, y_2, y_3)) = \sqrt{\sum_{i=1}^{3} (x_i - y_i)^2}
\]

\[
d_2(P_4, P_1)
\]
Define the following functions whose inputs are ordered pairs of 3-tuples each of whose components comes from the set \{-1, 0, 1\}

\[
d_1( (x_1, x_2, x_3), (y_1, y_2, y_3) ) = \max_{1 \leq i \leq 3} |x_i - y_i|
\]

\[
d_2( (x_1, x_2, x_3), (y_1, y_2, y_3) ) = \sqrt{\sum_{i=1}^{3} (x_i - y_i)^2}
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Next Steps

- Read the website carefully
- Make sure you can access canvas, piazza, gradescope
- Pre-class reading for Monday
  - Section 5.3, Definition 1 (Strings), Example 5 (p. 349), and Example 7 (p. 350)