



Welcome
to
CSE 331

Let's do some introductions

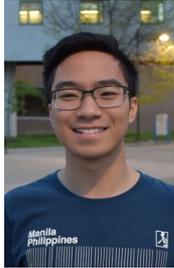


http://www.zazzle.com/warning_teaching_assistant_bag-149882665435161818

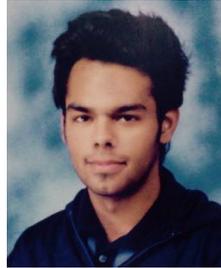
TAs first



Chinmayee



Hans



Sanchit



Priyanka



Elijah



Stephen

Nick



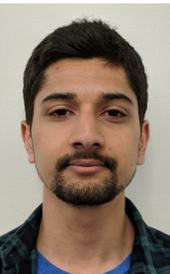
Sean



Rishi



Gitanjali



Supratik



Animesh

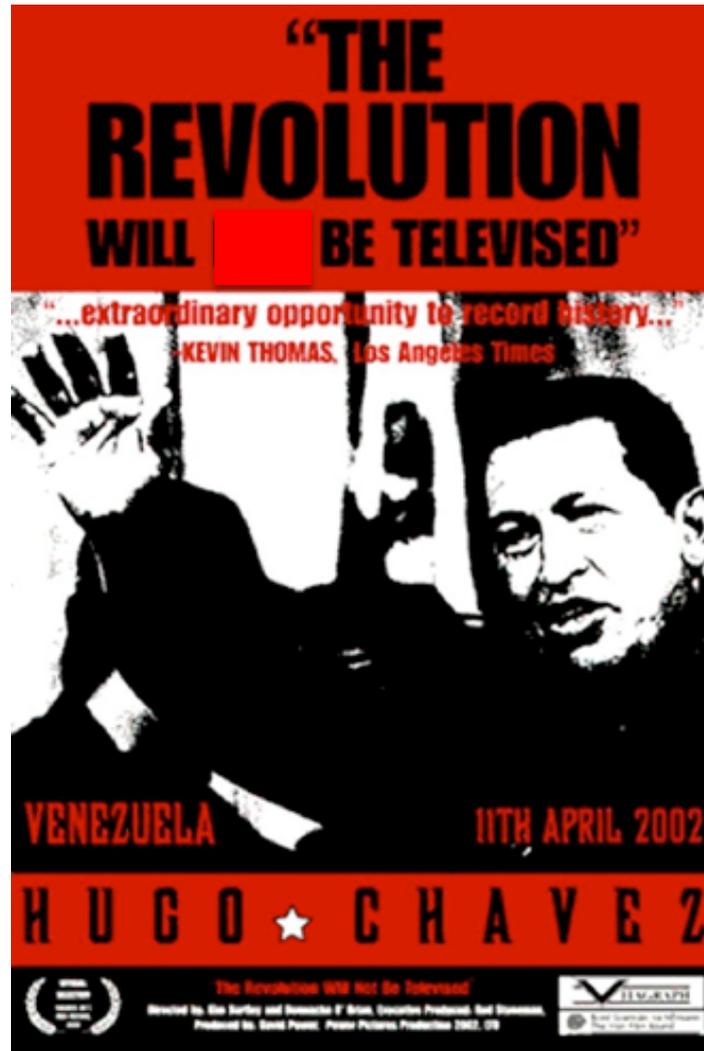


Tom



Veronica

Lectures will be videotaped



About Me

Atri Rudra

atri@buffalo.edu

Office: 319 Davis

Office hours: Mon 2-2:50pm; Wed, 3:00-3:50pm

OH starts today

Contact us all at



Or use piazza!

cse-331-staff@buffalo.edu

TAs will not respond to individual emails (except for re-grading requests)

Handouts for today

Syllabus (online)

Homework Policy document (online)

Homework 0 (online)

One Stop Shop for the Course

CSE 331 [Syllabus](#) [1-on-1s](#) [Piazza](#) [Schedule](#) [Homeworks](#) [Autolab](#) [Mini Project](#) [Support Pages](#) [channel](#)

CSE 331

Fall 2019

<http://www-student.cse.buffalo.edu/~atri/cse331/fall19/index.html>

Under Construction

This page is still under construction. In particular, nothing here is final while this sign still remains here.

One-on-one appointments

See this page for more details on [one-on-one appointments with TAs](#).

CSE 331 events

Today [←](#) [→](#) Aug 18 – 24, 2019 [Print](#) [Week](#) [Month](#) [Agenda](#)

	Sun 8/18	Mon 8/19	Tue 8/20	Wed 8/21	Thu 8/22	Fri 8/23	Sat 8/24
2pm							
3pm							
4pm							
5pm							

Homework 0 (Optional)

Homework 0

Due by **11:00am, Friday, August 30, 2019**.

Make sure you follow all the [homework policies](#).

All submissions should be done via [Autolab](#)

The [support page for matrix vector multiplication](#) could be very useful for this homework.

Submitting HW 0 is optional. However, we do encourage you to submit to get familiar with [Autolab](#) and to get some feedback.

HW 0

Allowed Sources

Homework Policies

Due: this Friday 11am

What is a proof?

The goal of this question is to present a gentle start to proofs. In particular, the idea is to highlight a common mistake students make while writing proofs.

The Problem

Consider the following "proof":

- [Brad Pitt](#) has a beard:
- Every goat has a beard:

Brad Pitt



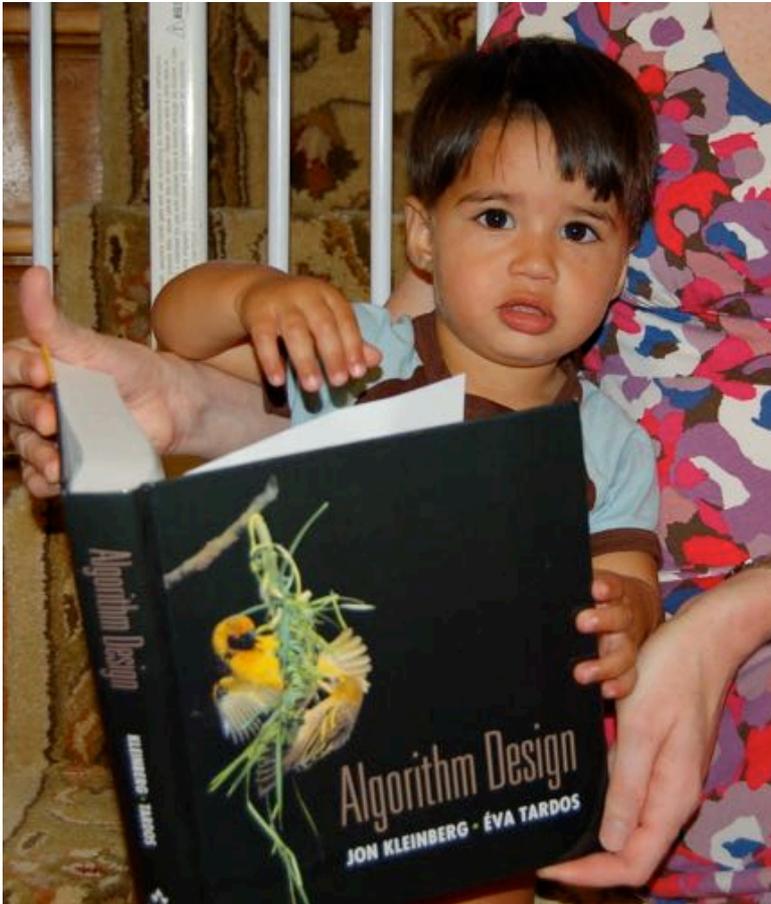
Three things to remember

WORK HARD!

DO NOT CHEAT!

READ CAREFULLY!

Wait.. What???



Make sure you follow submission instructions

Two most common ways
of losing points

Make sure you read problem statements carefully

Academic Dishonesty

All your submissions must be your own work

Penalty:

Minimum: An **grade reduction in course**

Possible: **F** (or higher penalty) if warranted

YOUR responsibility to know what is cheating, plagiarism etc.

If not sure, come talk to me

Excuses like “I have a job,” “This was OK earlier/in my country,” “This course is hard,” etc. **WON’ T WORK**

I DO NOT HAVE ANY PATIENCE WITH ANY CHEATING :
YOU WILL GET A GRADE REDUCTION IN THE COURSE
FOR YOUR FIRST MISTAKE

Read the syllabus CAREFULLY!

Syllabus Quiz

No graded material will be handed back till you pass the syllabus quiz!

Options

[View handin history](#)

[View writeup](#)

[Download handout](#)

 Due: December 12th 2019, 4:05 pm

 Last day to handin: December 12th 2019, 6:05 pm

Academic Integrity

Question 1: Sharing my answers to this syllabus quiz with other 331 students

- Is OK if I do it to help out a friend
- It does not matter since there is no grade attached with it
- Is an academic integrity violation and should not be done
- Is an academic integrity violation but I can take the chance

More information on the quiz

CSE 331 Syllabus

Algorithms and Complexity

Fall 2019

Time and location: **Mondays, Wednesdays and Fridays, 1:00-1:50pm**, [Norton](#) 112.

A Under Construction

This page is still under construction. In particular, nothing here is final while this sign still remains here.

Please note

It is **your responsibility** to make sure you read and understand the contents of this syllabus. If you have any questions, please contact the instructor.

Acknowledgment

Once you have read the syllabus carefully, please fill in the Syllabus quiz on [Autolab](#). As an incentive for you to fill in this form, **you will not receive any feedback on your assignments till you successfully answer AT LEAST 18 out of the 20 questions in the quiz.** (You can attempt the quiz as many times as you want.) Note that in addition to this syllabus, the quiz will also ask questions based on the [homework policies](#).

Autolab

AUTØLAB

You need to sign in or sign up before continuing.

Autolab Homepage

SIGN IN WITH MYUB

<https://autograder.cse.buffalo.edu/>

You can submit the following now

🏠 » CSE331: Algorithms and Complexity (f19)

Assignments

Homework 0

Q1 part (a) [Number of perfect matchings]

Q1 part (b)

Q3 (Structured Matrix Vector Multiplication)

Quiz

Syllabus Quiz

If you were registered by 9am on Monday, Aug 19 you should be on Autolab

Grading break-down

Grading Policy

Here is the split of grades:

Course Component	% of grade
Mini Project	10%
Homeworks	33%
Quizzes	3%
Exams	54%

Pre-requisites

Required (officially)

CSE 250, [CSE 191 or MTH 311] and MTH 142

At least a C-

Required (for practical purposes)

Comfort with proofs

Willingness to work hard!

Accessibility Resources

Information included in the syllabus

In short, let me know and consult with Accessibility Resources

Preferred Name

If you prefer using name diff from UB records

Let me know and we'll make a note of it.

Critical Campus Resources

Sexual Violence

UB is committed to providing a safe learning environment free of all forms of discrimination and sexual harassment, including sexual assault, domestic and dating violence and stalking. If you have experienced gender-based violence (intimate partner violence, attempted or completed sexual assault, harassment, coercion, stalking, etc.), UB has resources to help. This includes academic accommodations, health and counseling services, housing accommodations, helping with legal protective orders, and assistance with reporting the incident to police or other UB officials if you so choose. Please contact UB's Title IX Coordinator at ☎ 716-645-2266 for more information. For confidential assistance, you may also contact a Crisis Services Campus Advocate at ☎ 716-796-4399.

Mental Health

As a student you may experience a range of issues that can cause barriers to learning or reduce your ability to participate in daily activities. These might include strained relationships, anxiety, high levels of stress, alcohol/drug problems, feeling down, health concerns, or unwanted sexual experiences. Counseling, Health Services, and Health Promotion are here to help with these or other issues you may experience. You can learn more about these programs and services by contacting:

Counseling Services

- 120 Richmond Quad (North Campus), ☎ 716-645-2720
- 202 Michael Hall (South Campus), ☎ 716-829-5800

Health Services

Michael Hall (South Campus), ☎ 716-829-3316

Health Promotion

114 Student Union (North Campus), ☎ 716-645-2837

TA Office hours

YOU decide!

 poll ☆ stop following 8 views Actions

TA office hours (YOU decide!)

This is your chance to influence when the TA office hours are scheduled for this semester. Listed below are slots for which a TA is available to host their office hours. (The slots marked with (?) currently do not have any TA available but I'm putting those in case there is a lot of demand and we can look into it.)

Please note that the final office hour slots will depend on the individual TA availability and we might not be able to schedule all the popular slots.

Finally, note that the TA office hours will start from the second week and homeworks will be due by 11am on Fridays.

- Mon, 10:00-10:50am
- Mon, 11:00-11:50am
- Mon, 12:00-12:50pm
- Mon, 3:00-3:50am
- Mon, 4:00-4:50pm
- Mon, 5:00-5:50pm
- Tue, 9:00-9:50am
- Tue, 10:00-10:50am
- Tue, 11:00-11:50am
- Tue, 12:00-12:50pm
- Tue, 1:00-1:50pm
- Tue, 2:00-2:50pm
- Tue, 3:00-3:50pm
- Tue, 4:00-4:50pm
- Tue, 5:00-5:50pm
- Wed, 10:00-10:50am
- Wed, 11:00-11:50am
- Wed, 12:00-12:50pm
- Wed, 2:00-2:50pm
- Wed, 4:00-4:50pm
- Wed, 5:00-5:50pm
- Th, 9:00-9:50am
- Th, 10:00-10:50am

Recitations

Are on for this week!



Please stick to your recitation
section

At least for the first month since all sections are full

Exams

Mid term (two parts)

Mon, **Oct 14** and Wed, **Oct 16**, 2019. Usual place and time.

Final exam

Fri, **Dec 13**, 2018. Norton 112, **12:00-2:30pm**

Things new to HWs in Fall 19

The dreaded Q3 is no more!

It survives as Q2 😊

Q1 worth 50 points

The hard proof based Q2 and programming Q3 worth 25 points each

HWs due by 11:00am on Fridays

Other big change in Fall 18

Mini Project has two parts

As part of your mini-project you will consider societal implications of algorithms in two parts:

1. Make a **video** about ethical implications of an algorithm in real life; and
2. Do a **programming project** that involves making tradeoffs between various choices among which some have ethical dimensions.

See the tabs below for details on the two parts of the mini-project.

1 Acknowledgment

The development of this mini-project (especially the coding component) will be acknowledged.

Video Component

Coding Component

Coding Component

In the video component of the mini project y'all will study the ethical implications of an existing algorithm that has already been used in real life. In the coding component of the mini-project you will be developing and implementing algorithms in a scenario that is heavily influenced by a real life case study.

Your task

Your goal is to solve five programming problems and has to be done in **groups of size UP TO 3**. These will be setup in similar manner to programming question on the homeworks and will be due on [Autolab](#).

How is this different from programming question on the homeworks?

Below we have listed some major ways in which this coding component will be different from programming questions on homeworks:

- First, unlike the HW programming questions, here you can collaborate with others. Also you will be allowed to refer to some external sources (more details forthcoming)

Responsible Computer Science Challenge

With Great Code Comes Great Responsibility

a partnership of

ON OMIDYAR NETWORK

moz://a

SCHMIDT FUTURES

Craig Newmark Philanthropies

Topic Coverage will change

CSE 331 Support Pages -

Background Material
Common Mistakes
Algorithms via Examples
CSE 331 Care Package

CSE 331 Care Package

Starting in Fall 2020, CSE 331 will be assuming more background material was covered in CSE 250 (and CSE 191). In previous incarnations of CSE 331, we would assume a non-trivial coverage of proofs and other related material in CSE 191 and CSE 250. While we make this transition, this page collects materials that were covered in previous incarnations of CSE 331 but will no longer be covered going forward (this also includes material that are not covered in CSE 191/250). We hope that this page is helpful if you took the older version of CSE 191/250 or you took the equivalent courses in another school.

The Topics

Below we collect the topics that we will no longer cover in CSE 331 (but were covered as late as Fall 17 or Fall 18):

- [Asymptotic Notation](#)
- [Trees](#)
- [Topological Ordering](#)
- [Minimizing Maximum Lateness](#)

C++ vs Java/Python

Use Java/Python if as you just as comfortable with as C++

Use a VM with g++ installed for Ubuntu

We recommend that you install a VM that runs `g++` on Ubuntu. In particular, we recommend that you use [Jaric Zola's VM system that he created for his CSE 250 course](#). If you have questions on Jaric's setup, please do **NOT** contact him: email cse-331-staff@buffalo.edu instead.

If you still prefer using your own system, we would still recommend that you test your code in the VM system above before submitting to Autolab.

poll ☆

0 views

Help with installing VM for C++ (special office hours)

If you need some help installing the VM setup for submitting in C++:

<http://www-student.cse.buffalo.edu/~abr/cse331/fall19/autolab.html>

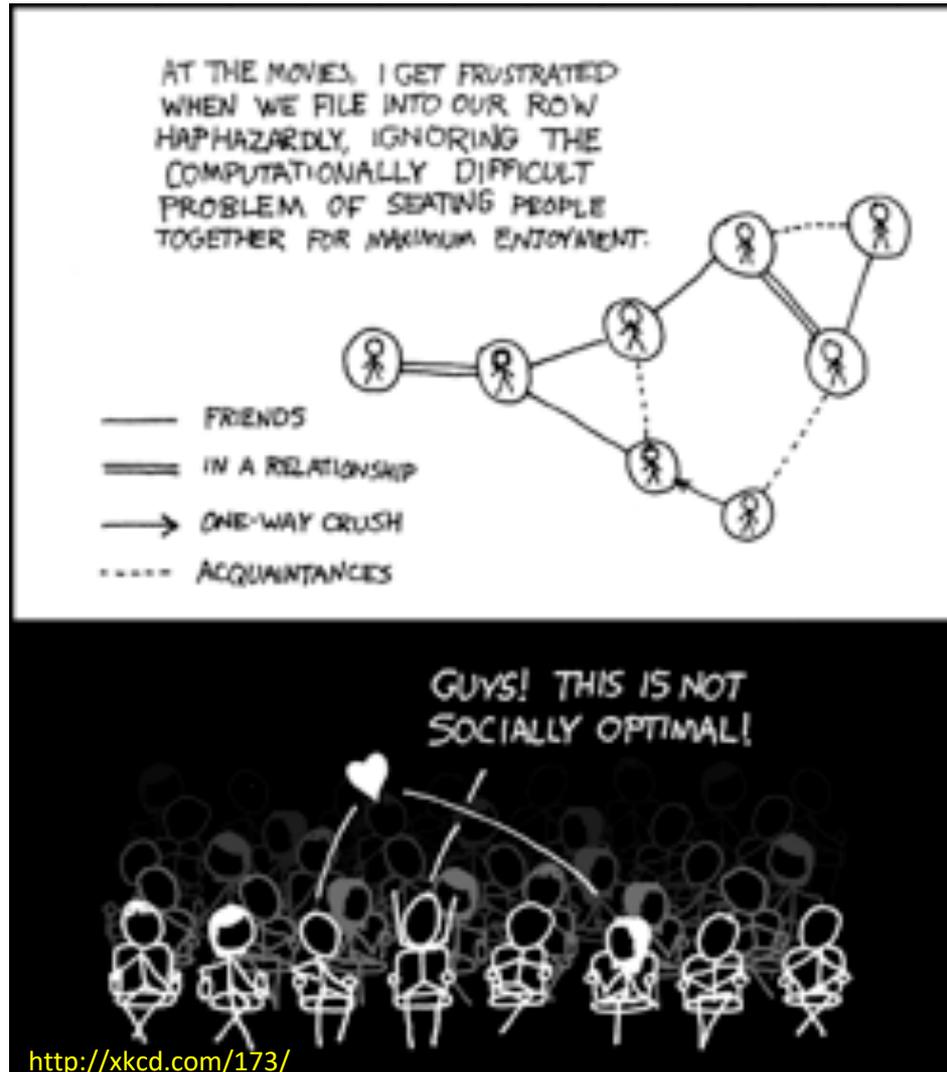
please select the times below that would work for you for some extra office hours. We will pick some of the most popular hour-long slots for Tuesday (August 27) and Wednesday (August 28). I would highly recommend that you try to install the vagrant system before you come to these office hours so that you can use the office hours to get help with trouble-shooting.

These slots are especially meant for transfer students who might not have had much practice working with linux/unix systems and have primarily use Windows as their main OS. Of course, these slots are open to anyone who needs help with this (even if you are not a transfer student!)

Please note that these office hours are just for help in installing the VM to run C++. The regular office hours will start from next week (do not forget to vote for those slots: [@13](#)).

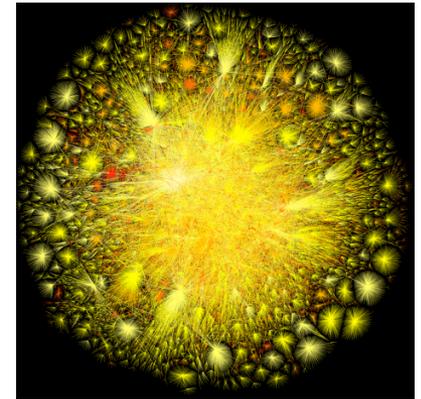
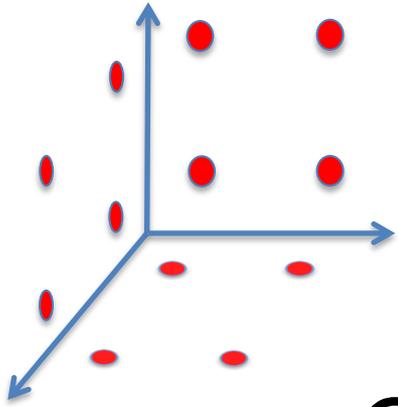
- Tue, 10:00-10:50am
- Tue, 1:00-1:50pm
- Tue, 2:00-2:50pm
- Tue, 3:00-3:50pm
- Tue, 4:00-4:50pm
- Tue, 5:00-5:50pm

This course: how to solve problems!



Why should I care ?





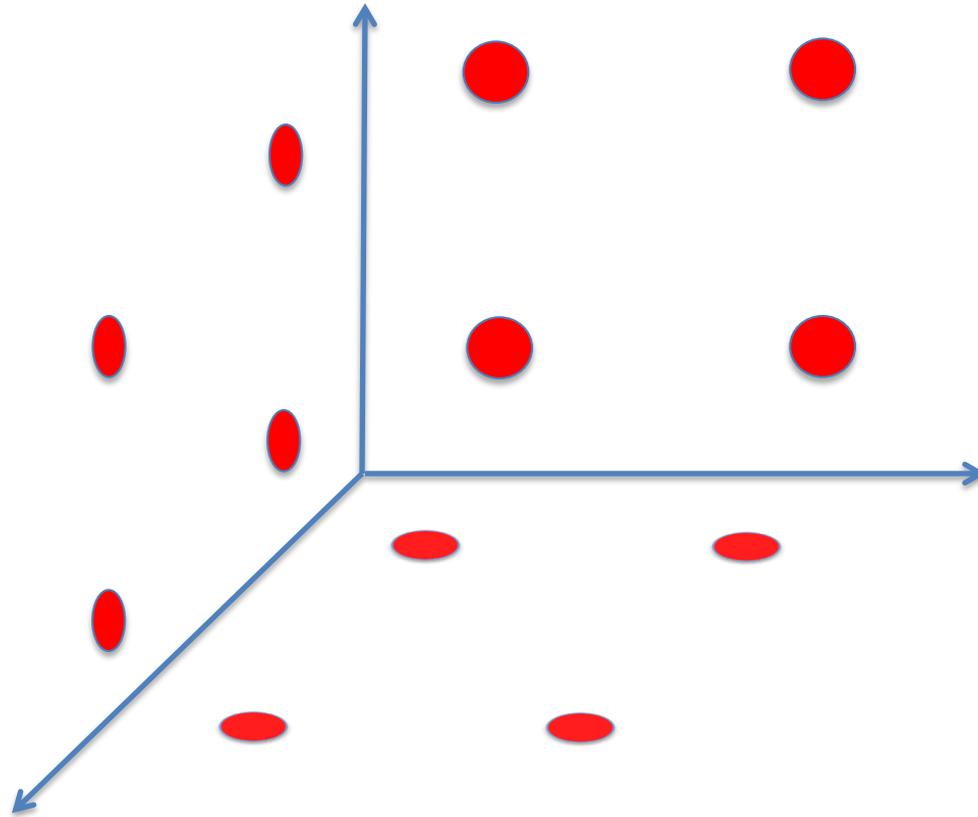
Combining Shadows to Understanding the network



LogicBlox

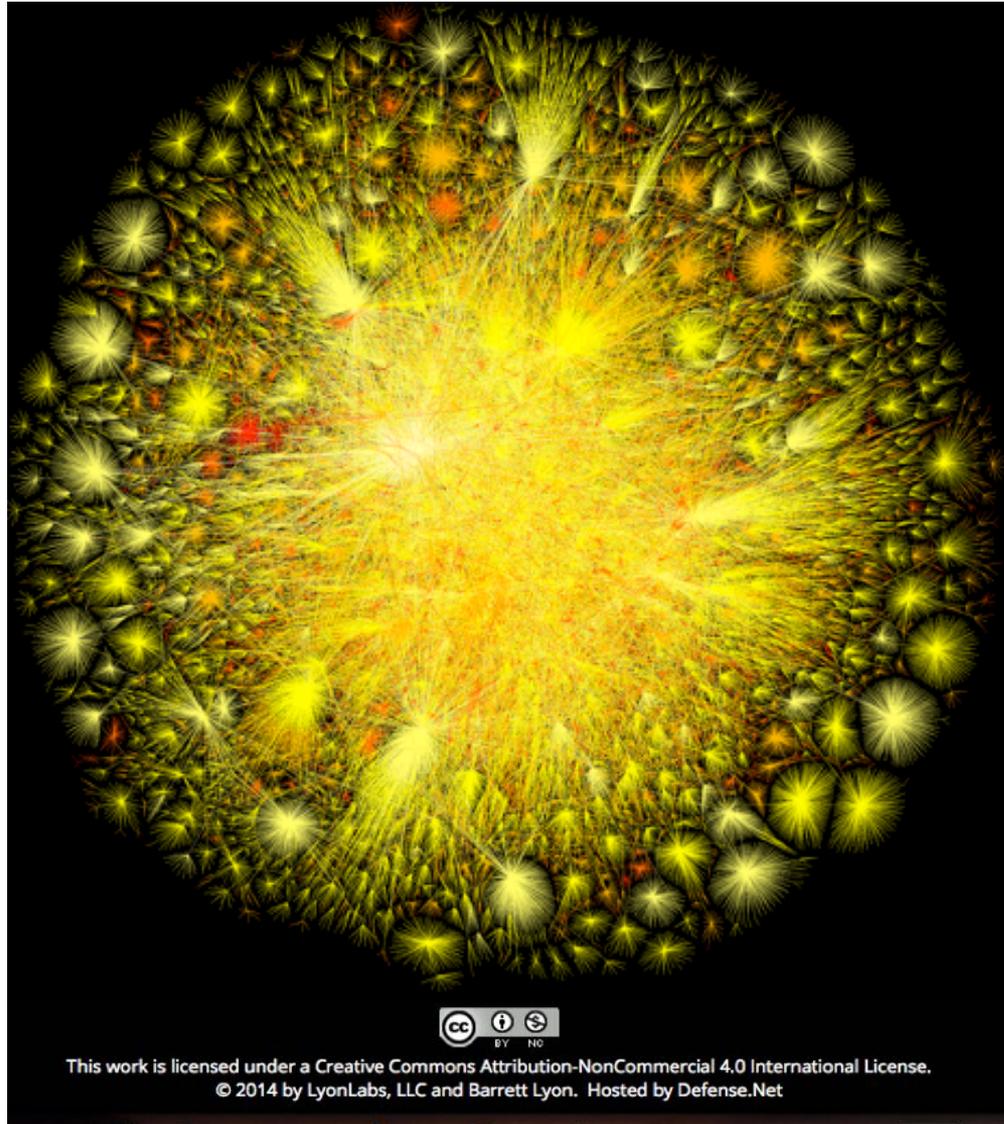
Stanford
University

The key technical problem

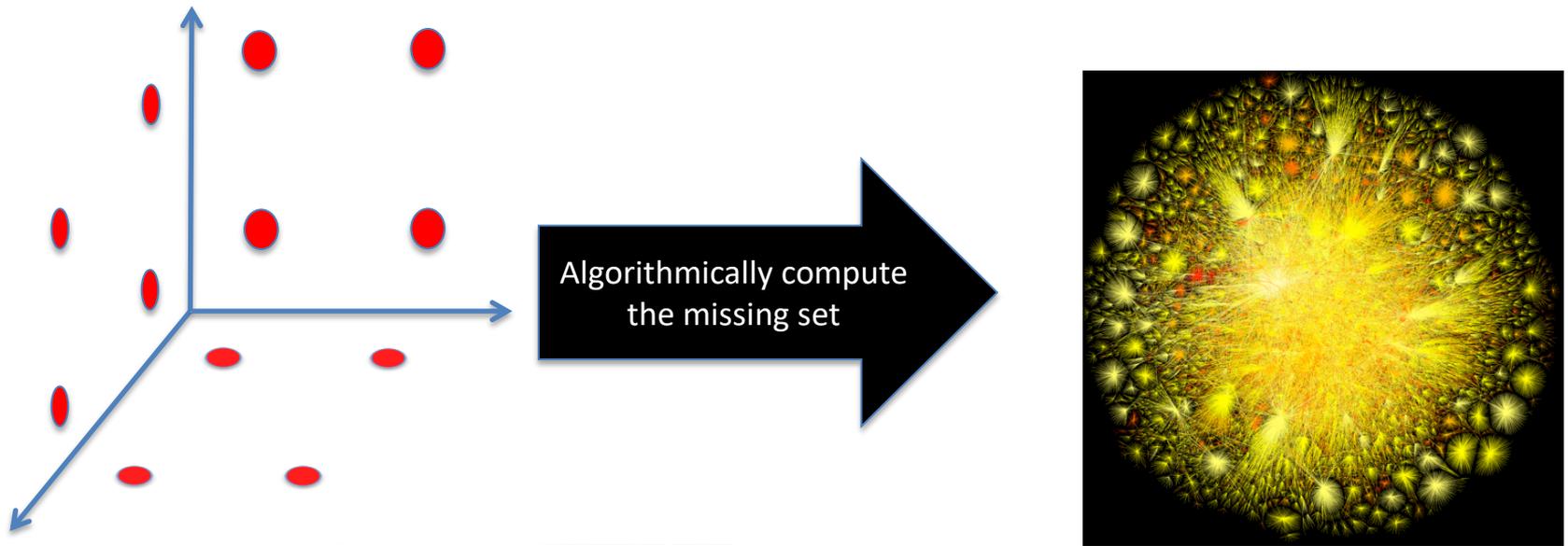


Given the three projections, what is the largest size of the original set of points?

Detecting Communities



Conquering Shadows to Conquering the Internet



The proof is in the performance



EMPTYHEADED

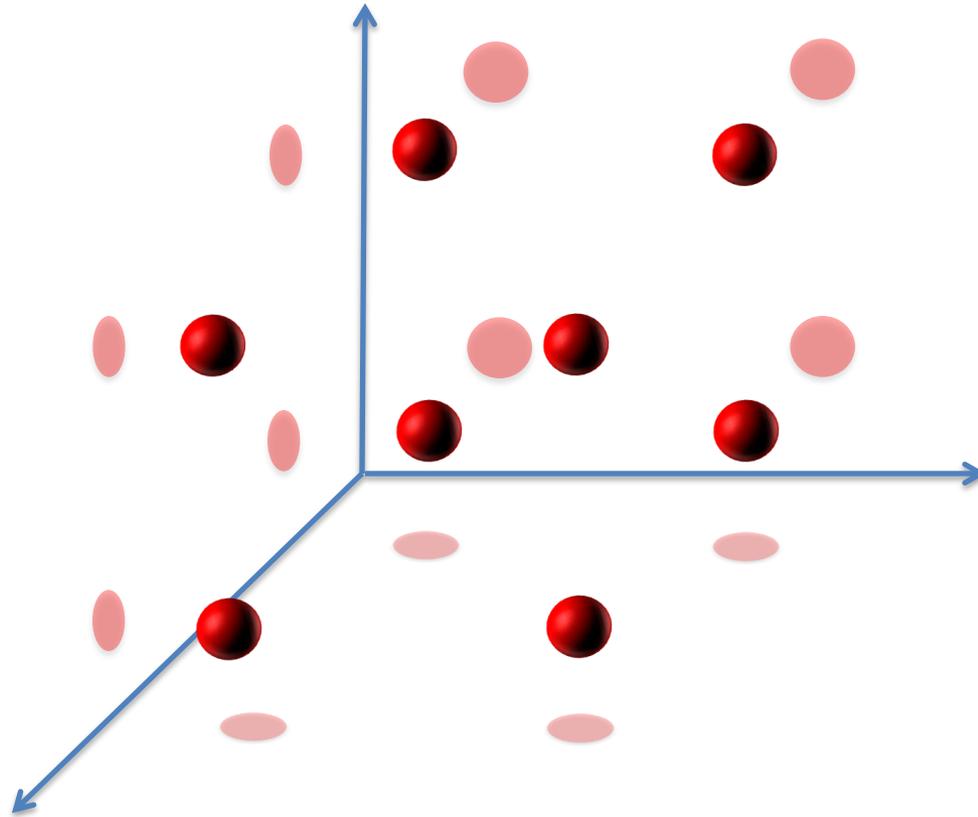


10x faster

A large, thick green arrow pointing from the left towards the right, indicating a comparison or transition.

Better algorithm with little hacking will beat a worse algorithm with tons of hacking

The key technical problem



Highly trivial: $4^3 = 64$

Still trivial: $4^2 = 16$

Correct answer: $4^{1.5} = 8$

If detecting communities is not for
you

Google™

Microsoft®



From someone who got a Google job

“You can let your algorithms class know that the phone interviews are essentially like **a difficult algorithms test.**”

Lots of data structures, specifying the algorithm, analyzing the run time and space requirements... And all on the phone and **you're supposed to talk through your thought process.**”

Coding jobs will be done by AI



stacksort

In a recent [xkcd's](#) alt text, Randall Munroe suggested `stacksort`, a sort that searches StackOverflow for sorting functions and runs them until it returns the correct answer. So, I made it. If you like running arbitrary code in your browser, try it out.

Like (or hate) it? Comment on HackerNews

stackoverflow_sort(

Try a list of numbers, a string, a list of words or json.

);

Sort

var output =

Output from the function.

;

output console

Coding jobs will be done by AI

MIT News

ON CAMPUS AND AROUND THE WORLD

Browse

or

Search



FULL SCREEN



Researchers have developed a flexible way of combining deep learning and symbolic reasoning to teach computers to write short computer programs. Here, Armando Solar-Lezama (left), a professor at CSAIL, speaks with graduate student Maxwell Nye.

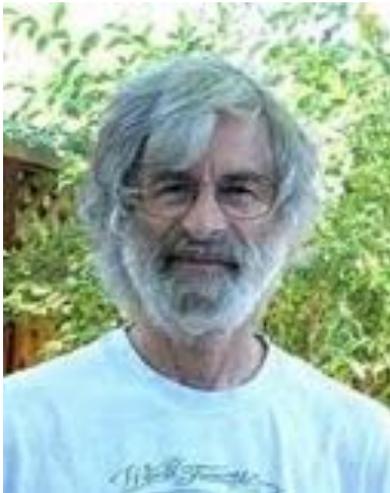
Photo: Kim Martineau

Toward artificial intelligence that learns to write code

Researchers combine deep learning and symbolic reasoning for a more flexible way

So am I doomed?

There will still be room for high level *algorithmic* thinking!



A screenshot of the European Association for Theoretical Computer Science (EATCS) website. The header features a logo on the left, a navigation menu with links for HOME, ABOUT, SEARCH, CURRENT, and ARCHIVES, and the title "European Association for Theoretical Computer Science" in blue. Below the navigation, there is a breadcrumb trail: "Home > No 125: June 2018 > Lamport". The main content area displays the title of an article, "If You're Not Writing a Program, Don't Use a Programming Language", and the author information, "Leslie Lamport, Distributed Computing & Education Column by Juraj Hromkovic, Stefan Schmid".

*Today, programming is generally equated with coding. It's hard to convince students who want to write code that they should learn to think mathematically, above the code level, about what they're doing. Perhaps the following observation will give them pause. **It's quite likely that during their lifetime, machine learning will completely change the nature of programming. The programming languages they are now using will seem as quaint as Cobol, and the coding skills they are learning will be of little use. But mathematics will remain the queen of science, and the ability to think mathematically will always be useful.***

Why care about algorithms?

Web Images Videos Maps News Shopping Gmail more ▾

atrinudra@gmail.com | My Profile | News | Web History | My Account | Help | Sign out

Google maps seattle wa Search Maps Show search options

Get Directions My Maps Print Send Link

Driving directions to Buffalo, NY

I-90 E 3,587 mi 1 day 18 hours

This route has tolls.

Seattle, WA

1. Head southwest on Madison St toward 4th Ave 0.0 mi
2. Take the 1st right onto 4th Ave 0.2 mi
3. Take the 1st right onto Spring St 0.1 mi
4. Turn right onto the I-5 S ramp to Portland 0.9 mi
5. Follow signs for I-90 E/Bellevue/Spokane and merge onto I-90 E 0.7 mi
6. Take exit 510 for US-212 E toward Battlefield/Broadus/Little Bighorn 0.3 mi
7. Turn left at US-212 E 1.06 mi
8. Turn right at US-212 E/Park Ave 0.4 mi
9. Turn right at US-212 BUS 605-85 S 0.4 mi
10. Turn left at S Dakota 34 E 17.9 mi
11. Turn left to merge onto S Dakota 34 E/I-90 E/US-14 E 0.47 mi
12. Take exit 196A to merge onto I-190 E 11.7 mi

seattle wa

© 2008 Google - Map data © 2010 Google Technology, Inc. Report a problem

Driving directions

Why care about algorithms?

The screenshot shows the Amazon.com homepage with a navigation bar at the top. The main content area is divided into two sections: Electronics Bestsellers and Toys & Games Bestsellers. The Electronics section lists three Kindle devices, and the Toys & Games section lists three items: a yellow banana, a toy set with two children, and a bag of colorful candies.

amazon.com Hello, Ash Rathi. We have recommendations for you. (0/2,027)
Ad's Amazon.com Today's Deals Gifts & Wish Lists Gift Cards

FREE Two-Day Shipping for College
Reviewed by Amazon
Your Account Help

Shop All Departments Search All Departments Cart Wish List

Bestsellers Hot New Releases Movers & Shakers Most Gifted Most Wanted For

Any Category:
Amazon Video On Demand
Automotive
Baby
Beauty
Books
Camera & Photo
Cell Phones & Service
Clothing
Computer & Accessories
Electronics
Grocery & Gourmet Food
Health & Personal Care
Home & Garden
Home Improvement
Industrial & Scientific
Jewelry
Kindle Store
Kitchen & Dining
Magazines
Movies & TV
MP3 Downloads
Music
Musical Instruments
Office Products
Patio, Lawn & Garden

Bestsellers
The most popular items on Amazon.com (Updated hourly)

Electronics Bestsellers

1. 26 days in the top 100

Kindle Wireless Reading Device, Wi-Fi, 6" Display, Graphite... Latest Generation by Amazon
2. 28 days in the top 100

Kindle 3G Wireless Reading Device, Free 3G + Wi-Fi, 6" Display, Graphite, 3G Works Globally... Latest Generation by Amazon
3. 24 days in the top 100

Kindle 3G Wireless Reading Device, Free 3G + Wi-Fi, 6" Display, White, 3G Works Globally... Latest Generation by Amazon

[See all bestsellers in Electronics](#)

Toys & Games Bestsellers

1. 712 days in the top 100

2. 2 days in the top 100

3. 112 days in the top 100


Computing Bestsellers on the fly

Why care about algorithms?

Welcome - Already a member? | Sign In | My Itineraries | My Account | Customer Support | Feedback

Home Vacation Packages Hotels Cars **Flights** Cruises Activities DEALS & OFFERS Maps Business Travel

Buffalo, NY (BUF) to Atlanta, GA (ATL)

These results cover a metro area with several airports. Review your choices carefully.

	Mix & Match Airlines	US Airways	Go! from AirTran Airways	Delta	UNITED	Continental
Nonstop	from \$274 \$295 total see below	—	from \$274 \$295 total	from \$283 \$305 total	—	—
1 stop	from \$254 \$293 total see below	from \$254 \$293 total	from \$241 \$373 total	—	from \$282 \$326 total	from \$282 \$326 total

Prices are per person for roundtrip travel; they are e-ticket prices and include all flight taxes and fees. Prices do not include baggage fees or other fees charged directly by the airline.

No Expedia booking fees on flights PLUS you still earn airline miles!

1 Choose a departing flight or view complete roundtrips

Sort by: Price Duration Departure time Arrival time

Roundtrip: from \$254.00 + \$39.80 taxes & fees = \$293.80

6:25 am Depart Buffalo (BUF)
Arrive Atlanta (ATL) 10:39 am
Sun 21-Nov
Duration: 4hr 14min
US Airways 1656 / 29
Connect in Charlotte (CLT)

Don't spend too much on this flight. Book as a package and save up to \$450*. Shop Now

Roundtrip: from \$254.00 + \$39.80 taxes & fees = \$293.80

7:05 pm Depart Buffalo (BUF)
Arrive Atlanta (ATL) 11:27 pm
Sun 21-Nov
Duration: 4hr 22min
US Airways 959 / 1897
Connect in Charlotte (CLT)

Booking cheapest air tickets

Why care about algorithms?

Web Images Videos Maps News Shopping Gmail more ▼



About 176,000,000 results (0.19 seconds) [Advanced search](#)

Everything
More

Any time
Past 2 months
More search tools

[How Does Google Work? Learn How Google Works: Search Engine + AdWords](#) ☆
OMG infographic shows the search process, from indexing right on through to search result ranking & delivery.
[ppcblog.com/how-google-works/](#) - Cached

[Google Technology](#) ☆
How exactly **does Google** manage to find the right results for every query as quickly as ... Building upon the breakthrough **work** of B. F. Skinner, ...
[www.google.com/technology/pigeonrank.html](#) - Cached - Similar

[How Google Works](#) ☆
How **Google Works**. As a company, **Google** focuses on three key areas: Search, ... (See also [How the Google Ad Auction Works](#) or learn more about **Google ads**.) ...
[www.google.com/howgoogleworks/](#) - Cached
+ Show more results from [www.google.com](#)

[How Does Google Work? | SEO Book.com](#) ☆
Jun 30, 2010 ... This image might need updated in the years to come, but it **does** a great job laying out how **Google works** when you type a query into their ...
[www.seobook.com/how-does-google-work](#) - Cached

[How does Google work - PageRank explained | Switch I.T.](#) ☆
How **does Google work** - PageRank explained. Ben Richardson - March 2005. Many people are under the impression that if they create a web site with a catchy ...
[www.switchit.com/news/improve-pagerank.asp](#) - Cached - Similar

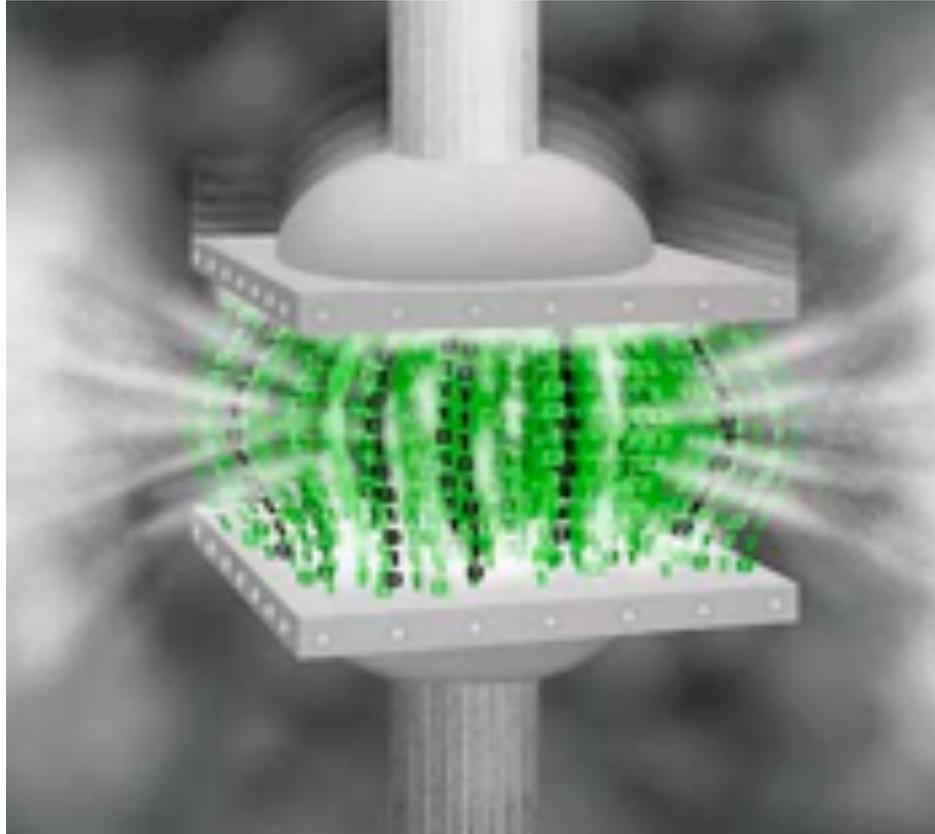
[How Google Works - Google Guide](#) ☆
Feb 2, 2007 ... For more information on how **Google works**, take a look at the following ...
How does Google collect and rank results?, [www.google.com/](#) ...
[www.googleguide.com](#) - Part II: Understanding Results - Cached - Similar

[How Does Google Work](#) ☆
Google is the undisputed king of the search engines. This leads to the question of **how does Google work**?
[www.marketingllan.com/how_does_google_work](#) - Cached - Similar

[Google: How does it work? by Jon Burgess of RedFusion Media](#) ☆

Google searches

Why care about algorithms?



<http://www.di.ens.fr/~cherniav/teaching.html>

Data compression

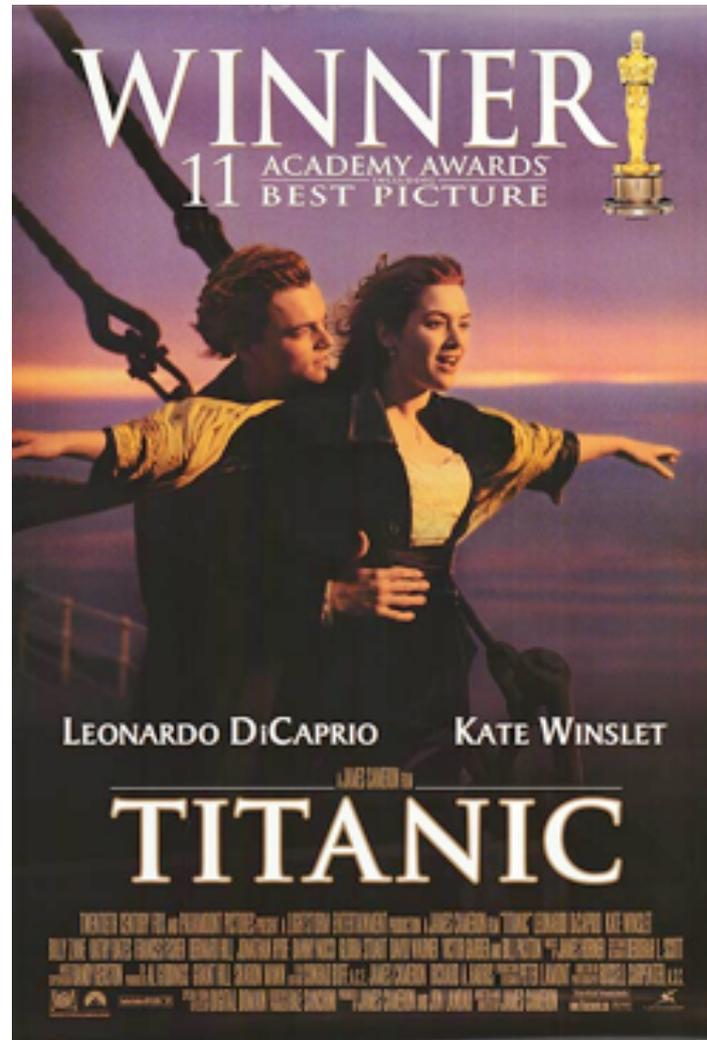
Why care about algorithms?



<http://www.switched.com/2010/02/11/fix-dvd-scratches-using-a-banana-and-toothpaste/> courtesy: Unliggs

Error correction

(And I could) go on...



<http://www.movieposter.com/poster/MPW-33672/Titanic.html>

Find out for yourself

Mini project: Video on ethical impacts of algorithm. Groups of size = 3

CSE 331 Mini Project

Fall 2019

Details and motivations for the mini project.

Under Construction

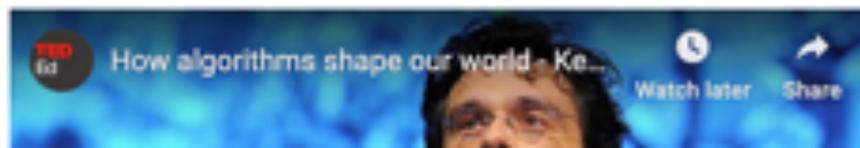
This page is still under construction. In particular, nothing here is final while this sign still remains here.

Motivation

CSE 331 is primarily concerned with the technical aspects of algorithms: how to design them and then how to analyze their correctness and runtime. However, algorithms are pervasive in our world and is common place in many aspects of society. The main aim of the mini-project is to have you explore in some depth social implications of algorithms.

Just to give two examples for such implications:

- Algorithms are pervasive in financial transactions and these algorithms have consequences beyond just trading:



Questions/Comments?



Now about the course

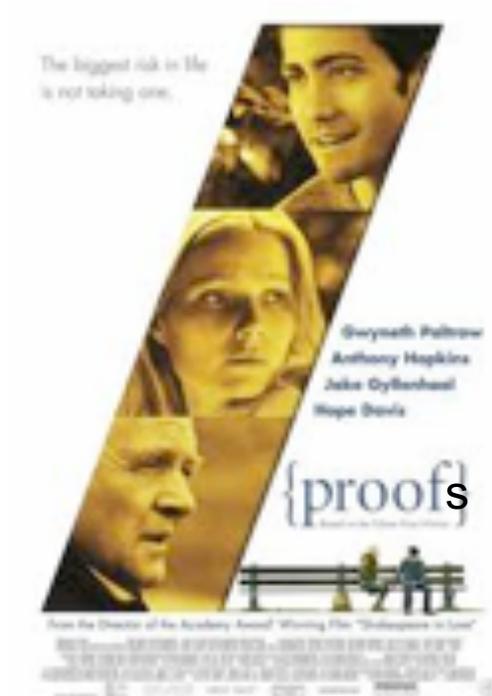


IT'LL BE

HARD

SUSPENSE - EXCITEMENT
ADVENTURE - ON EVERY LEVEL

We'll do loads of



<http://www.impawards.com/2005/proof.html>

Writing down your thought process formally and precisely!

An incorrect “proof”



A more subtle incorrect “proof”

Brad Pitt had a beard



waleg.com

Every goat has a beard



animaldiversity.org

Hence, Brad Pitt is a goat.

Why do proofs?

Makes you think logically about problems and solutions

From a friend who works on Google Maps:

Proving that the algorithm I am implementing is correct helps me identify corner cases

Why should we do proofs?

We will focus a lot on proofs in CSE 331. In this document I will motivate why doing proofs is good even though you might not do proofs for a living. ⇒ While doing this, we will also go through examples of how to write algorithm ideas and details as well as proof ideas and details (which you will need to write in your homework solutions).

Some reasons to do proofs

In this section, I will lay out some reasons why I think it is beneficial for you guys to do proofs. The first two are probably more along the lines of “if you do proofs for a living” situation. The rest of the reasons should be valid for all of you. I will try and make the reasons as concrete as possible: in the next section, we will consider algorithms for the specific problem of generating all permutations (recall that we [previously](#) had punted on designing an algorithm for this problem).

Sometimes you might not have a choice

One of the easiest way to verify an algorithm idea you have is to code up the algorithm and then test it on some (say random) inputs. However, sometimes this might not be a choice. E.g. if you work on [Quantum Computing](#), then you do not have a quantum computer to run your quantum code on! So currently pretty much the only choice you have is to prove that your algorithm is indeed correct. For example, one of the crowning achievements of quantum computing is [Shor's algorithm](#) to compute the factors of large numbers efficiently on a quantum computer (that recall does not exist yet!). (You might also want to read [Scott Aaronson's high level description of Shor's algorithm](#).) The reason why [factoring large numbers](#) is important is that if one can solve this problem efficiently then one can break the [RSA cryptosystem](#). RSA is used everywhere (e.g. when you use your credit card online, RSA is used to make the transaction secure), so this is a big deal.

A common complaint

Your examples in class look nothing like HW questions.

True because....



zazzle.com

False because...

HWs and exams will test your **understanding** of the material

To get an A in the class

Have to get at least 90.000000000000000000000000000000%

Rest graded on the curve

A cautionary tale...

When I was an undergrad

 Took algorithms as a sophomore

Understood all the lectures

Did not study outside of lectures

 (We had no homeworks)

Did decent on the mid-term

Nearly flunked the finals

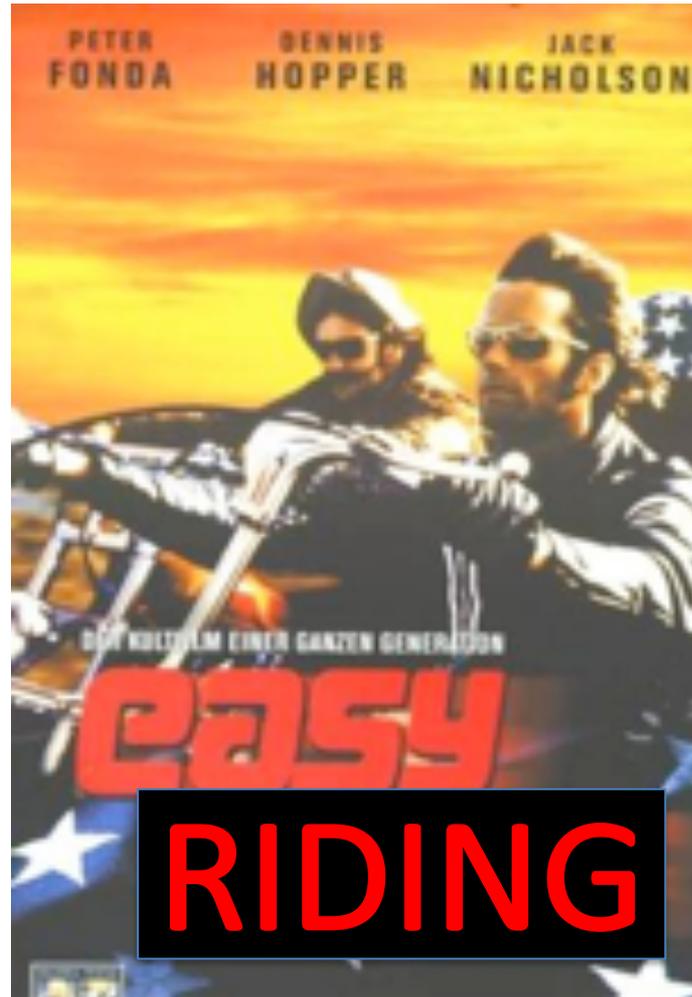
Got a **C**



Questions/Comments?



How we will make 331



What we'll strive to do

Help you with your questions and/or doubts

If need be, email us for time outside of regular office hours

We're not mind readers



If you need it, ask for help



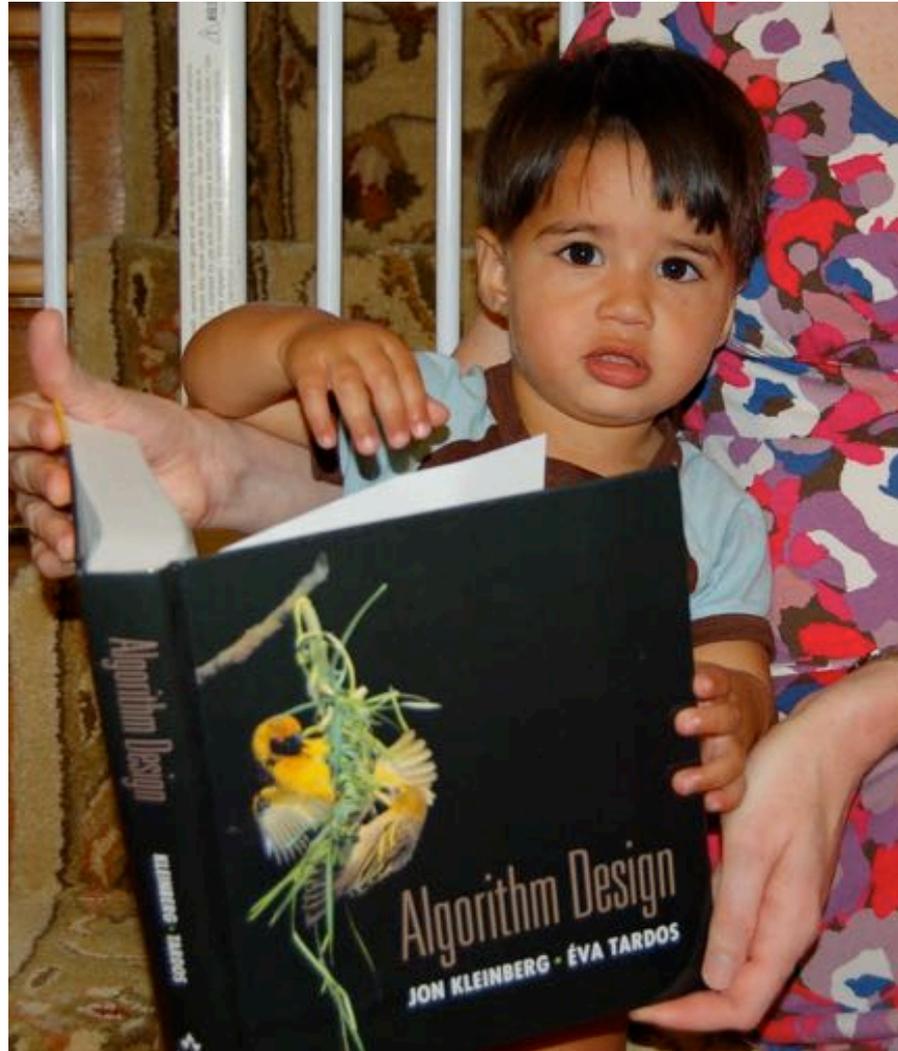
More chances to recover

Lowest three HW scores will be dropped

If you do better on the final exam than the mid-term exam

then only final exam score will count

Follow the Textbook



CSE 331 Support Page

This page contains certain webpages that students taking CSE 331 might find useful.

The material is roughly divided into two parts: one on (primarily mathematical) background material and one of common mistakes that students generally make.

Disclaimer

Please note that this material is intended as a support material. It is not meant as a replacement for actually having taken background courses like CSE 116, 191 or 250 nor is this meant to be exhaustive. I'll try my best to make these as comprehensive as possible but that might take some time.

Background material

CSE 331 will need a fair bit of math: most of which you must have seen earlier. However, if you have not used those material for a bit then you might be a bit rusty. The pages linked below are some notes that I wrote up that might help you refresh the material that you might have seen in CSE 116, 191 or 250. The rest of the

Common Mistakes

Here we collect some common mistakes that students make in CSE 331 material (and sometimes more than once). The hope is to list these common pitfalls so that you can avoid them!

Other Resources

Below we collect other 331 related material that do not neatly fall into the two left category:

- [Visualizing Algorithms](#).

<http://www-student.cse.buffalo.edu/~atri/cse331/support/index.html>

The cautionary tale has a silver lining...



C in undergrad algorithms



Ph.D. in algorithms/complexity

The only way to do well is to work hard

