

# Lecture 2

CSE 331

Sep 1, 2021

# Please have a face mask on

## Masking requirement



*UR requires all students, employees and visitors – regardless of their vaccination status – to wear face coverings while inside campus buildings.*

<https://www.buffalo.edu/coronavirus/health-and-safety/health-safety-guidelines.html>

# Enroll on Piazza

The screenshot shows the Piazza website interface for a CSE 331 class. The top navigation bar includes 'piazza', 'CSE 331', 'Resources', 'Statistics', and 'Manage Class'. A search bar is visible on the left. The main content area is titled 'Class at a Glance' and includes a 'Class at a Glance' section with three green checkmarks indicating 'no unread posts', 'no unanswered questions', and 'no unresolved followups'. To the right, an 'Instructor License' section shows 'license status: pending instructor license (0 days left)' and statistics: 27 total posts, 195 total contributions, 6 instructors' responses, 0 students' responses, and n/a avg. response time. Below this is a 'Student Enrollment' section with a green progress bar and a 'Download us in the app store' button. A 'Share Your Class' section provides a demo link: [https://piazza.com/demo\\_login?site=kellyn15ad?me&auth=6682946](https://piazza.com/demo_login?site=kellyn15ad?me&auth=6682946). At the bottom, there is a '2021 Product Updates' section.

**Class at a Glance** Updated 7 seconds ago. Refresh [Go to Live Q&A](#)

- ✓ no unread posts
- ✓ no unanswered questions
- ✓ no unresolved followups

**license status** pending instructor license (0 days left)

- 27 total posts
- 195 total contributions
- 6 instructors' responses
- 0 students' responses
- n/a avg. response time

**Student Enrollment** [out of 125 returned](#) [Edit](#)

Download us in the app store:

### Share Your Class

Professors appreciate Piazza best when they see how it is being used.

Allow colleagues to view your class through a demo link - a restricted, read only version of your class where all students' names are anonymized and all student information hidden.

[https://piazza.com/demo\\_login?site=kellyn15ad?me&auth=6682946](https://piazza.com/demo_login?site=kellyn15ad?me&auth=6682946)

Opening this link in the same browser will log you out at ubuffalo.edu

### 2021 Product Updates

We wanted to share [exciting news](#) about institutions that have entered enterprise license agreements with Piazza for

<https://piazza.com/buffalo/fall2021/cse331/>

# Read the syllabus CAREFULLY!


## Syllabus Quiz

### Options

[View handin history](#)

[View writeup](#)

[Download handout](#)

 Due: December 16th 2021, 11:59 pm

 Last day to handin: December 16th 2021, 11:59 pm

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

### 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

# Autolab FAQ

## 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. I believe Autolab should now be using your preferred name instead of your official UB first and last name. **If this is not the case, 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 in time).
4. After you have done the above steps, you wait.

## What happens next

Here are the steps that we need to take on our end:

# Homework 0 is out

note @27

stop following 0 views

## Homework 0

This is a bit earlier than usual but HW0 is now live:

<http://www-student.cse.buffalo.edu/~atri/cse331/fall21/hws/hw0/index.html>

Few reminders/comments:

- Submitting HW 0 is optional but we **very very strongly** encourage y'all to submit if for nothing just to get more practice submitting proofs (esp. in the format we expect in CSE 331) as well as to make sure can submit to Autolab without issues.
- You can start submitting your HW 0 solutions on Autolab starting 9am tomorrow (Wed, Sep 1)
  - Just for HW 1, you should only submit Q1 and Q3 (i.e. no Q2).
- You can also access the HW from any of the Fall 21 CSE 331 webpage from under the "Homeworks" tab in the navigation bar on the top.

If you have any questions, please do not hesitate to use the comments section below.

Screenshot

add

good note

Updated Just now by Atri Rudra

# 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](#)).

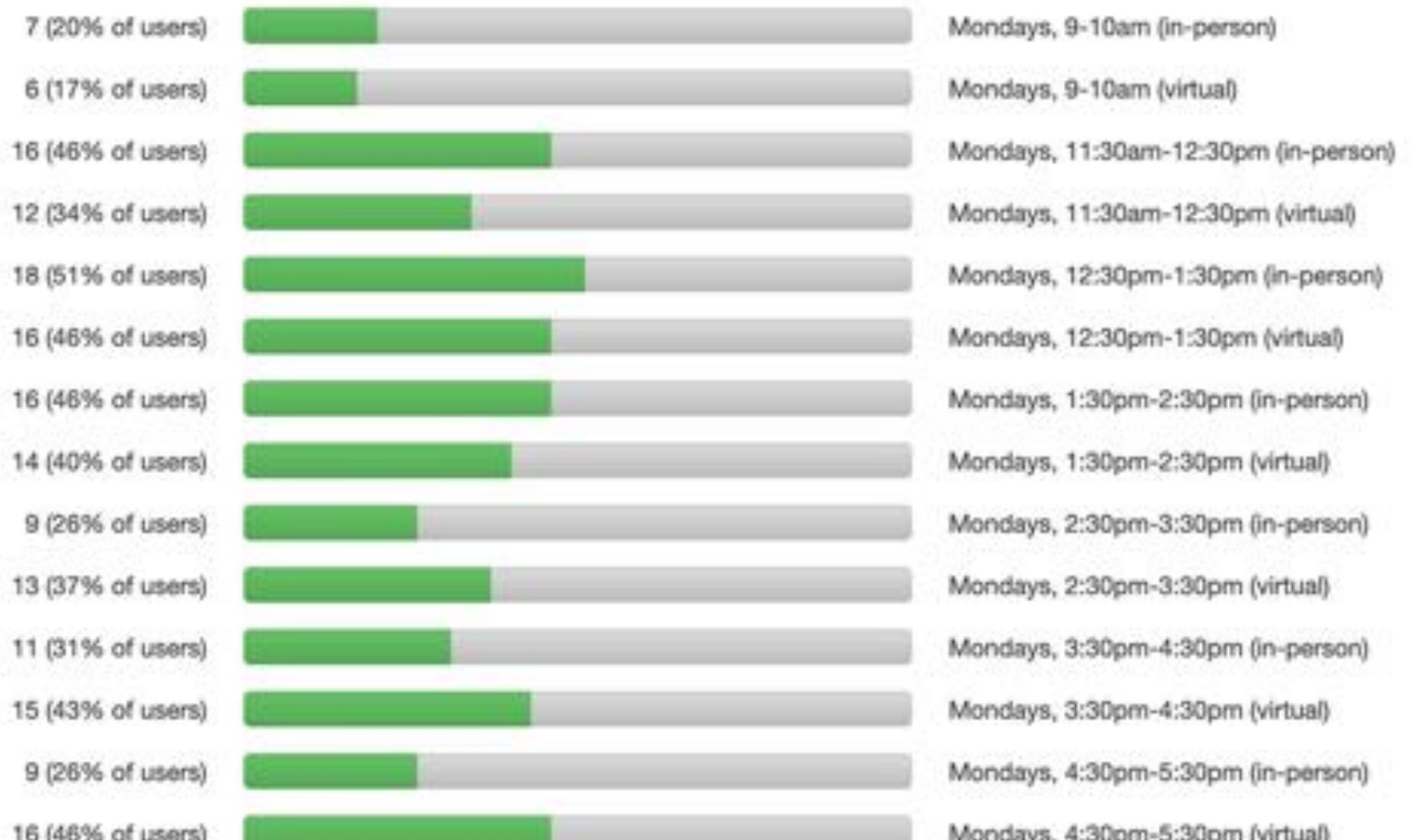
- [Gale Shapley algorithm](#) ↗.
- [DFS](#) ↗.
- [Dijkstra's Algorithm](#) ↗.
- [Dinic's algorithm](#) ↗.



# TA Office hours finalized tomorrow

## TA office hours closes in 5 day(s)

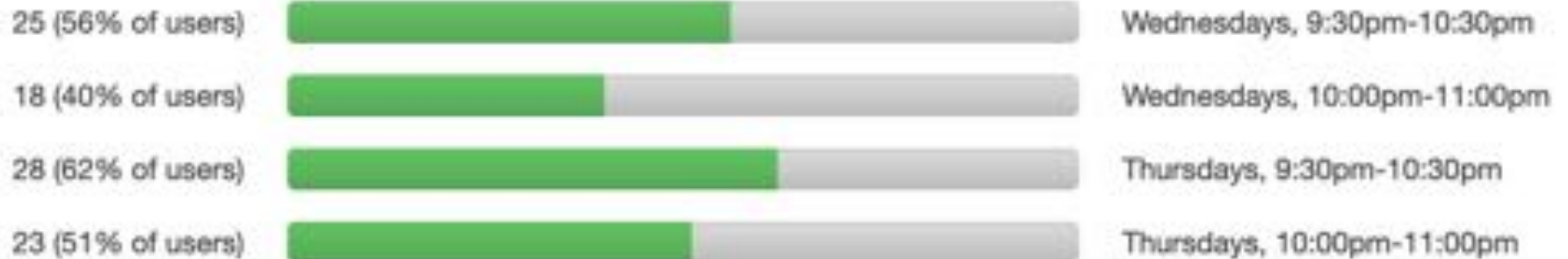
A total of 35 vote(s) in 46 hours



# Night Office hour as well

## Late night office hour closes in 5 day(s)

A total of 45 vote(s) in 46 hours



Why should I care about CSE 331?



# The proof is in the performance



**EMPTYHEADED**



10x faster

A large, thick green arrow pointing from the EmptyHeaded logo towards the Oracle logo.

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

# My preferred way to be addressed

Atri

My colleagues might have a different preference!

# Proof Idea vs. Proof Details

## Questions 1 and 2

For Q1 and Q2, think of the algorithm and proof ideas as things that go inside a header ( `.h` ) file. They are the high level overview of how you are approaching the problem; you don't have to be very technical here. For example, listing out all the steps in your algorithm, what proof technique are you using, what property of the algorithm are you induction on, etc.

Algorithm and proof details are the implementation inside the source ( `.cc` ) file. They are simply the detailed technical algorithm/ proof of the idea that was outlined.

### More on the idea vs details divide

Always start off with the ideas. Just smashing random keys on the keyboards won't get you anywhere with writing code and certainly would not help with proofs. In the real world, a user of your library doesn't care about the details; just wants to know how to use it. Similarly, in your proof and algorithm ideas, briefly explain what you're doing, how it works and why it should work. For example, if you're using contradiction in the proof details; just state that you use contradiction on a specific property (but do specify which property).

In the algorithm and proof details, be as detailed as you can be and try to avoid loopholes (more explained below).

# Questions/Comments?

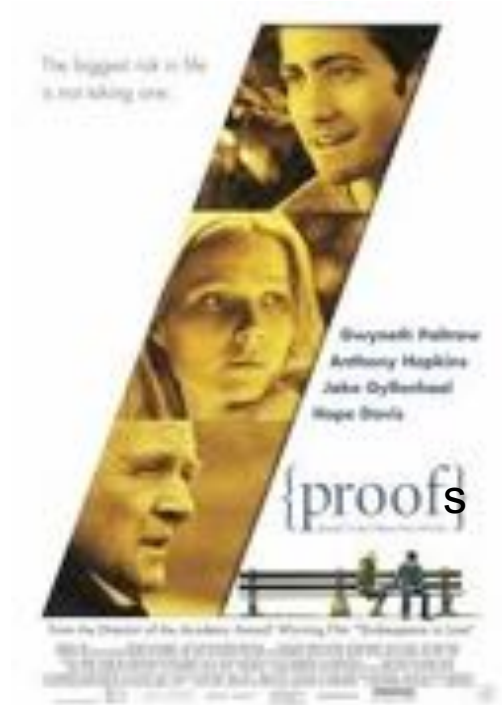


# Bit more about the course





# 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 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](http://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



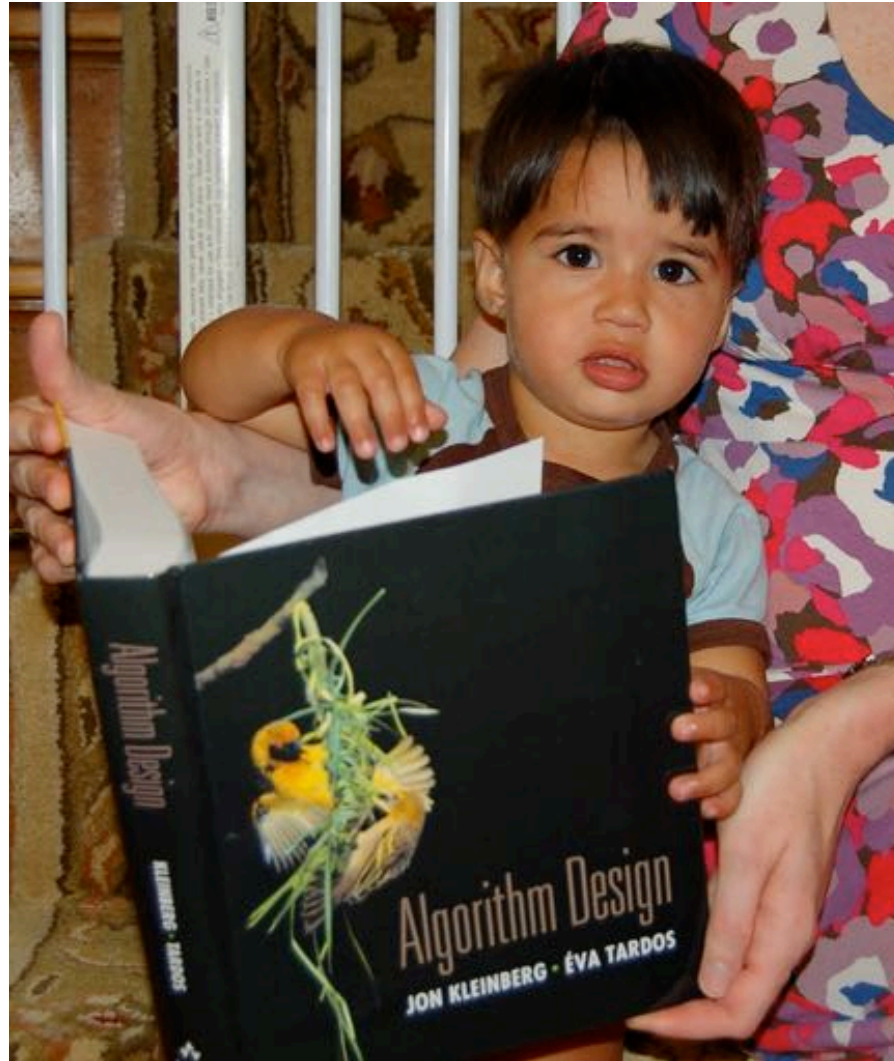
# More chances to recover

Lowest two 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 118, 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

## 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



# Questions/Comments?



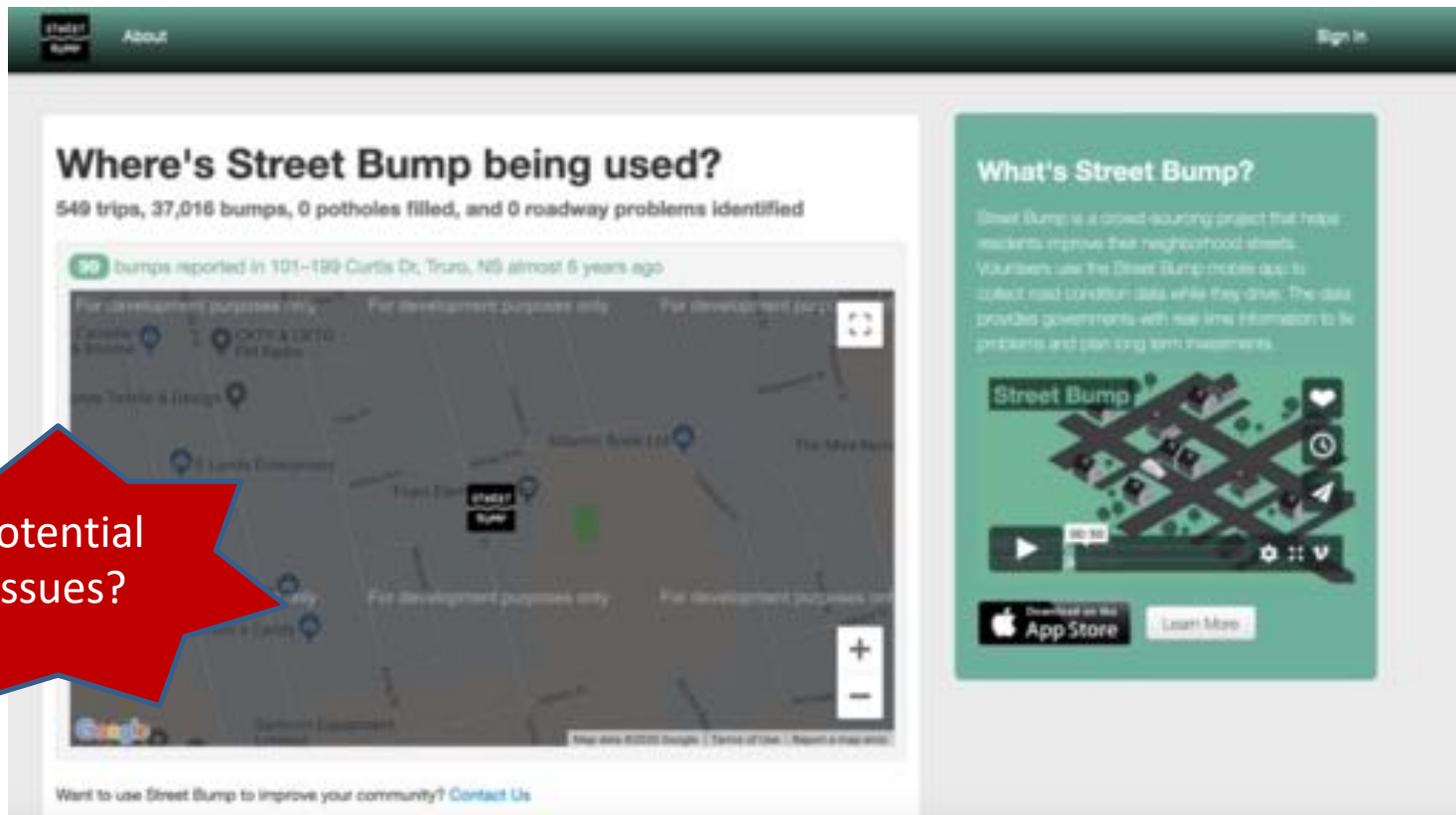
Let the fun begin!



Remember: Stick with your group



# Common solution: Let's build an app for that!



The screenshot displays the Street Bump website interface. At the top, there is a dark green header with the Street Bump logo, an 'About' link, and a 'Sign In' button. The main content area is divided into two columns. The left column features a heading 'Where's Street Bump being used?' followed by statistics: '549 trips, 37,016 bumps, 0 potholes filled, and 0 roadway problems identified'. Below this is a map showing a specific location with a callout: '30 bumps reported in 101-120 Curtis Dr, Truro, NS almost 6 years ago'. The map includes various street names and a 'Street Bump' label. The right column has a heading 'What's Street Bump?' and a paragraph explaining the project: 'Street Bump is a crowd-sourcing project that helps residents improve their neighborhood streets. You/they use the Street Bump mobile app to collect road condition data while they drive. The data provides governments with real time information to fix problems and plan long term investments.' Below the text is a video player showing a 30-second video of the app in use, with a play button and a 'Learn More' button. At the bottom of the right column, there is a 'Download on the App Store' button and a 'Learn More' button. At the bottom of the left column, there is a link: 'Want to use Street Bump to improve your community? [Contact Us](#)'.

Potential issues?

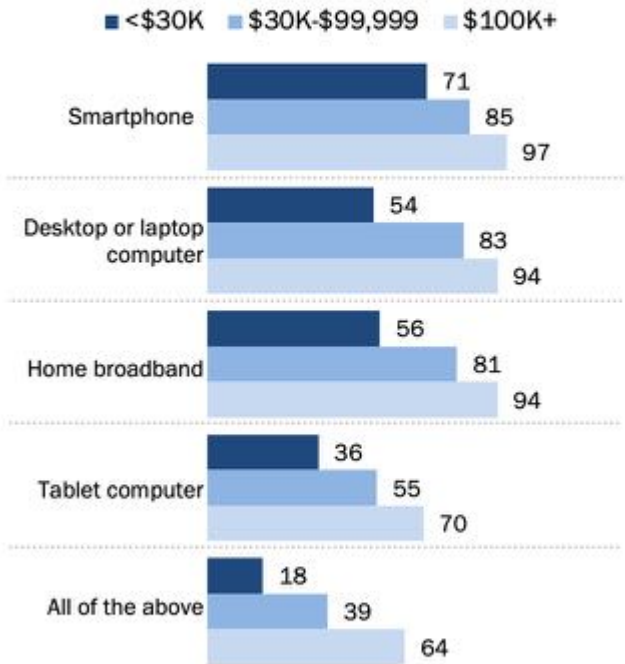
# The smartphone blind-spot

Many of us in CSE assume that “everyone” has smartphones

More generally, we assume “everyone” has access to the Internet

## Lower-income Americans have lower levels of technology adoption

*% of U.S. adults who say they have the following ...*

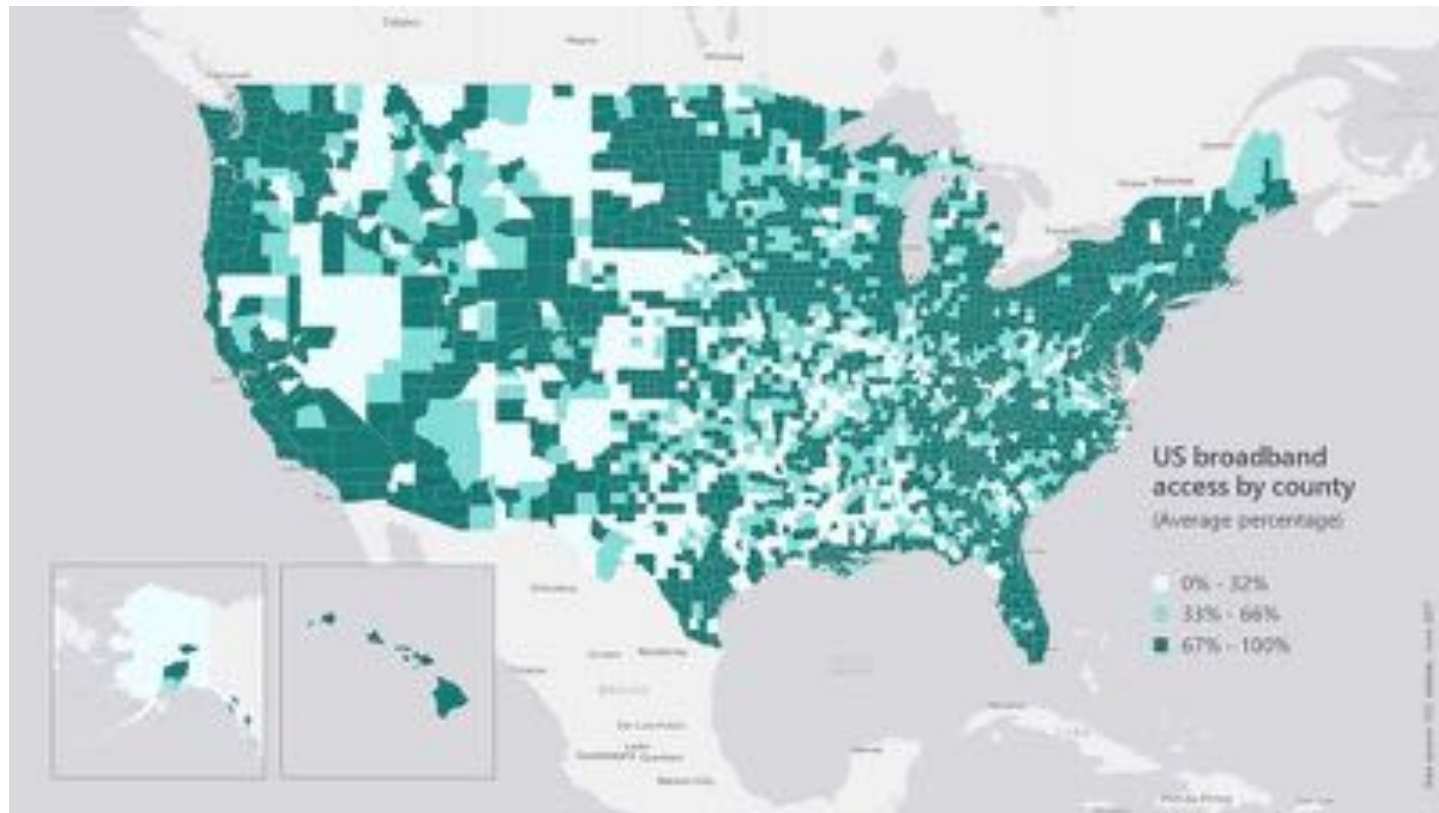


Note: Respondents who did not give an answer are not shown.  
Source: Survey conducted Jan. 8-Feb. 7, 2019.

PEW RESEARCH CENTER

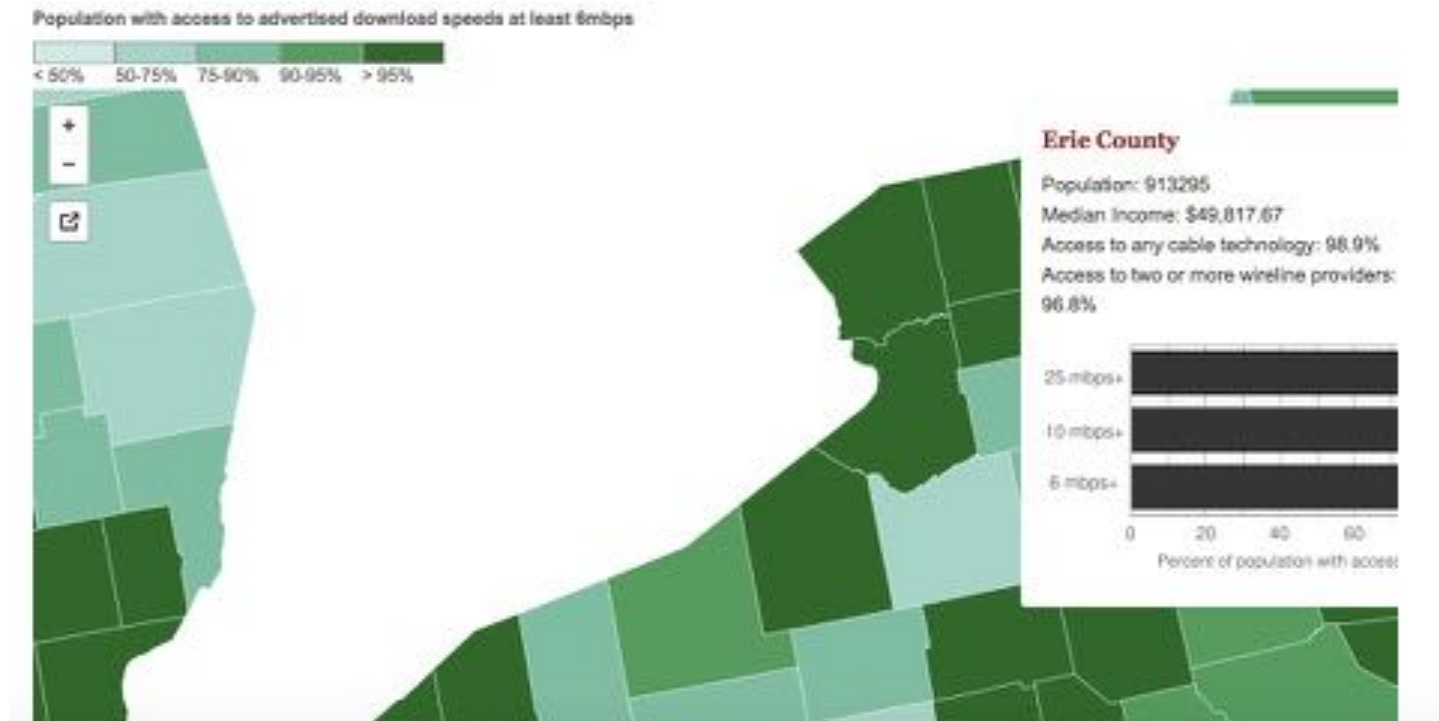


# Broadband access



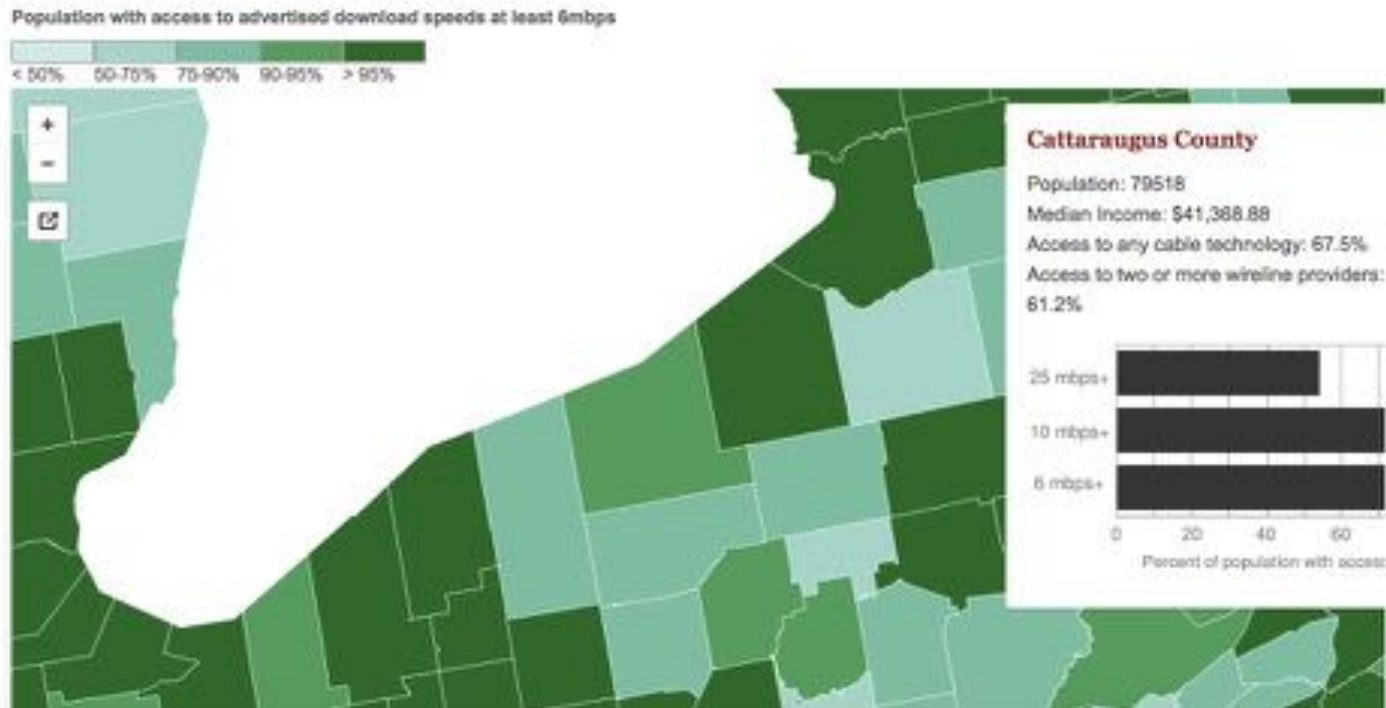
<https://assets.bwbx.io/images/users/iqjWHBFdfxIU/iZSjibxE1KJs/v1/800x-1.jpg>

# 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

