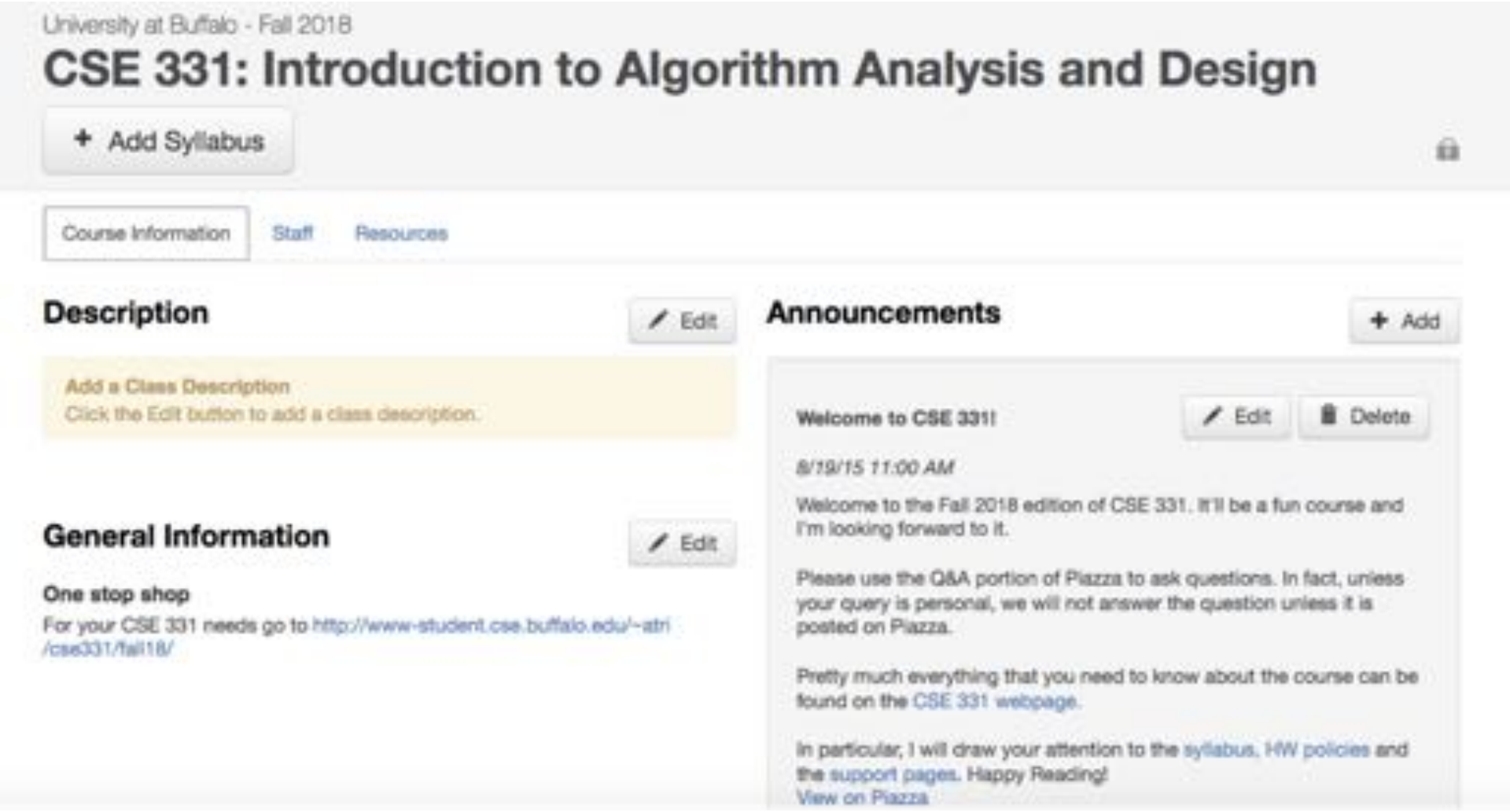
Lecture 2

CSE 331

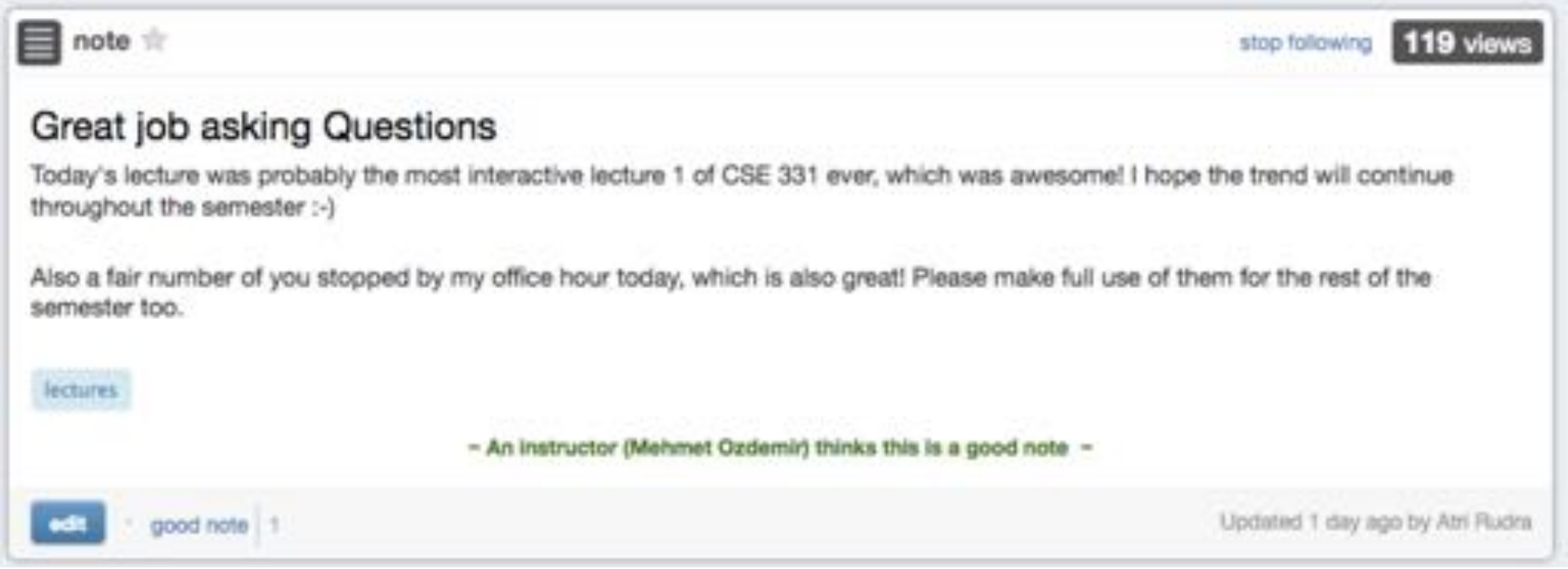
Aug 29, 2018

Enroll on Piazza



https://piazza.com/buffalo/fall2018/cse331/

Please do keep on asking Qs!


note

stop following 119 views

Great job asking Questions

Today's lecture was probably the most interactive lecture 1 of CSE 331 ever, which was awesome! I hope the trend will continue throughout the semester :-)

Also a fair number of you stopped by my office hour today, which is also great! Please make full use of them for the rest of the semester too.

lectures

– An instructor (Mehmet Ozdemir) thinks this is a good note –

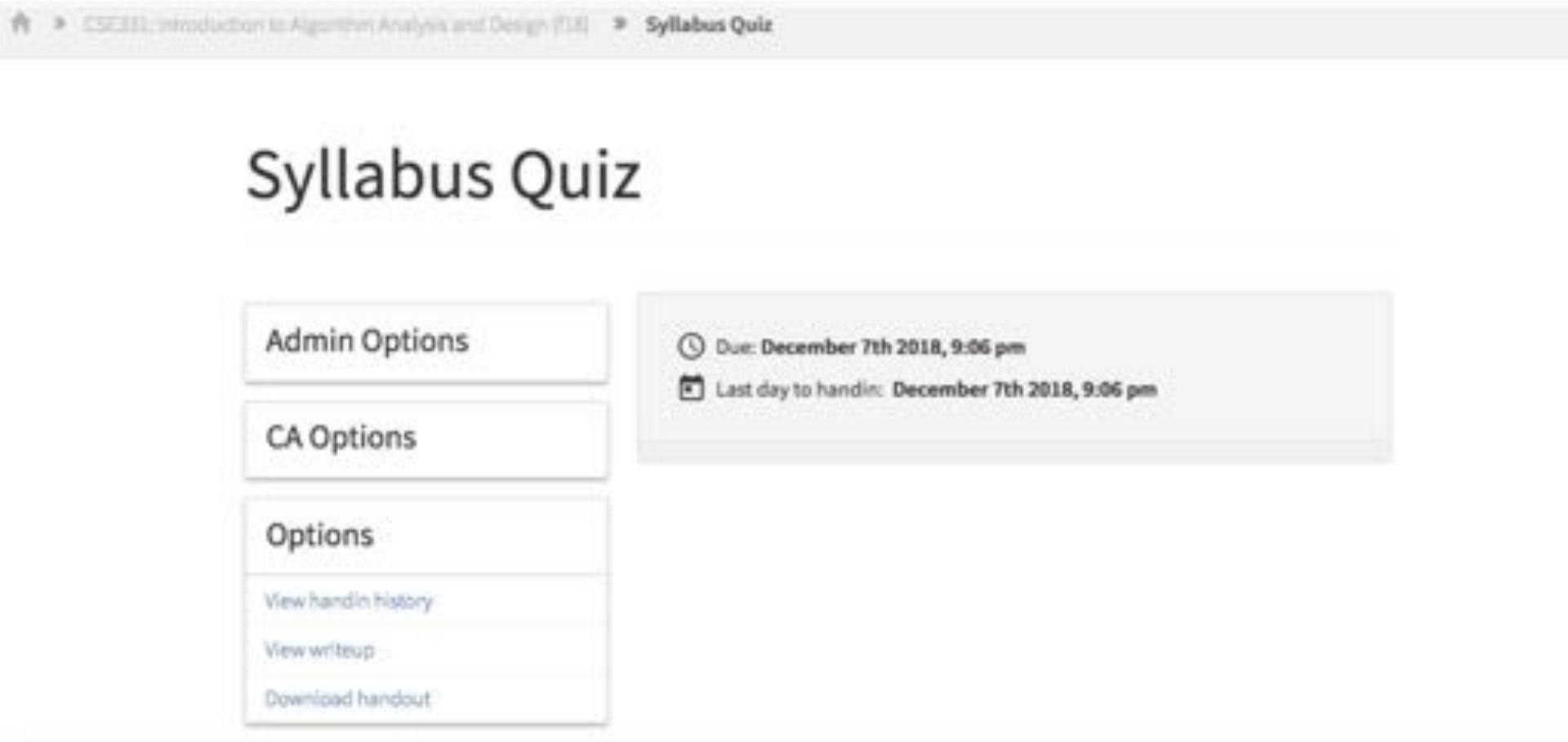
edit · good note 1

Updated 1 day ago by Atri Rudra

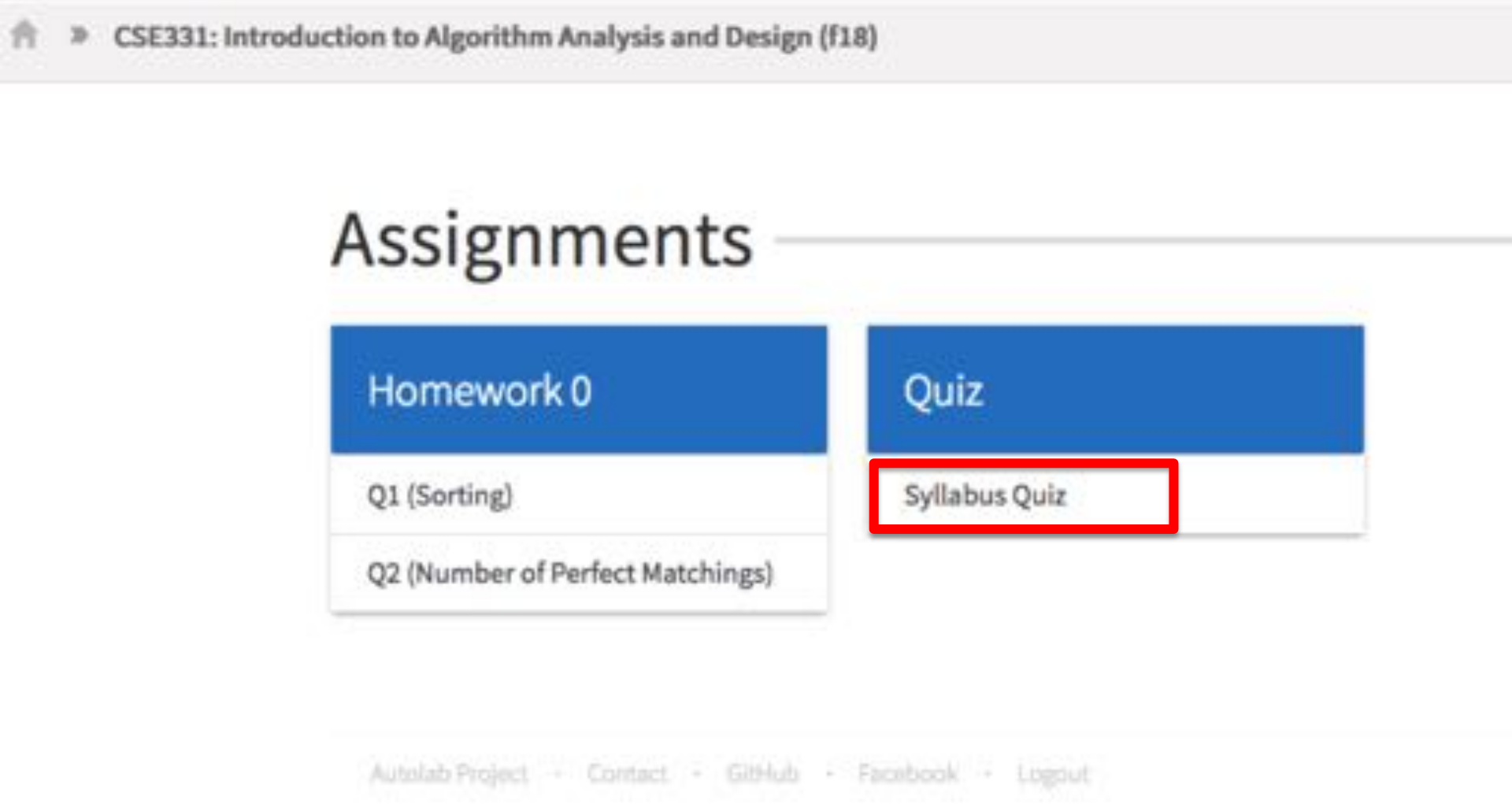
Anyone missing their umbrella?

Read the syllabus CAREFULLY!

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

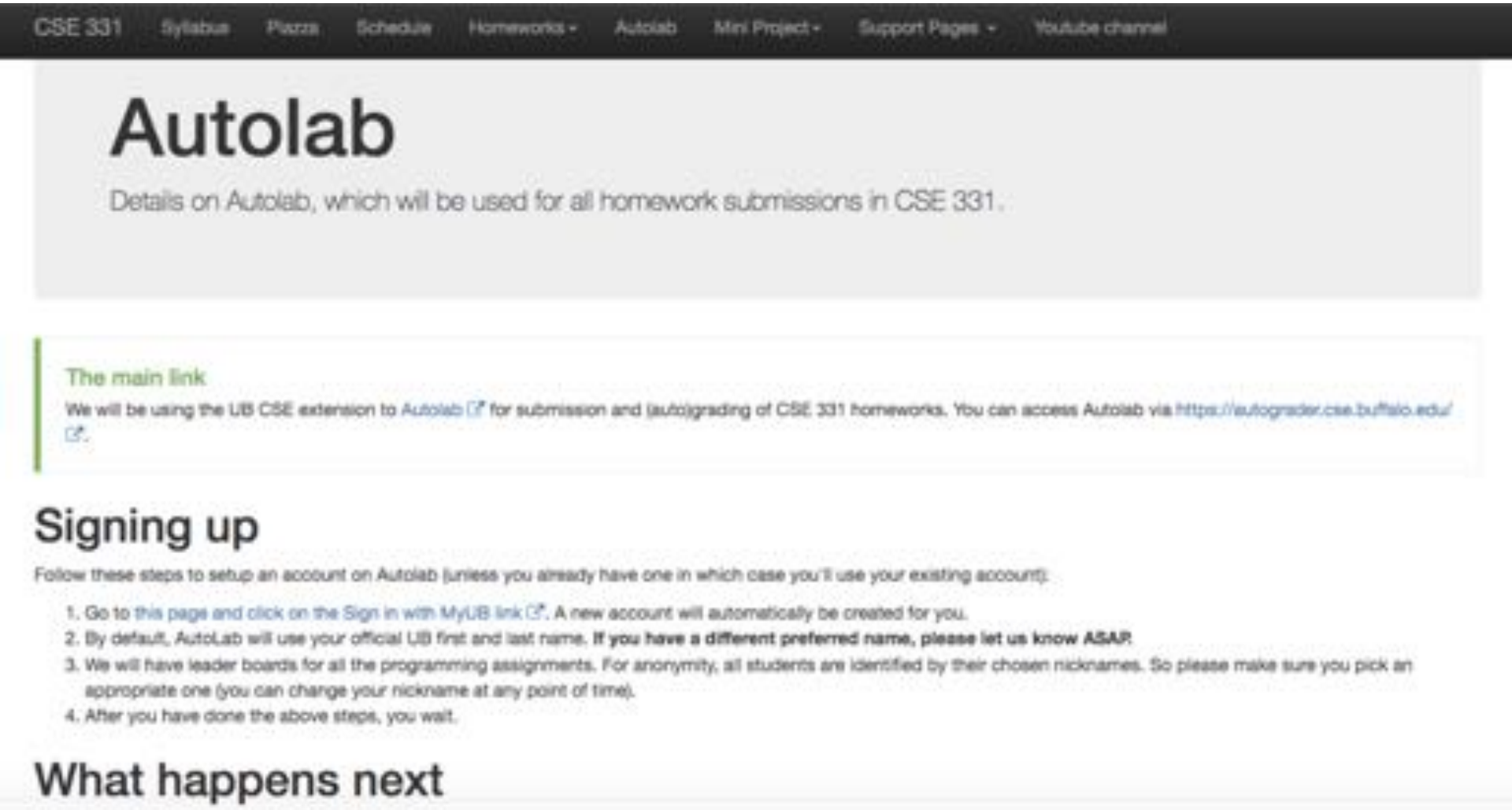


You can submit the following now



You should be on Autolab now

Autolab FAQ


CSE 331
Syllabus
Piazza
Schedule
Homeworks
Autolab
Mini Project
Support Pages
Youtube channel
Autolab
Details on Autolab, which will be used for all homework submissions in CSE 331.
The main link
We will be using the UB CSE extension to Autolab for submission and (auto)grading of CSE 331 homeworks. You can access Autolab via https://autograder.cse.buffalo.edu/
Signing up
Follow these steps to setup an account on Autolab (unless you already have one in which case you'll use your existing account):
1. Go to this page and click on the Sign in with MyUB link. A new account will automatically be created for you.
2. By default, AutoLab will use your official UB first and last name. If you have a different preferred name, please let us know ASAP.
3. We will have leader boards for all the programming assignments. For anonymity, all students are identified by their chosen nicknames. So please make sure you pick an appropriate one (you can change your nickname at any point of time).
4. After you have done the above steps, you wait.
What happens next

Allowed Sources

Allowed sources

You can **ONLY** use the following sources for reference once you start working on the homework problems:

1. **the Kleinberg-Tardos textbook**,

> ### Other textbooks are not allowed
>
> While you can use other textbooks (e.g. those listed in the syllabus) to better understand the lecture material, you **cannot** use them once you start working on the homeworks.

2. **any material linked from this webpage or the CSE 331 piazza page (including any discussion in the Q&A section)**,

> ### One-click rule
>
> When using webpages that are allowed as sources, you **cannot** click on link on that source. (Otherwise within a constant number of clicks one can reach any webpage one wants.)

3. **specific mathematical result from a previous course**,
4. **anything discussed in the lectures, recitations and/or office hours** and
5. **any notes that you might have taken during class or recitation.**

> ### Everything else is not allowed
>
> Note that the above list covers all the allowed sources and **everything else is not allowed**. In particular, *YOU ARE NOT SUPPOSED TO SEARCH FOR SOLUTIONS ON THE*

… even for programming Q

All discussions and posts on piazza.

Basic programming references

C++ Sources

- cppreference.com (and all pages within the website).

Java Sources

- Oracle Java Documentation (and all pages within the website).

Python Sources

- Python 3.5.2 documentation (and all pages within the website).

Asymptotic Analysis

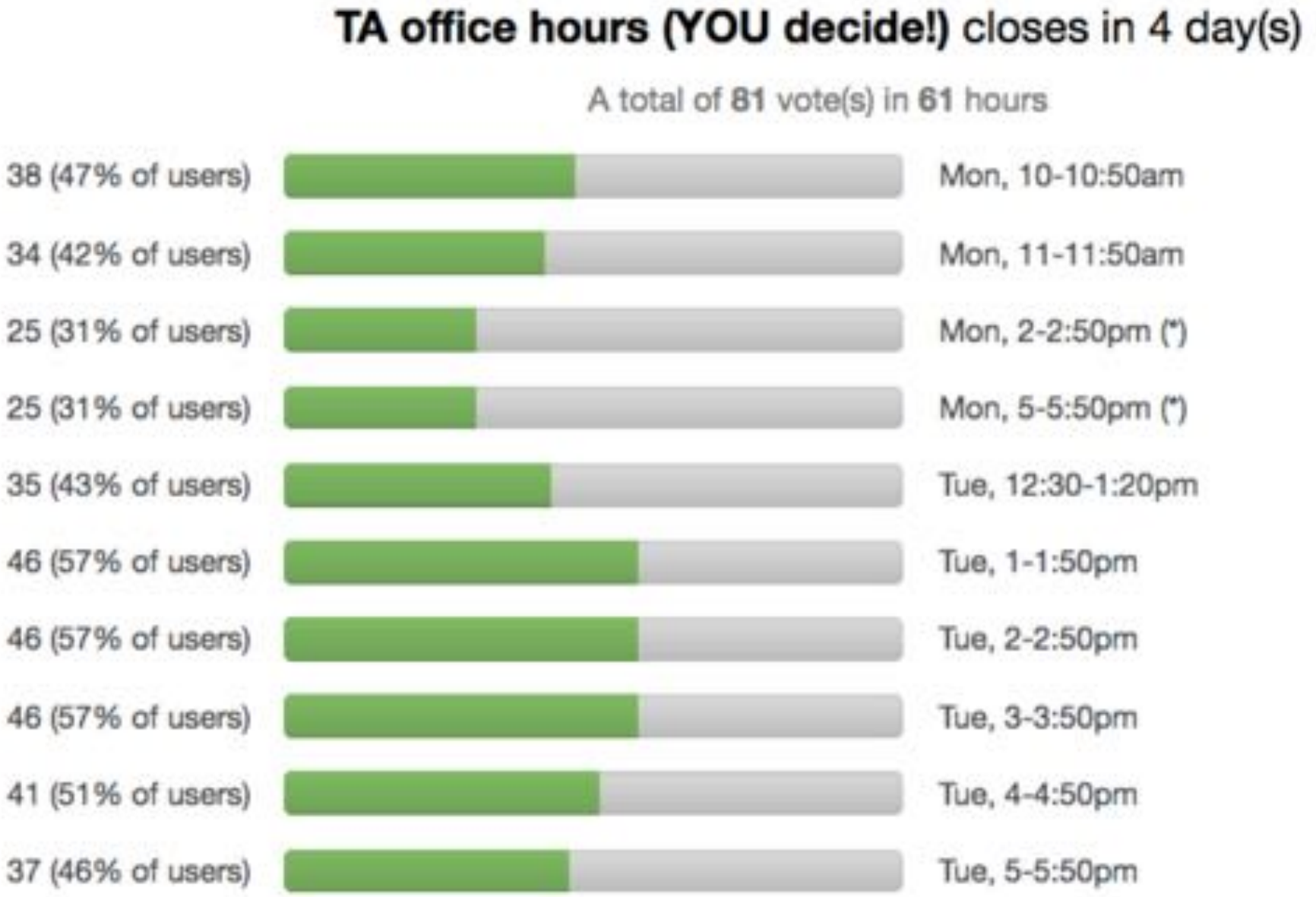
- Big-O cheat sheet.

Wikipedia Pages

Below are some approved Wikipedia pages (in addition to those that are already linked to in other pages in the CSE 331 Fall 2018 web page.

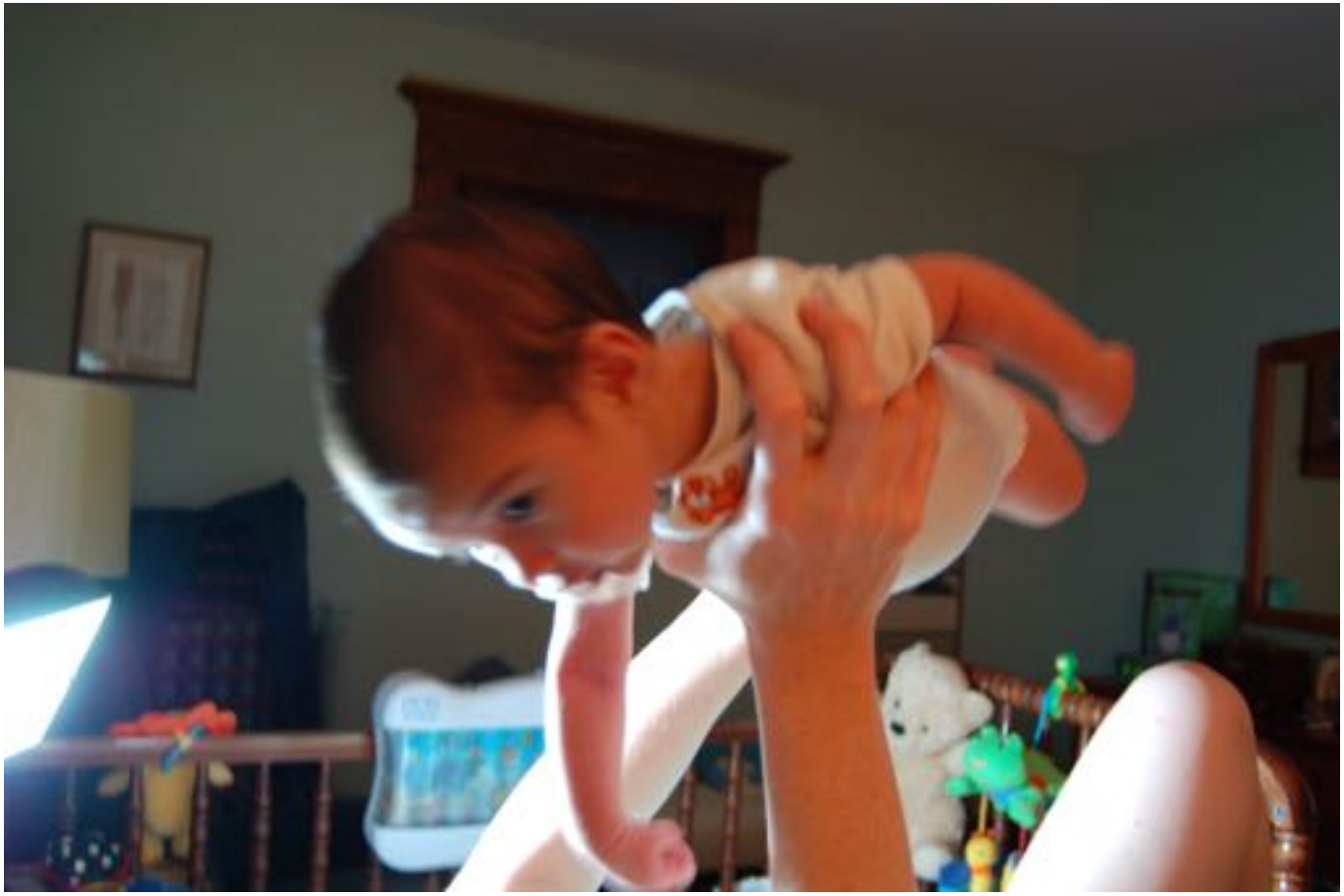
- Gale Shapley algorithm.
- DFS.
- Dijkstra's Algorithm.
- Prim's algorithm.

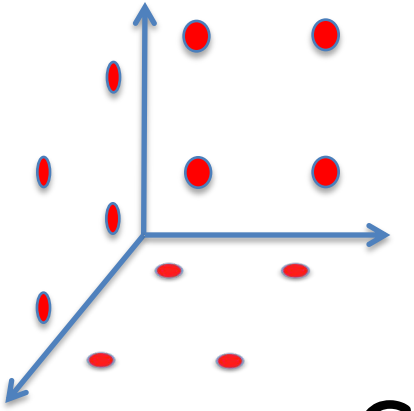
TA Office hours finalized today

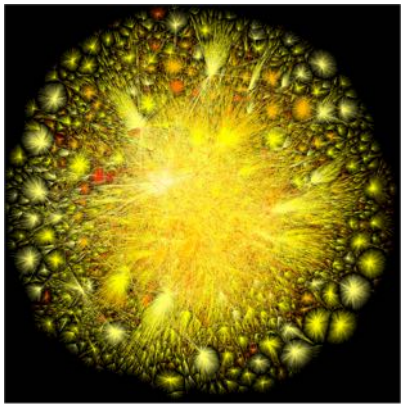


Questions/Comments?

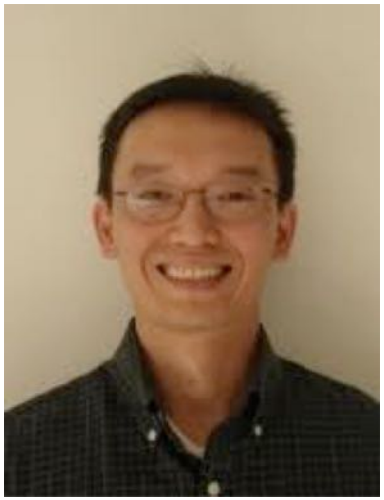
Let the fun begin!







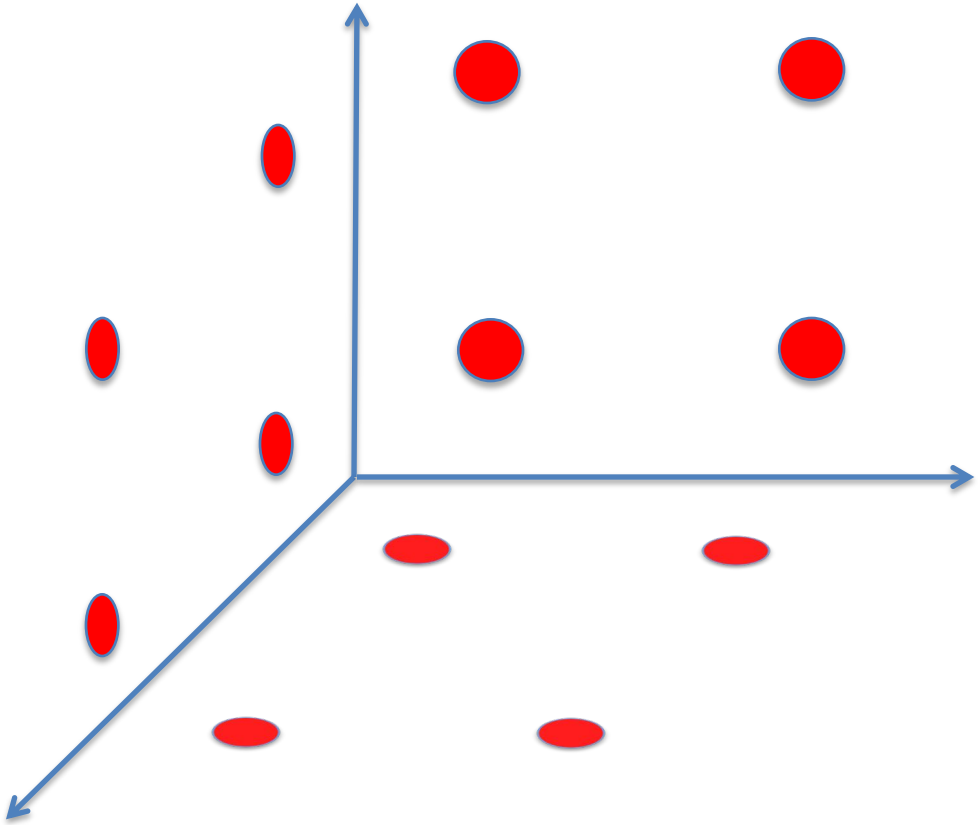
Combining Shadows to Understanding the network



LogicBlox

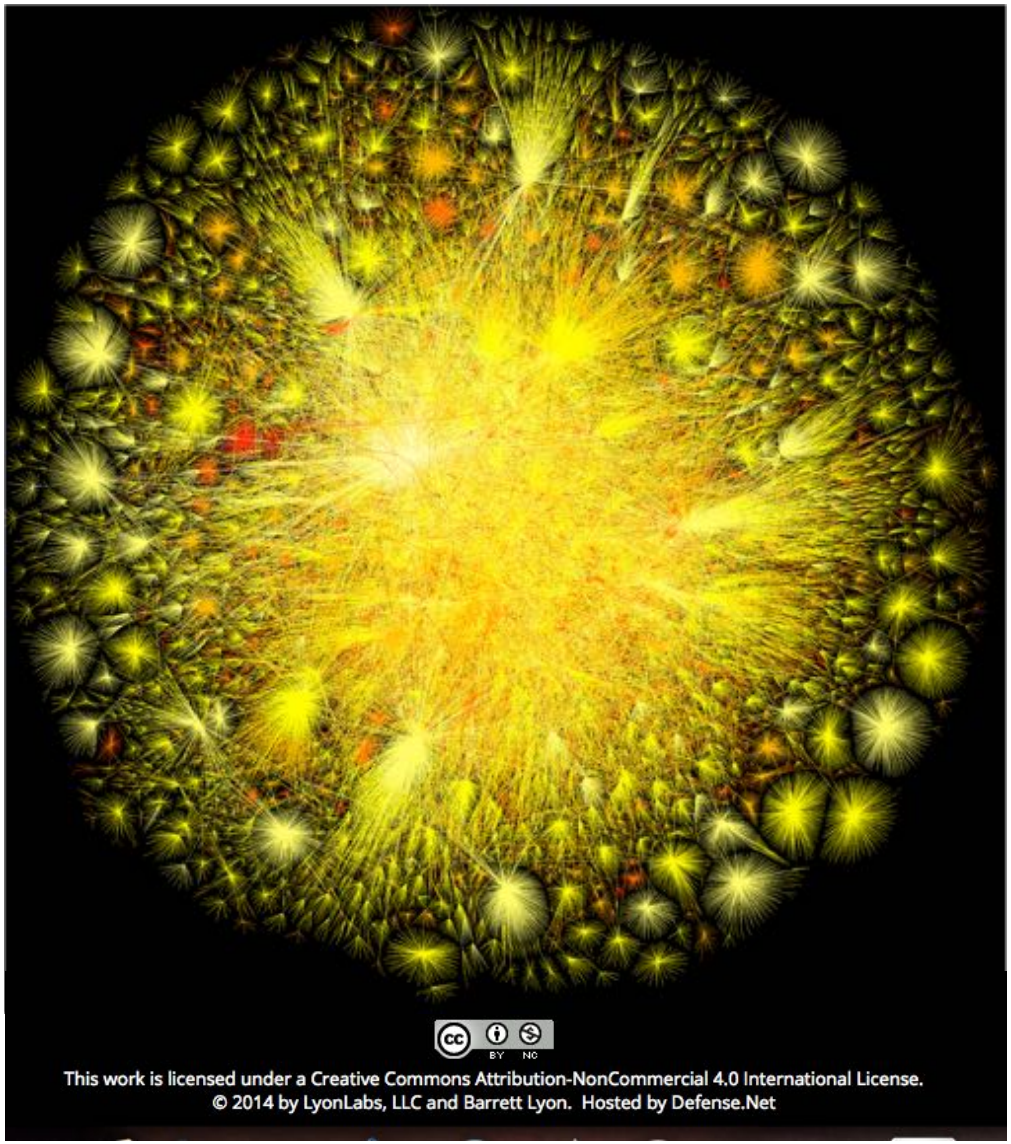
Stanford University

The key technical problem

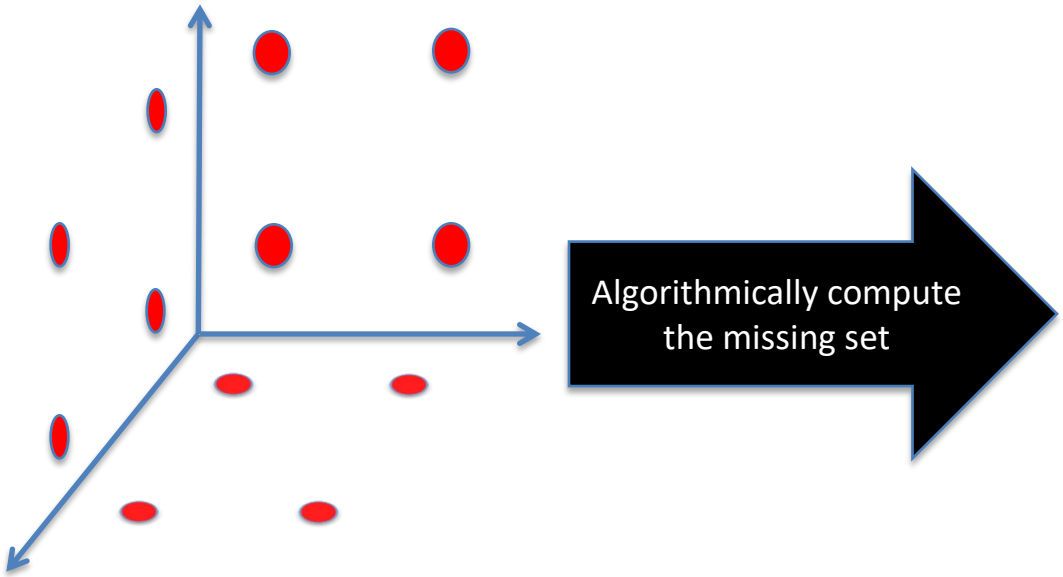


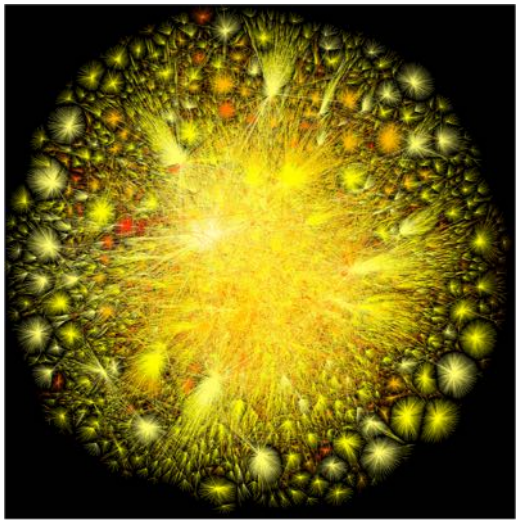
Given the three projections, what is the largest size of the original set of points?

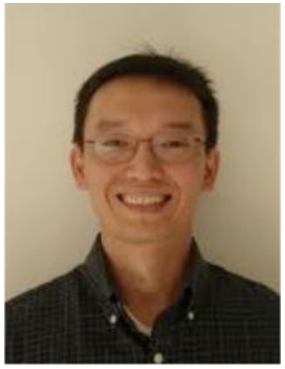
Detecting Communities



Conquering Shadows to Conquering the Internet







The proof is in the performance

EMPTYHEADED

10x faster

ORACLE

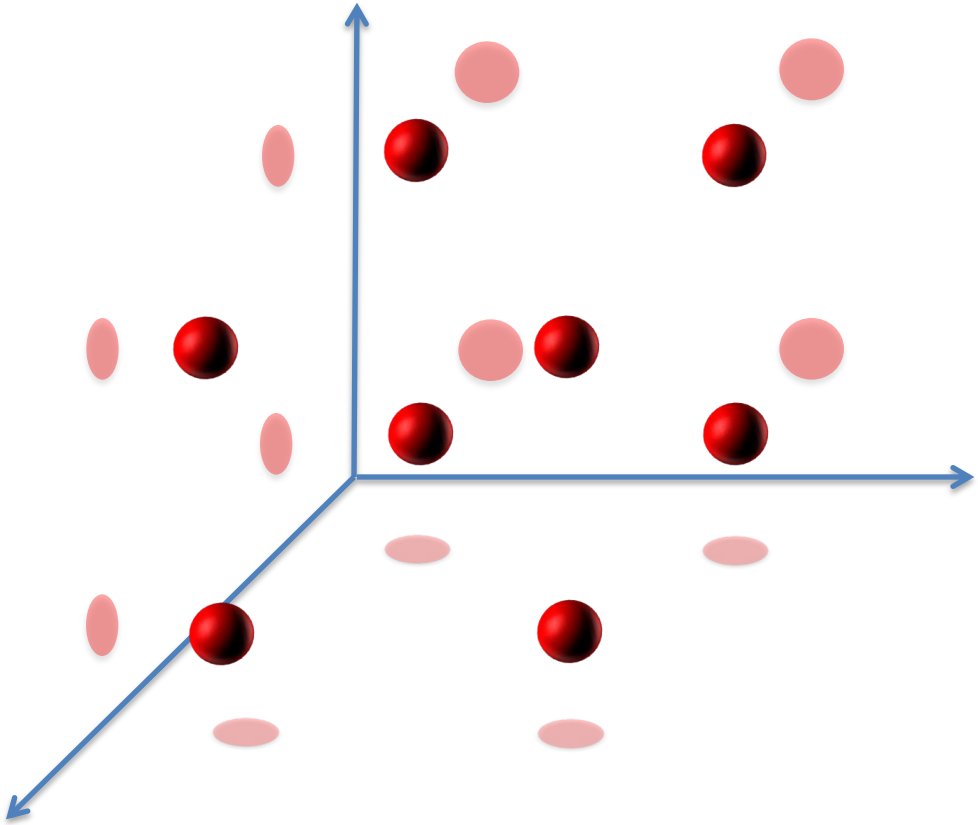
Dato GraphLab

LogicBlox

SNAP

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: $4^{1.5} = 8$

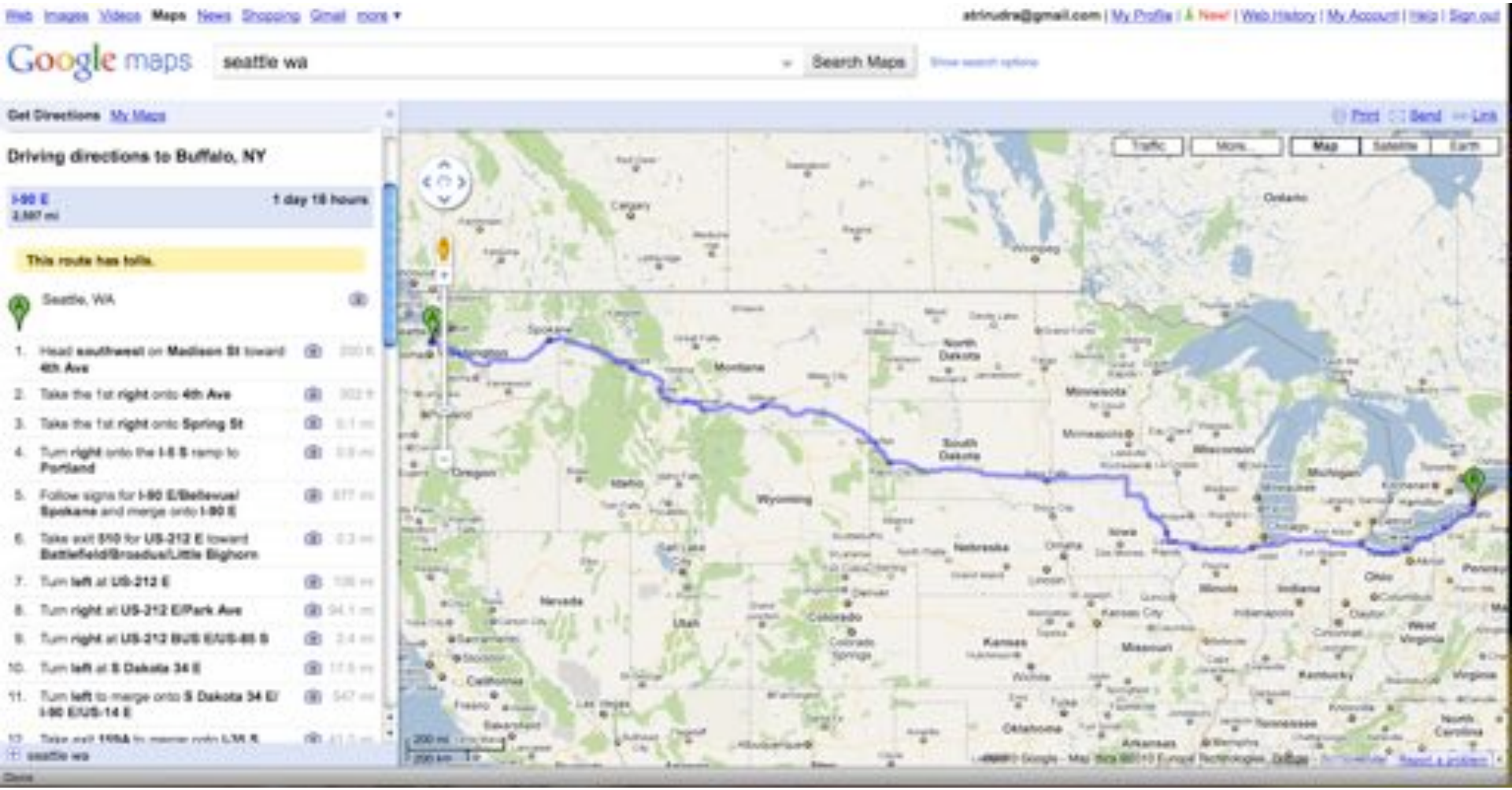
If detecting communities is not for you

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**.

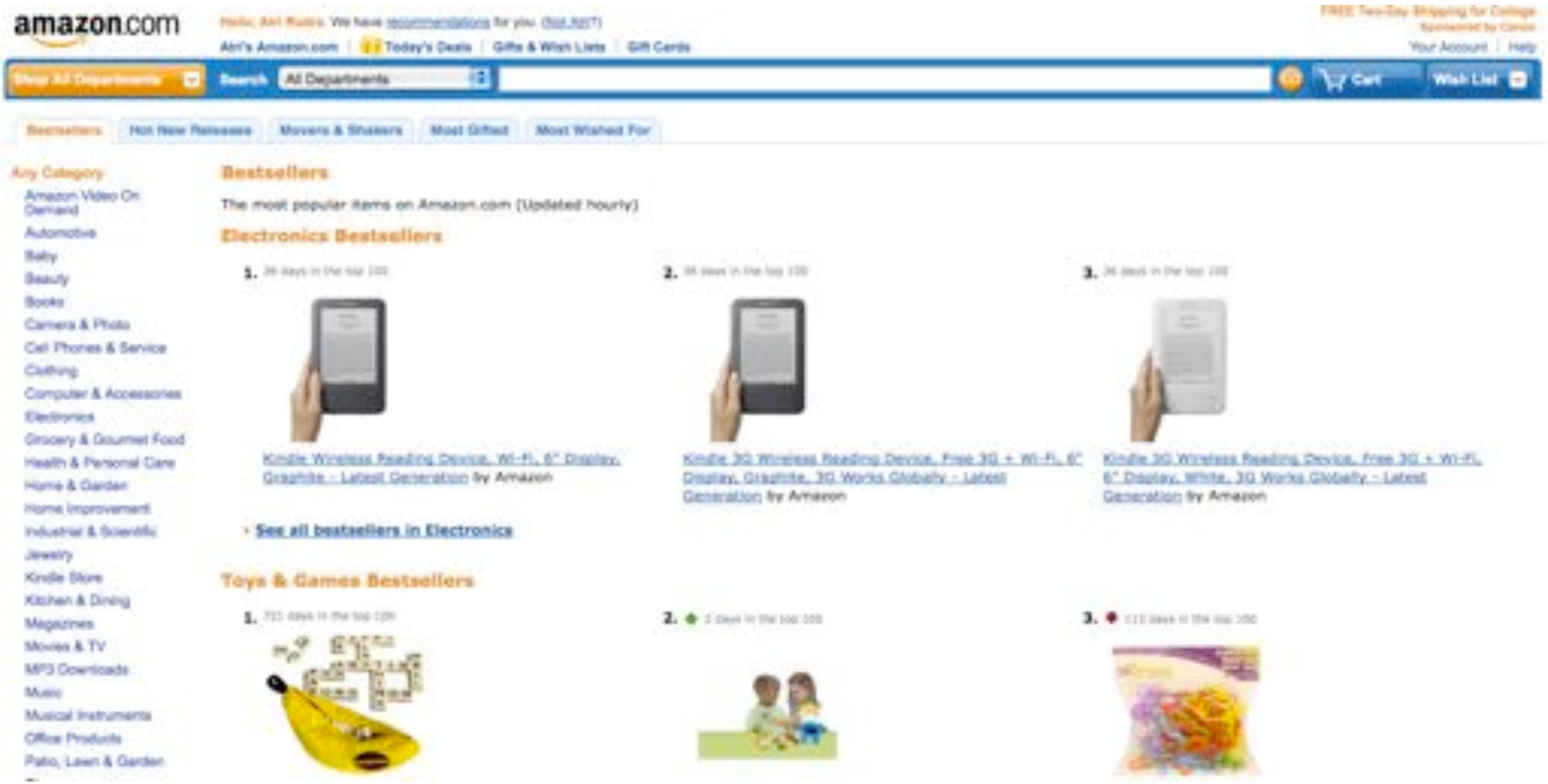
Lots of data structures, specifying the algorithm, analyzing the run time and space requirements... And all on the phone and **you're supposed to talk through your thought process**.”

Why care about algorithms?



Driving directions

Why care about algorithms?

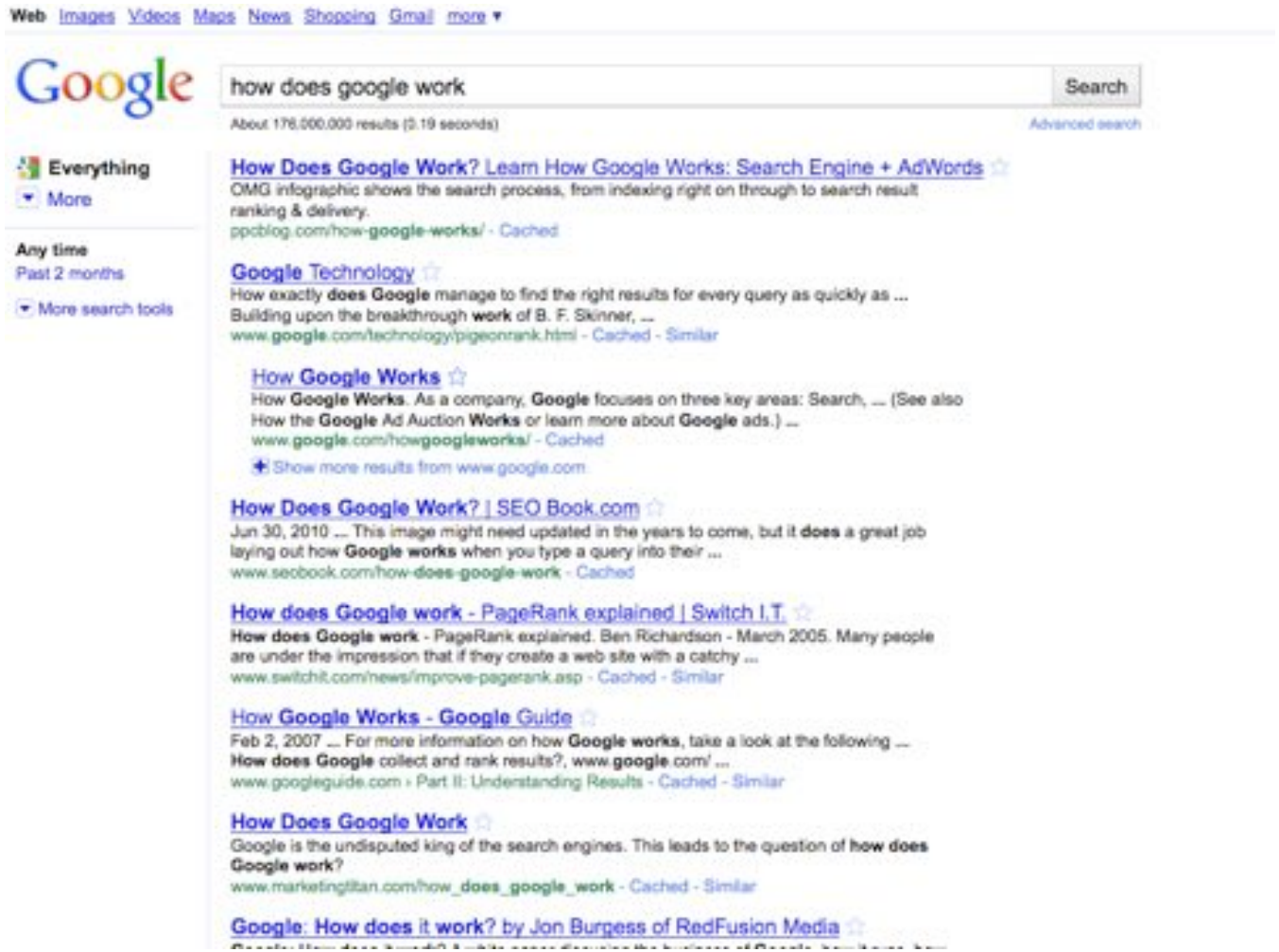


Computing Bestsellers on the fly

Why care about algorithms?

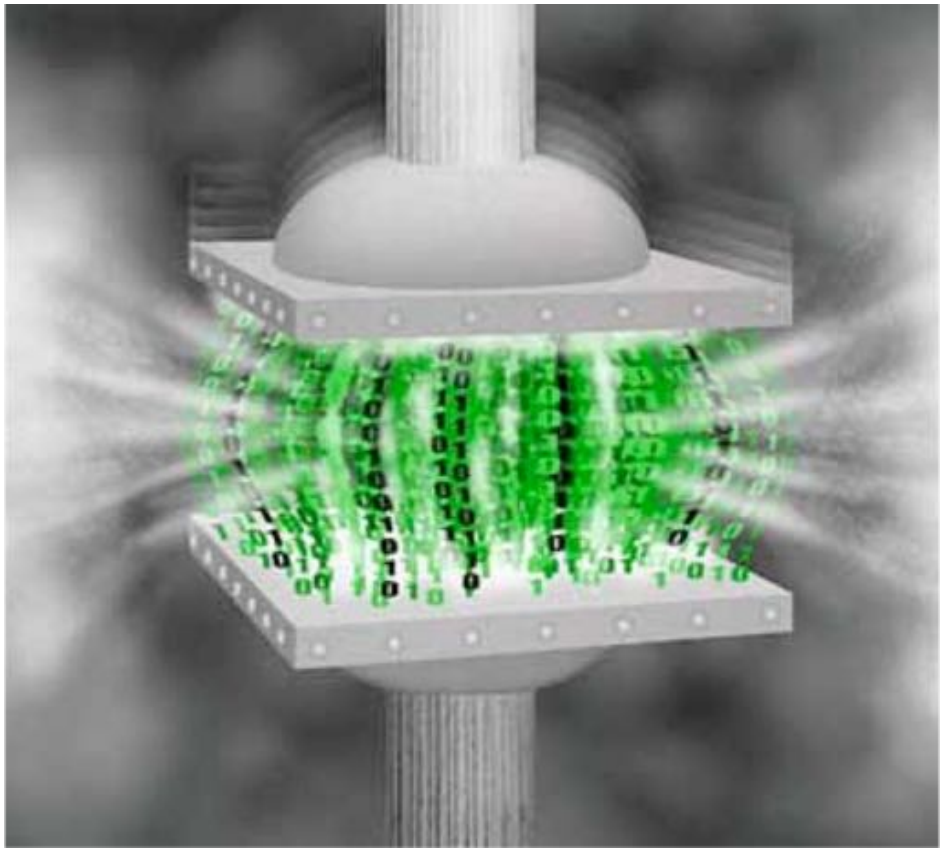
Booking cheapest air tickets

Why care about algorithms?



Google searches

Why care about algorithms?



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

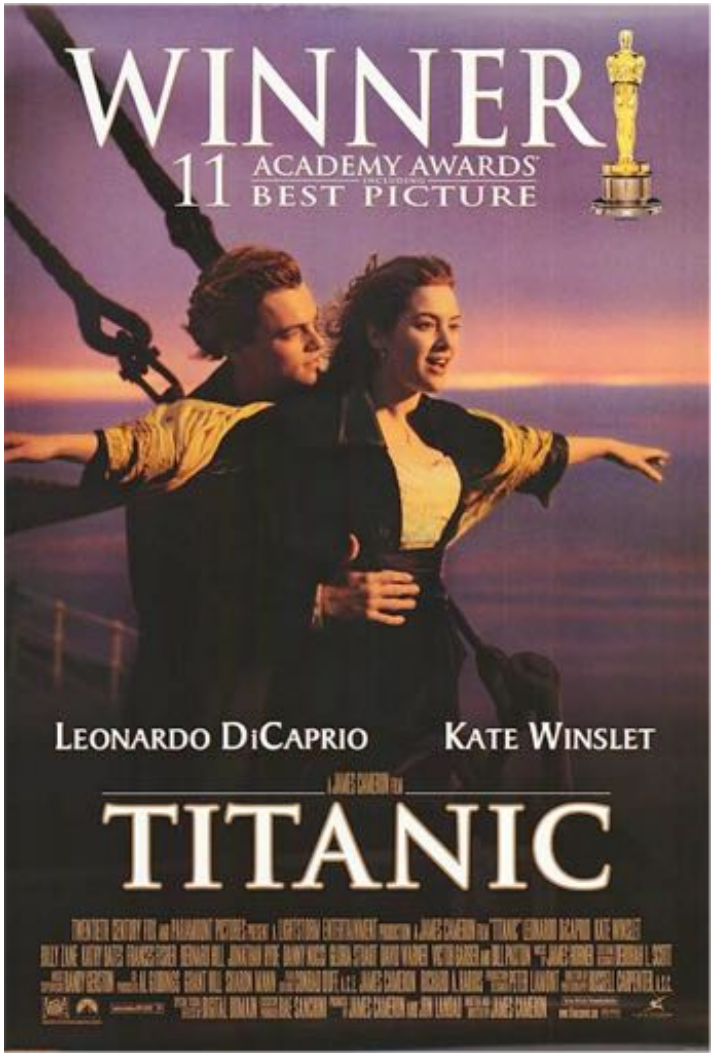
Data compression

Why care about algorithms?

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

Error correction

(And I could) go on…



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

Find out for yourself

Mini project: Video on social impact of algorithm. Groups of size = 3

CSE 331 Syllabus Piazza Schedule Homeworks Autolab Mini Project Support Pages Youtube channel

CSE 331 Mini Project

Fall 2018

Details and motivations for the mini project.

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?

Who is Algorithm named after?

Abū ʿAbd Allāh Muhammad ibn Mūsā al-Khwārizmī

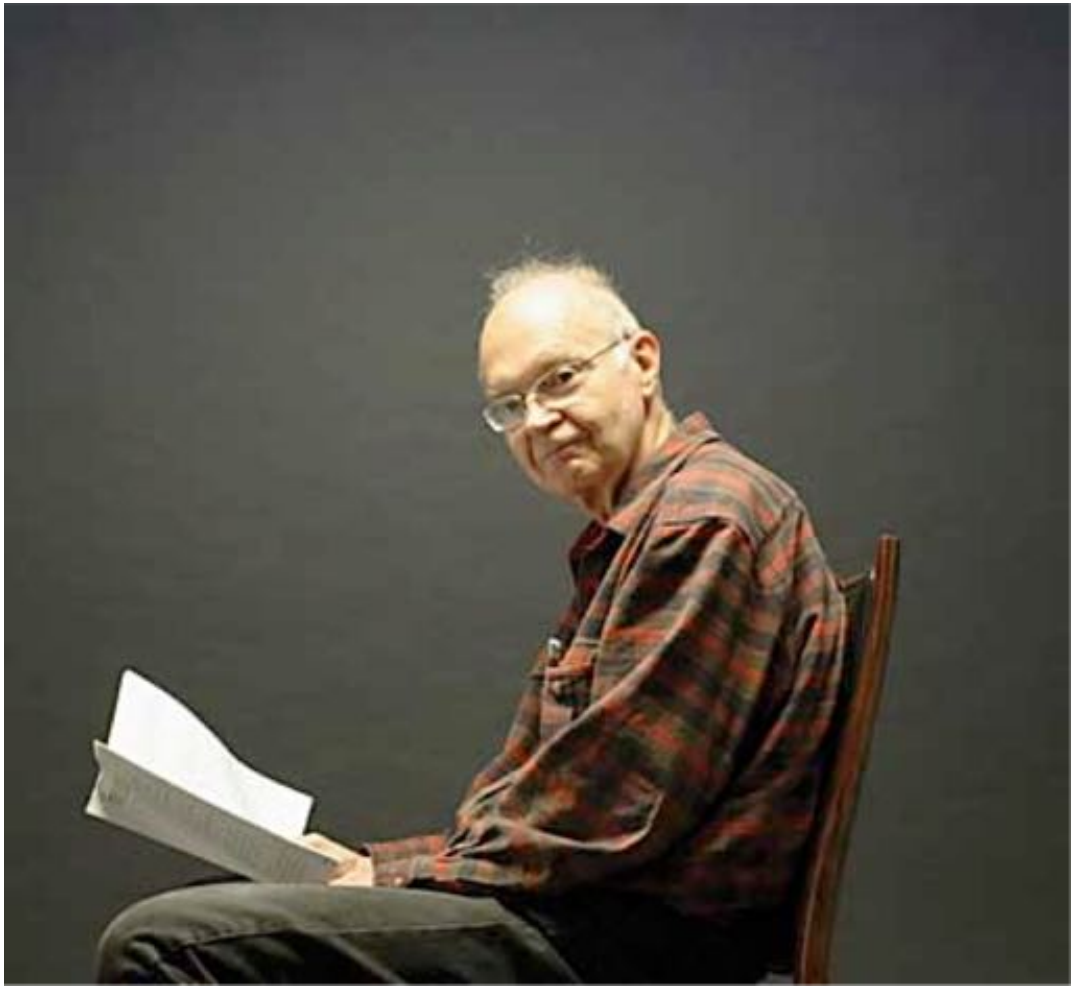
9th century Persian astronomer/mathematician

825 AD: "On Calculation with Arabic Numerals"

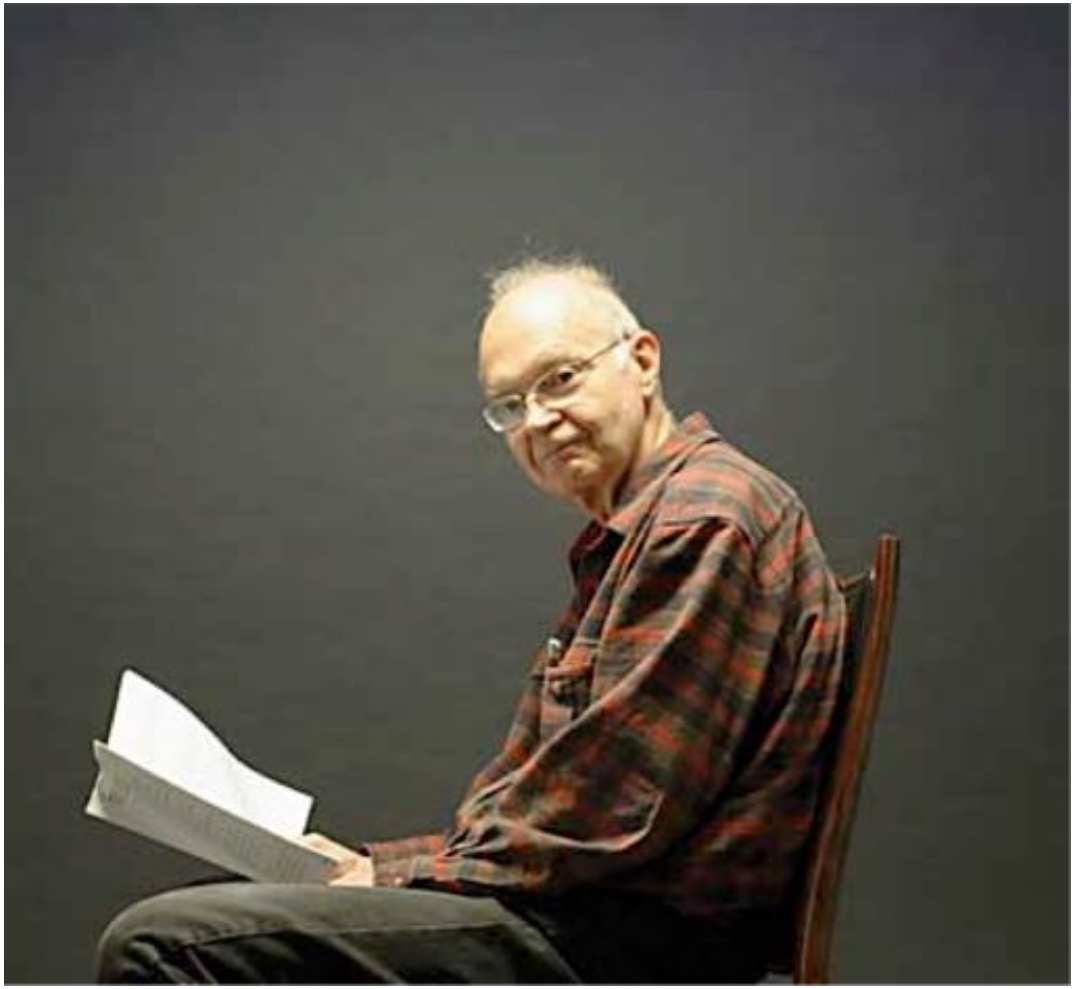
Latin translation 12th century

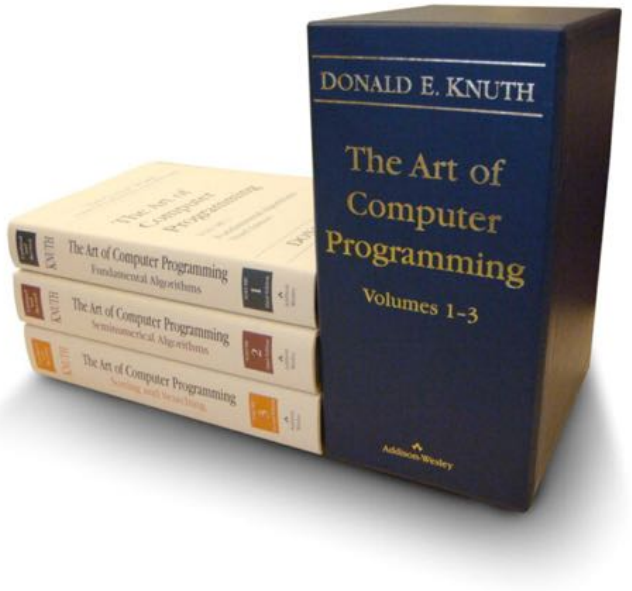
"Algorithmi de numero Indorum"

What are Algorithms?

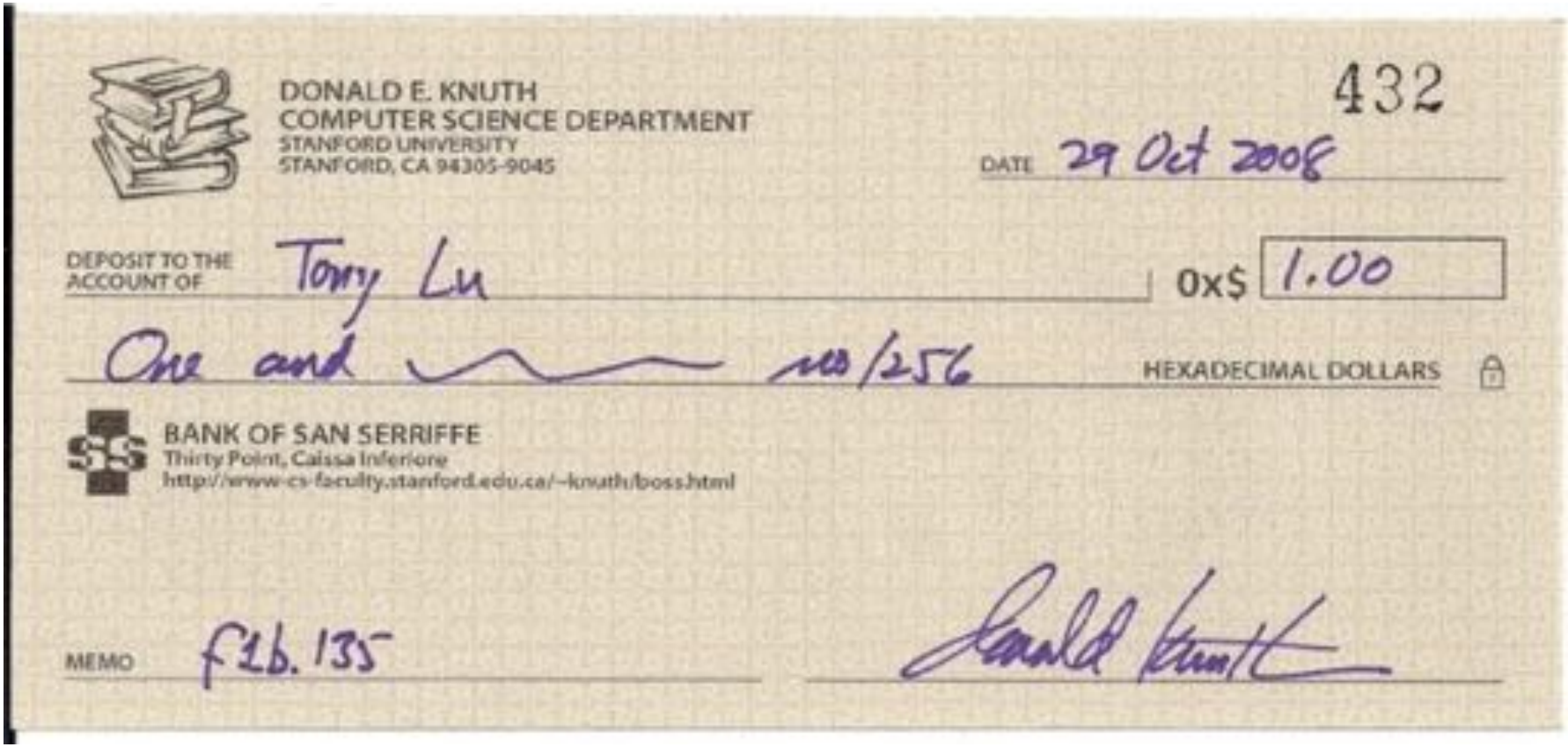


Don Knuth




DONALD E. KNUTH
The Art of Computer Programming
Volumes 1-3
The Art of Computer Programming
Fundamental Algorithms
The Art of Computer Programming
Seminumerical Algorithms
The Art of Computer Programming
Addison-Wesley

Don Knuth Reward Checks

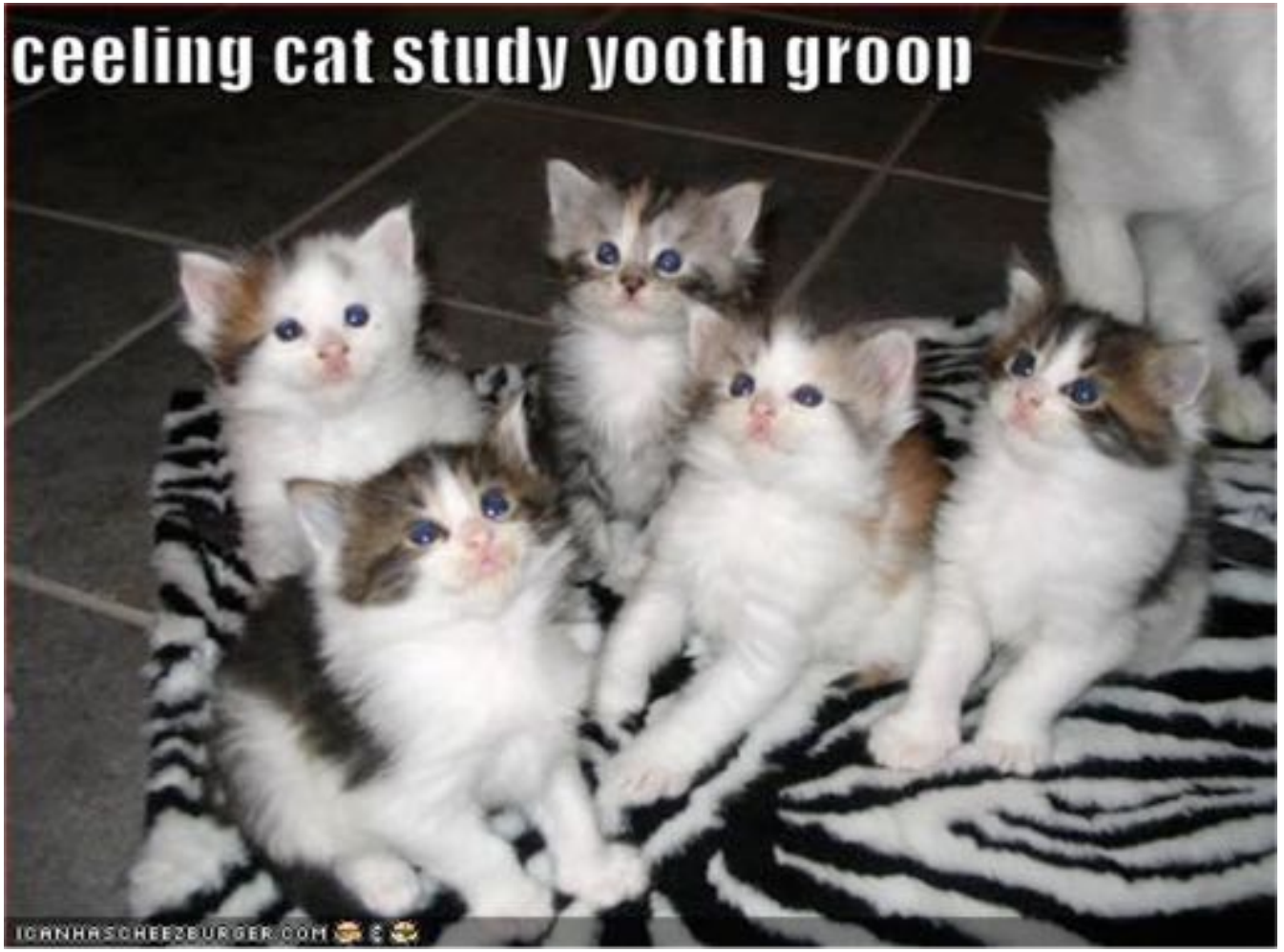


http://www.flickr.com/photos/32184482@N03/3010989157/

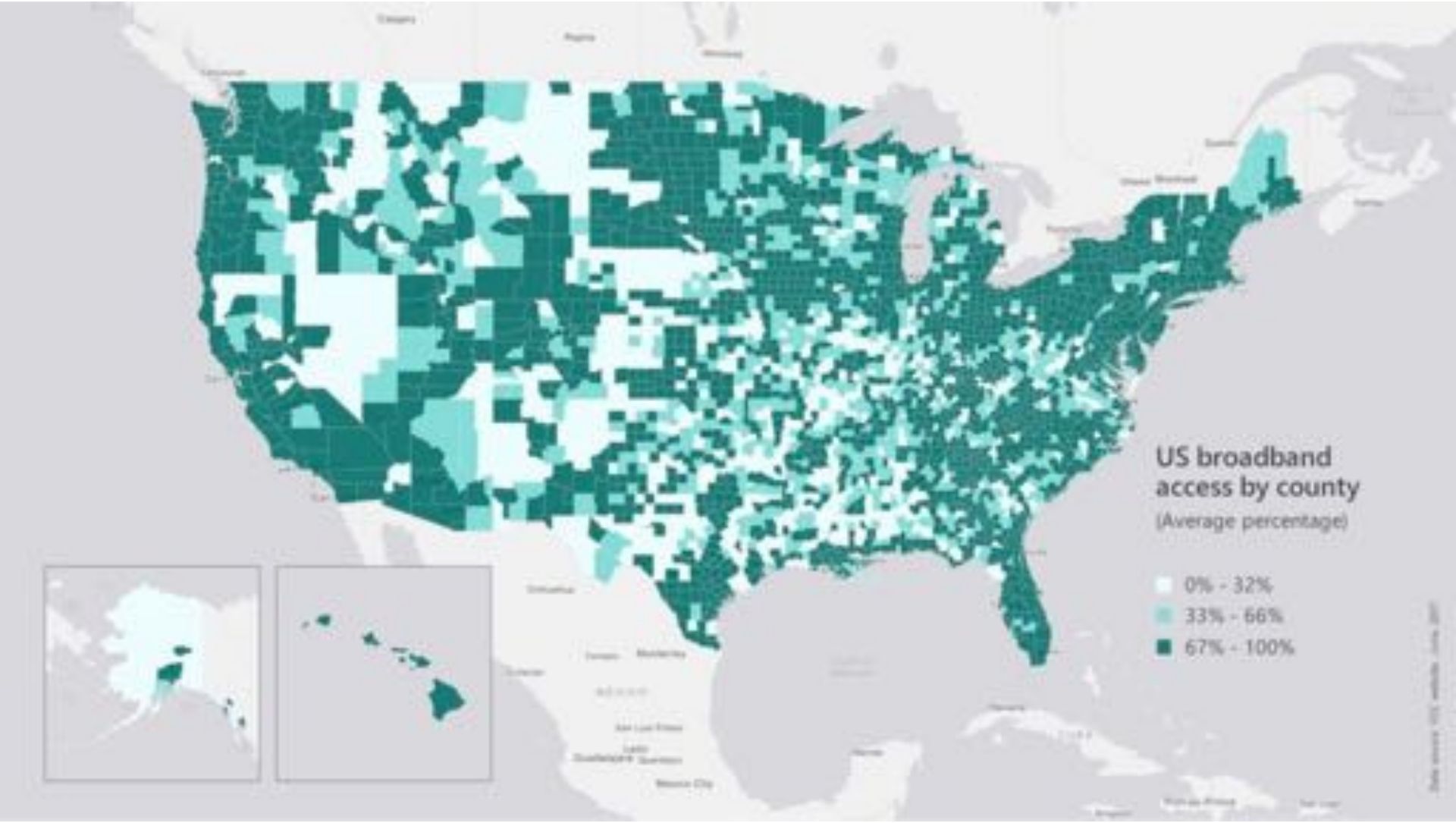
Knuth's Definition

An algorithm is a finite, definitive, effective procedure with some input and some output

Remember: Stick with your group

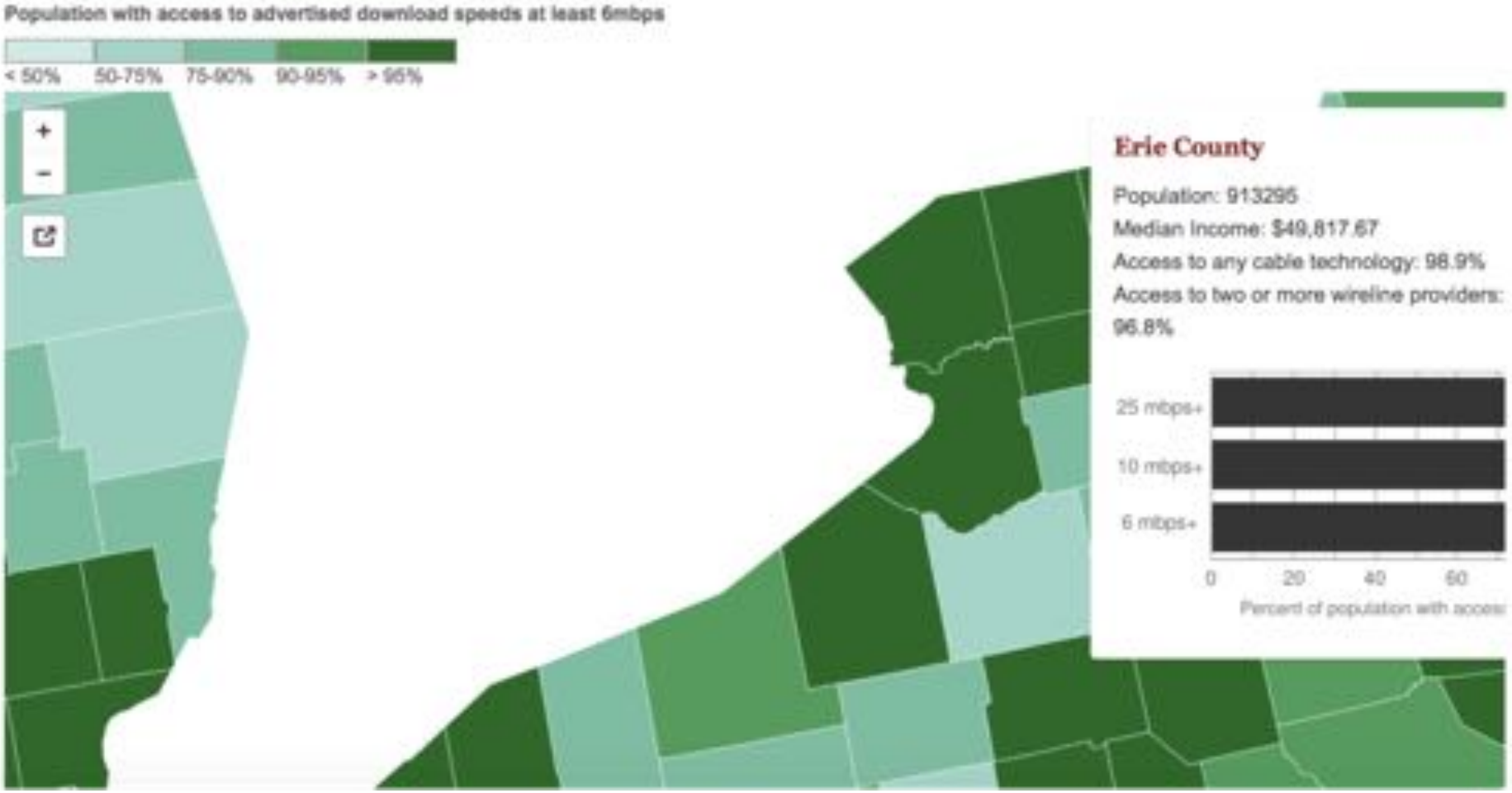


Broadband access



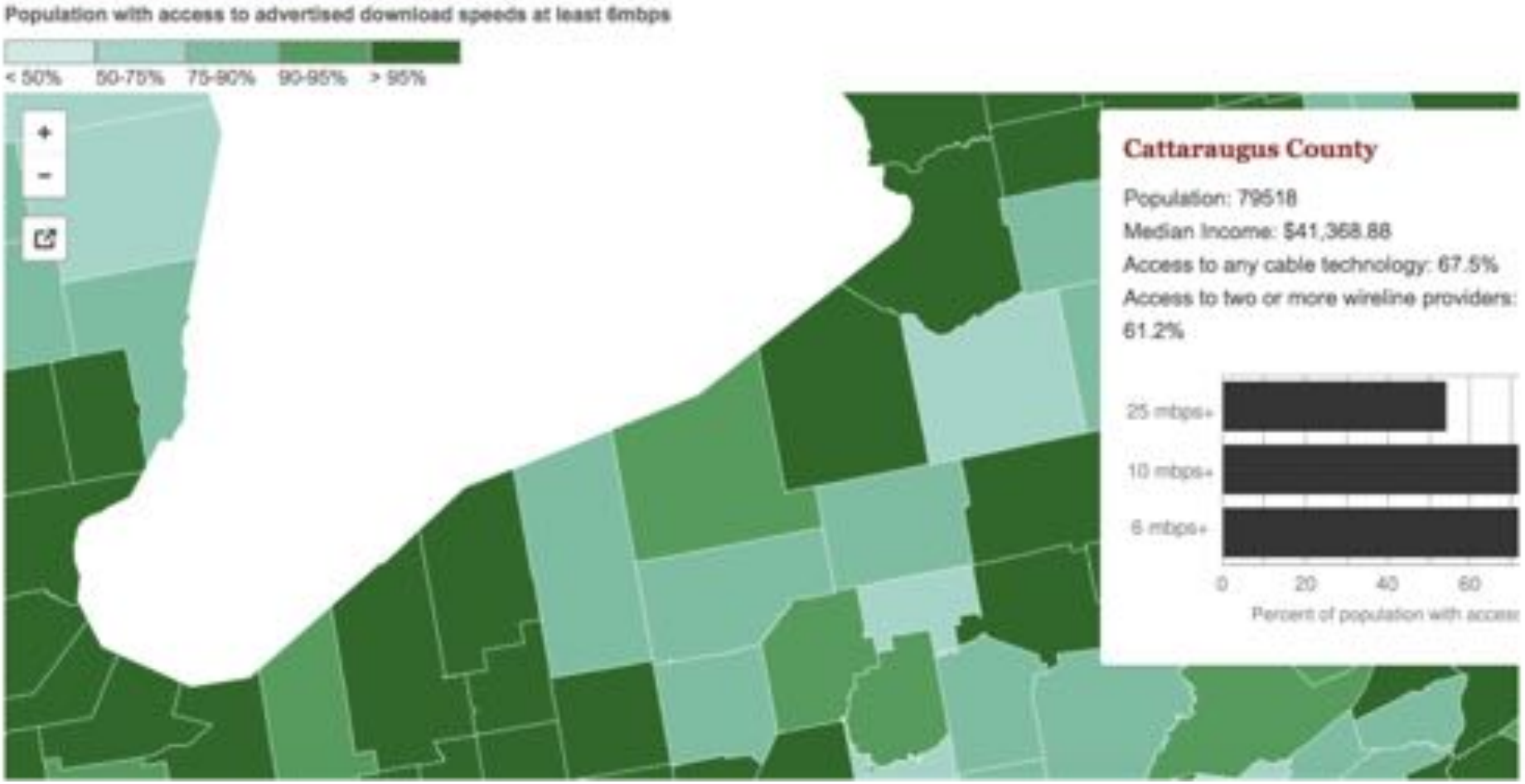
https://assets.bwbx.io/images/users/iqjWHBFdfxIU/iZSjibxE1KJs/v1/800x-1.jpg

Erie county is reasonably good



http://www.governing.com/gov-data/broadband-speeds-availability.html

One county over

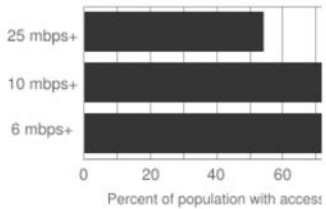


http://www.governing.com/gov-data/broadband-speeds-availability.html

Make broadband more available

Cattaraugus County

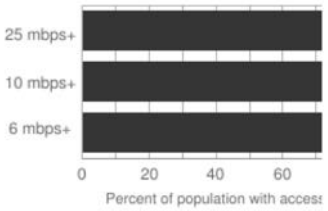
Population: 79518
Median Income: $41,368.88
Access to any cable technology: 67.5%
Access to two or more wireline providers: 61.2%



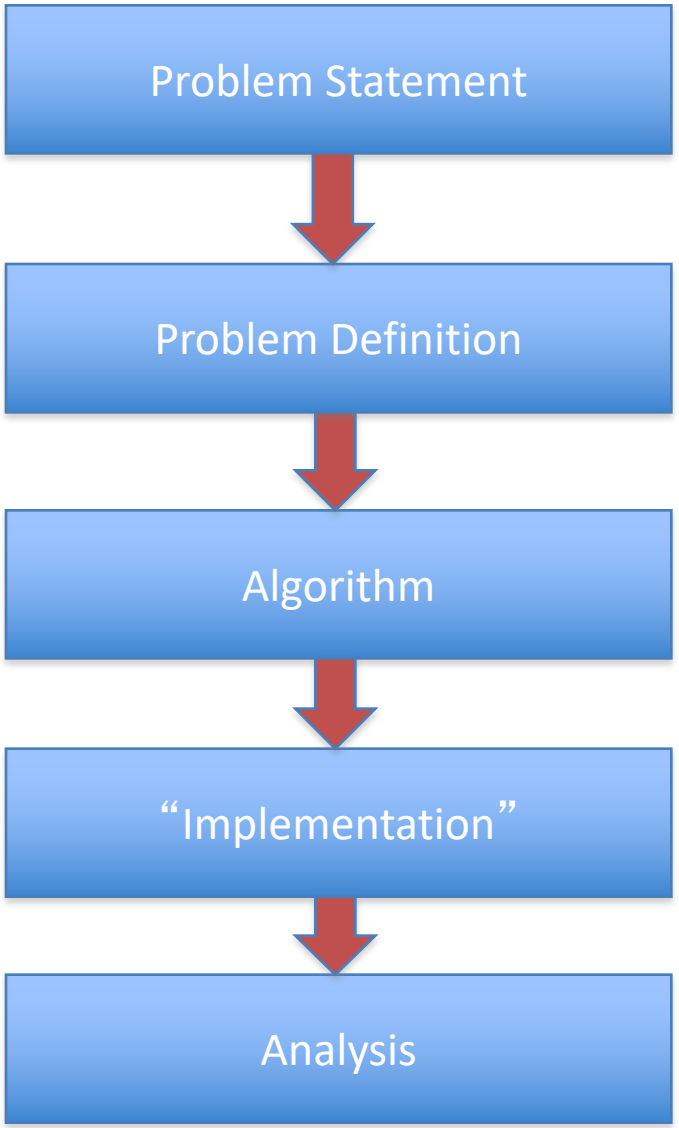
Say you are tasked to come up with the infrastructure

Erie County

Population: 913295
Median Income: $49,817.67
Access to any cable technology: 98.9%
Access to two or more wireline providers: 96.8%



Main Steps in Algorithm Design



Real world problem

Precise mathematical def

Data Structures

Correctness/Run time

Worst-case analysis

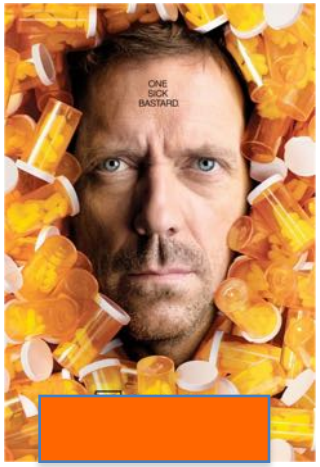
Correctness should hold for every valid input

Resource usage by the worst-possible input

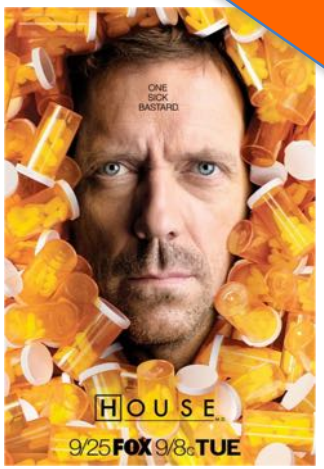
Questions/Comments?

National Resident Matching

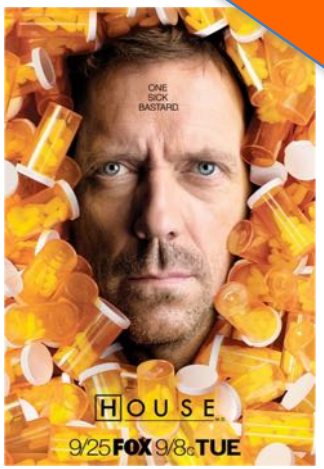
(Screen) Docs are coming to BUF



What can go wrong?



The situation is unstable!



What happens in real life

Preferences

NRMP
National Resident Matching Program

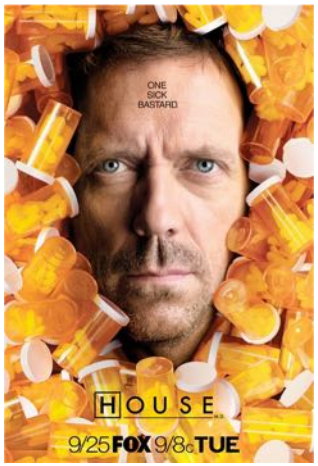
Information

NRMP
National Resident Matching Program

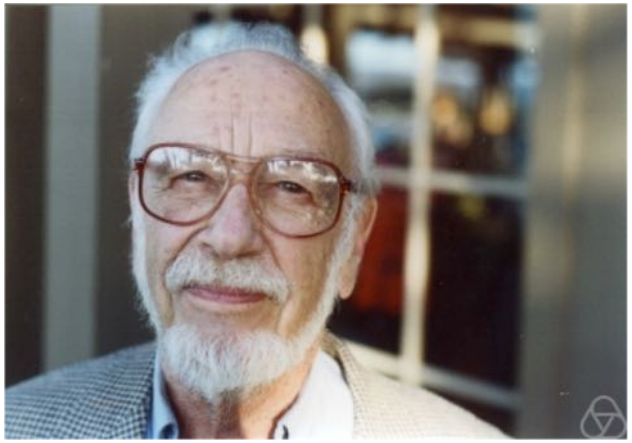
Preferences

NRMP
National Resident Matching Program

NRMP plays matchmaker



Stable Matching Problem



David Gale

Lloyd Shapley