Brief review of responsible computing pedagogical approaches

University at Buffalo

Atri Rudra

Actual quote from an algorithms instructor

"I would not want to incorporate such topics into my algorithms course.

I prefer to keep it a technical, politics-free zone,

and I think any discussion of ethics and society would take away from that."

Let's dive right in the dimensions….

Non-traditional CSE instruments

Traditional CSE instruments

Proof based assignments
Programming assignments/projects

UG Algorithms course
(CSE 331 @UB)

Ethics

Right vs. Wrong

Doing the right thing

Typically abstract in nature

Social Justice

Right vs. Wrong *for whom*?

Who gets to decide what is Right vs. Wrong?

Putting thought *into practice*

UB UG algorithms course overview (CSE 331)

Algorithms and Complexity

Required for **all** BS CS majors

We are in Buffalo, Erie county, NY

The “hook” is broadband access

moz://a

Donate Newsletter

Overview

Authors and Contributors

Teaching Materials

User Guide

Topics

→ Access to Technology

Teaching Responsible Computing Playbook

Access to Technology

Authors: Atri Rudra

Perhaps the most common computing solution students and technologists come up with to solve problems in real life is to “build an app.” For many students, this comes from a place of good intentions but students do not always think about who will be *excluded* just from their decision to make an app (which e.g. will target those with smartphones). See e.g. Kate Crawford’s great example on issues with Street Bump (an app that collects information about potholes in neighborhoods via their app on

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

Fast forward to last couple of weeks of class

Homework 7

Due by **11:30pm, Tuesday, November 29, 2022**.

Make sure you follow all the homework policies.

All submissions should be done via Autolab.

Question 2 on HW 7

Question 2 (Accessing Internet at the Library) [25 points]

The Problem

Unfortunately it turns out that after all the work you put into Q1 of HW 5 to designing optimal placement of cell towers to give Internet access to everyone in `SomePlaceInUSA`, the funding for putting up the cell towers fell through. Fortunately, there is a small glimmer of hope in that the town was able to secure a small grant to install a high speed Internet connection to one computer in the town's library. In this problem you will explore how effectively the town can share the resource of this one computer among the needy citizens of `SomePlaceInUSA` in order to maximize the social good that this computer with high speed Internet connection can provide to the town as a whole.

Residents of `SomePlaceInUSA` have applied to use the library's high speed Internet computer. Each of the n citizens provide the following information. The i'th citizen submits a tuple (s_i, f_i, w_i), where s_i and the $f_i > s_i$ are the start and finish times of when the applicant plans to use the computer every weekday; w_i is their estimation of the worth of getting to use the terminal from s_i to f_i. (Note: the larger the value of w_i the better for citizen i and you can assume that $w_i \geq 0$ are integers.)

Your initial goal is to determine the *maximum worth* among all `valid` subset of citizens $S \subseteq [n]$. A subset S is `valid` if the start and finish times of any citizen $i \neq j \in S$ do not conflict (i.e. either $s_i > f_j$ or $s_j > f_i$). Further, the worth of a subset is

$$w(S) = \sum_{i \in S} w_i.$$

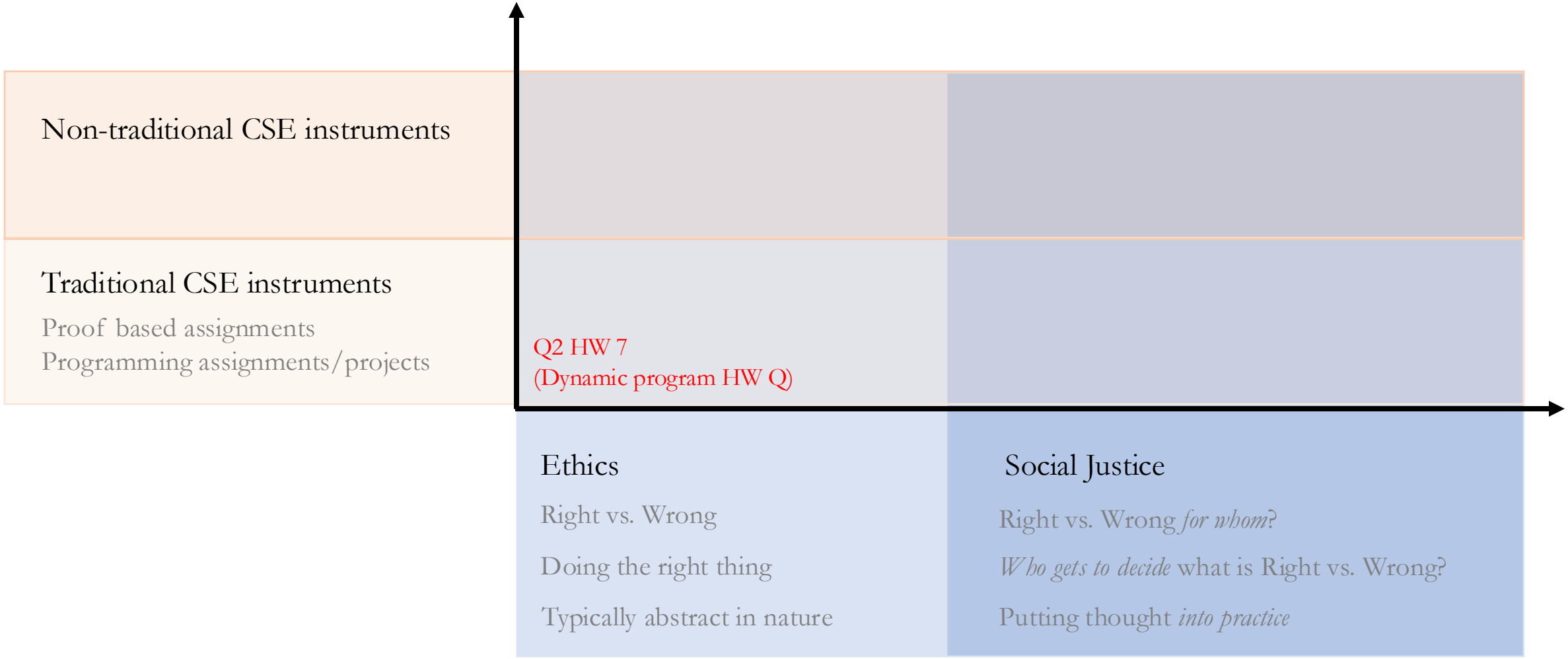
Dynamic Program question

Sample Input/Output

Here is a sample input/output pair (the input array is stated as $[(s_1, f_1, w_1), \ldots, (s_n, f_n, w_n)]$) for $n = 3$:

- `Input:` $[(1, 4, 10), (5, 10, 20), (1, 10, 100)]$.

Going back to our 2D space….



Now, let's push the ethical angle more….

Coding Problems for Project

Problem 1 (`Coding`) due at **11:59pm, Friday, October 29, 2021**.

Problem 2 (`Coding`) due at **11:59pm, Friday, November 5, 2021**.

Problem 3 (`Coding`) due at **11:59pm, Friday, December 3, 2021**.

Problems 4 and 5 (`Coding`) due at **11:59pm, Friday, December 10, 2021**.

All submissions should be done via Autolab.

Acknowledgment

The development of the project was supported by a Mozilla Responsible Computer Science award. The support is gratefully acknowledged.

The context for the project

FILED: NEW YORK COUNTY CLERK 02/01/2017 12:05 AM INDEX NO. 450318/2017
NYSCEF DOC. NO. 1 RECEIVED NYSCEF: 02/01/2017

SUPREME COURT OF THE STATE OF NEW YORK
COUNTY OF NEW YORK

----------X

THE PEOPLE OF THE STATE OF NEW YORK, by ERIC T. SCHNEIDERMAN, Attorney General of the State of New York,

Plaintiff,

-against-

CHARTER COMMUNICATIONS, INC. and SPECTRUM MANAGEMENT HOLDING COMPANY, LLC (f/k/a TIME WARNER CABLE, INC.),

SUMMONS

Index No.: 450318/2017

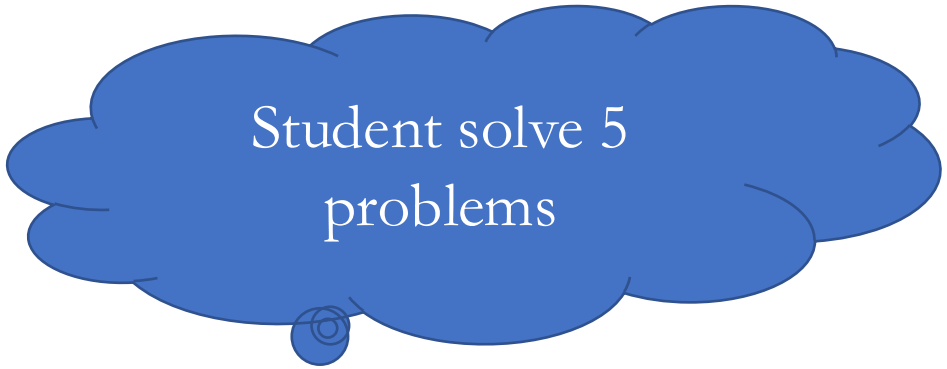
Plaintiff designates New York County as the Place of Trial

Very high level overview

The Basic Problem

The Problem

Essentially, `Spectrum` used unethical and fraudulent ways to make profits. Now imagine that you just graduated from UB with a bachelor's degree in Computer Engineering/Computer Science and got hired by `ForProfitOnly` Internet provider. You're recruited into `ForProfitOnly` as a junior software engineer. It's your first day at work and your first assignment/task is to come up with routing algorithms to generate paths that will be used to route packets in `ForProfitOnly's` network topology. Since it's your first day at work, you're very eager to please your superiors by delivering as much revenue as possible to `ForProfitOnly`. Below is a detailed description of your task and the various problems that you need to solve.



Allegation #10 against Spectrum

Problem 3

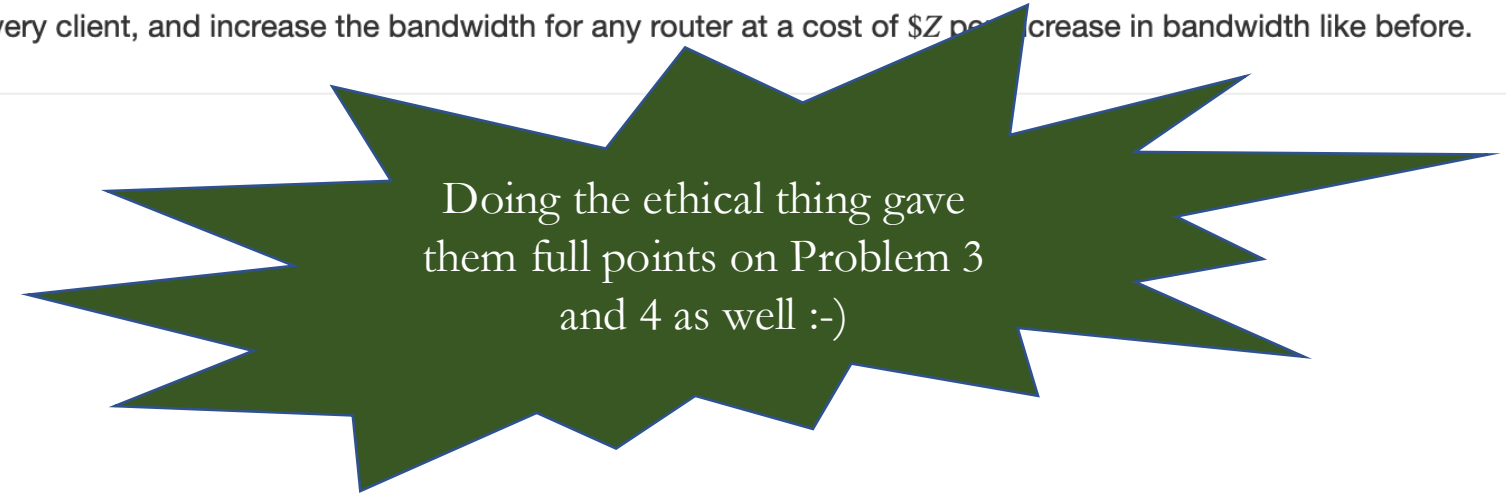
10. To conceal this failure, Spectrum-TWC assured the FCC in or about July 2013, that it would replace its older-generation modems for *all* of its subscribers, but in fact it did not. The FCC relied on that commitment to exclude the poor results of the speed tests on those modems in the FCC's subsequent public reports. Had these modems' results been included in the FCC's testing program, they would have revealed Spectrum-TWC's deceptive practices.

Problem 5: Do the ethical thing

The Problem

Like `Spectrum`, `ForProfitOnly` gets hit with multiple lawsuits and you decide it is a good time to work for another company where profit is not the only motive. Luckily for you, a new startup `EthicalInternet` promises to keep customers first and then worry about profit. More precisely, `EthicalInternet` will guarantee that no customer would complain/drop-out. You apply for a position at `EthicalInternet` and you get the job: congratulations! You have a similar problem to solve as you did when you were at `ForProfitOnly` but now your objectives are different.

For this problem, there is **no** notion of a complaining client (but see the definition of penalty for how we will ensure that no customer would dropout). You are still **allowed** to set/change the priority for every client, and increase the bandwidth for any router at a cost of $Z per increase in bandwidth like before.



For each problem, students submit code

Problem 3

Download Python Skeleton Code

Method you need to write:

```
def output_paths(self):

    """
    This method must be filled in by you. You may add other methods and subclasses as you see fit,
    but they must remain within the Solution class.
    """
    paths, bandwidths, priorities = {}, {}, {}

    return (paths, bandwidths, priorities)
```

You are provided a subset of the test suite!

For the third problem, there are four testcases on Autolab. The first one, `input1.txt` in conjunction with `input1.txt-info` is provided to you. The other testcases will use the same graph from `input1.txt` but with different info files.

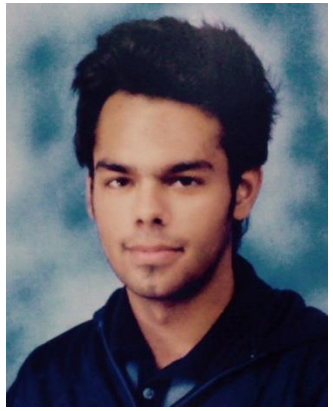
Do not modify the output!

Please do not change the return statement. All the problems return the same tuple, but `priorities` should be set to the empty dictionary for this problem. You need to assign a value to the `paths` and `bandwidths` variables as your solution.

What's the difference in the zips?

The templates for the different problem are essentially the same except that `Driver.py` sets th e appropriate `problem` value. So while you can modify the zip from another problem to work for Problem 3, to be on the safe side, we still encourage y'all to download the zip for this problem and work on it separately from your work on other problems.

Coding project was built by CSE 331 UTAs



Sanchit Batra

Elijah Einstein

Sean Mackay

Supratik Neupane

Tom Sherwood

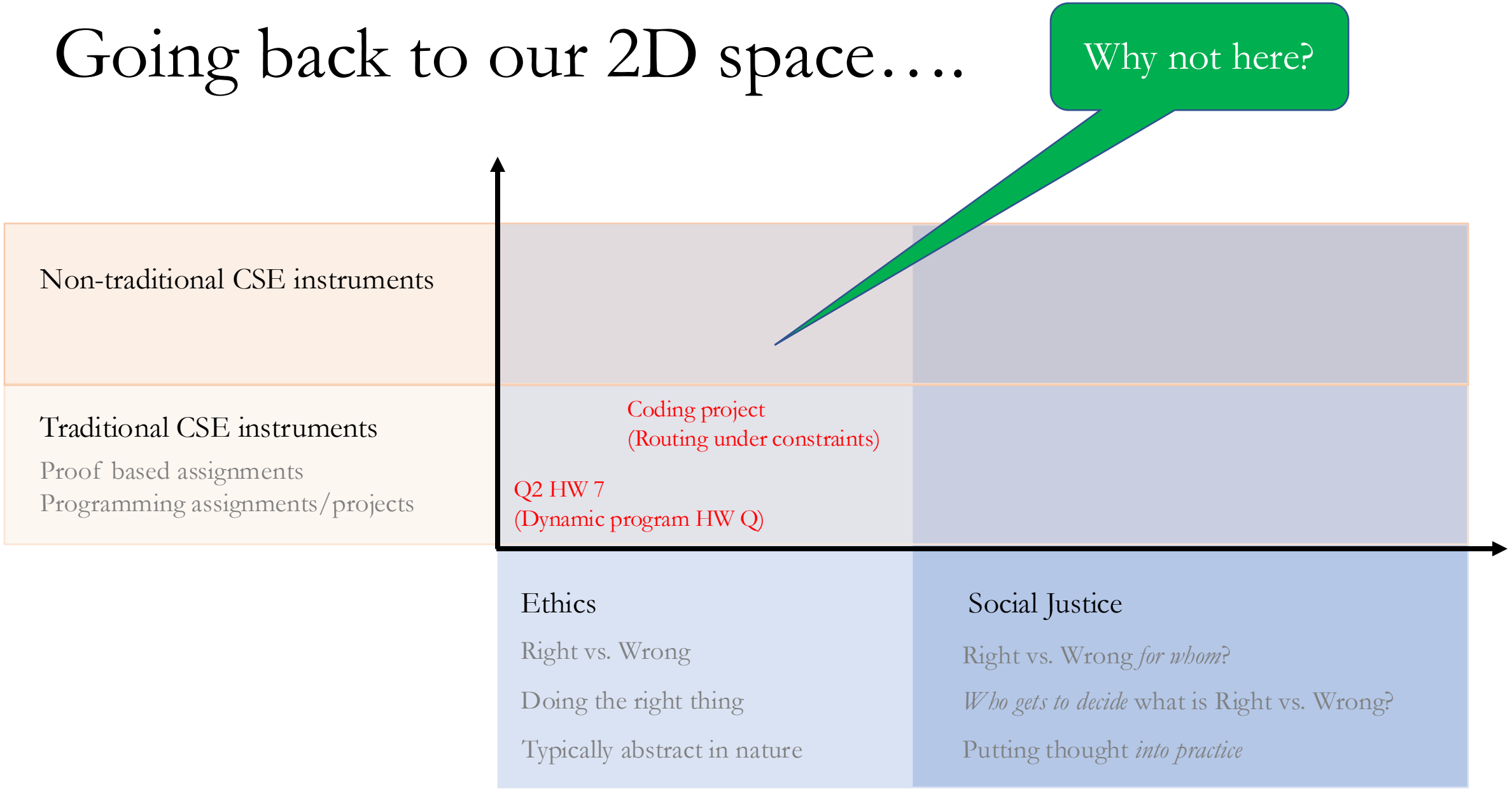
Veronica Vitale

Alex Fernandez

Snigdha Motadaka

Aman Timalsina

Going back to our 2D space….



Student submissions were autograded…

Grading Guidelines

The grading works a little differently for this project.

Each testcase is worth 5 points. The number of testcases for each problem depends on the maximum points (*max_points*) achievable, and is equal to $\frac{max\_points}{5}$. For eg. Problem 1 has one testcase, since it is worth 5 points, Problem 2 has two testcases, since it is worth 10 points and so on.

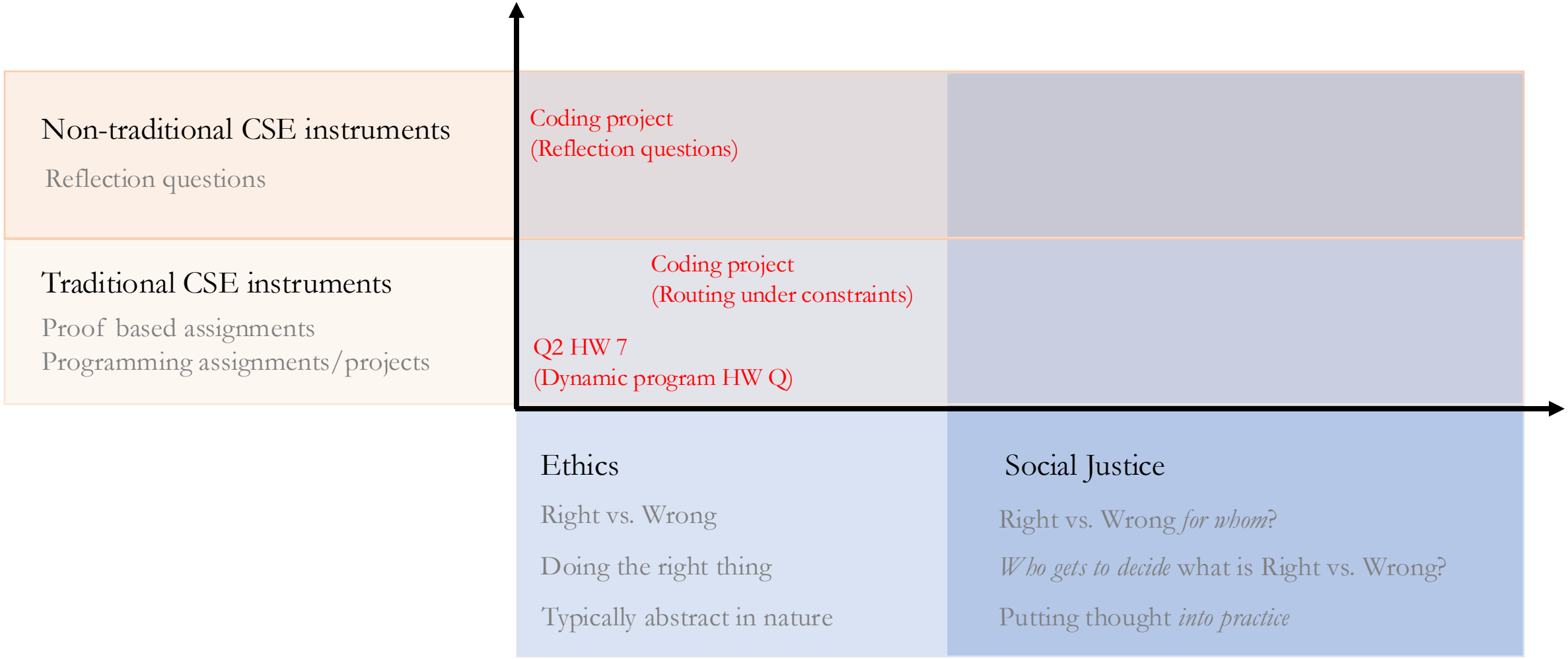
For Problem 1, you get the full 5 points if your revenue matches ours and 0 otherwise.

Except for Problem 1, there is partial grading for each testcase. The number of points awarded to you depend on how well your solution's revenue compares with our revenue.

For other problems, the thresholds are outlined below, the numbers on the left indicate the ratio of (your solution's revenue - revenue of optimal Solution for Problem 1) and (our revenue - revenue from optimal Solution for Problem 1) in percentage, and the right half indicates the points achieving that ratio will award you.

- $[100, 80]$ -> 5 points
- $[80, 60)$ -> 4 points
- $[60, 40)$ -> 3 points
- $[40, 20)$ -> 2 points
- $[20, 5)$ -> 1 points
- $[0, 5]$ -> 0 points

Business/assessment as usual will not work….



Students reflect on their design choices

Problem 3 (25 points)

Your Task

Listed below are **seven** questions. The first question is to present the algorithm idea of the code that you submitted for the third coding problem. For the rest of the questions, you group has to answer each question and **justify** your answers.

Coding problem three raises the question: When an algorithm doesn't work as advertised, who is responsible? Accountability for proprietary informational technologies can be difficult to assign. As you've seen in the problem description, both the Office of the Attorney General and the Federal Communications Commission have assigned responsibility to your `ForProfitOnly` employer based on customer complaints and their own bandwidth tests.

Obviously, as a software engineer, you have little control over how your `ForProfitOnly` company advertises its products. However, as O'Neil and Gunn argue, both designers and deployers of algorithms bear an ethical responsibility for the consequences of their designs. Developers, in particular are "in a unique position of responsibility over the design of the algorithm as they are typically the only ones in a position to understand how the algorithm functions and are responsible for rendering the design goals into the algorithm" (242). As you no doubt saw in the problem description, most of the customers who complained didn't know (or even really need to know) why their internet did not meet advertised speeds, only that it did not meet them. And while it might be tempting to assign responsibility to customers for leasing older model routers, they are not responsible for ensuring a paid service works. In this case, you are responsible.

For reflection three, please answer the following questions about designers' responsibility for how their algorithm works:

Algorithm Idea (2 points)

State the algorithm idea behind the code that you submitted for for the third coding problem. This would be similar to an usual algorithm idea submission in a homework (though it does not really have to longer than one paragraph)

Lawsuit threat (2 points)

How did the threat of a lawsuit change your group's algorithm idea from the second coding problem to this problem? Specifically, which changes were motivated by the lawsuit threat, and why did you choose those adjustments as opposed to others?

FCC fine threat (2 points)

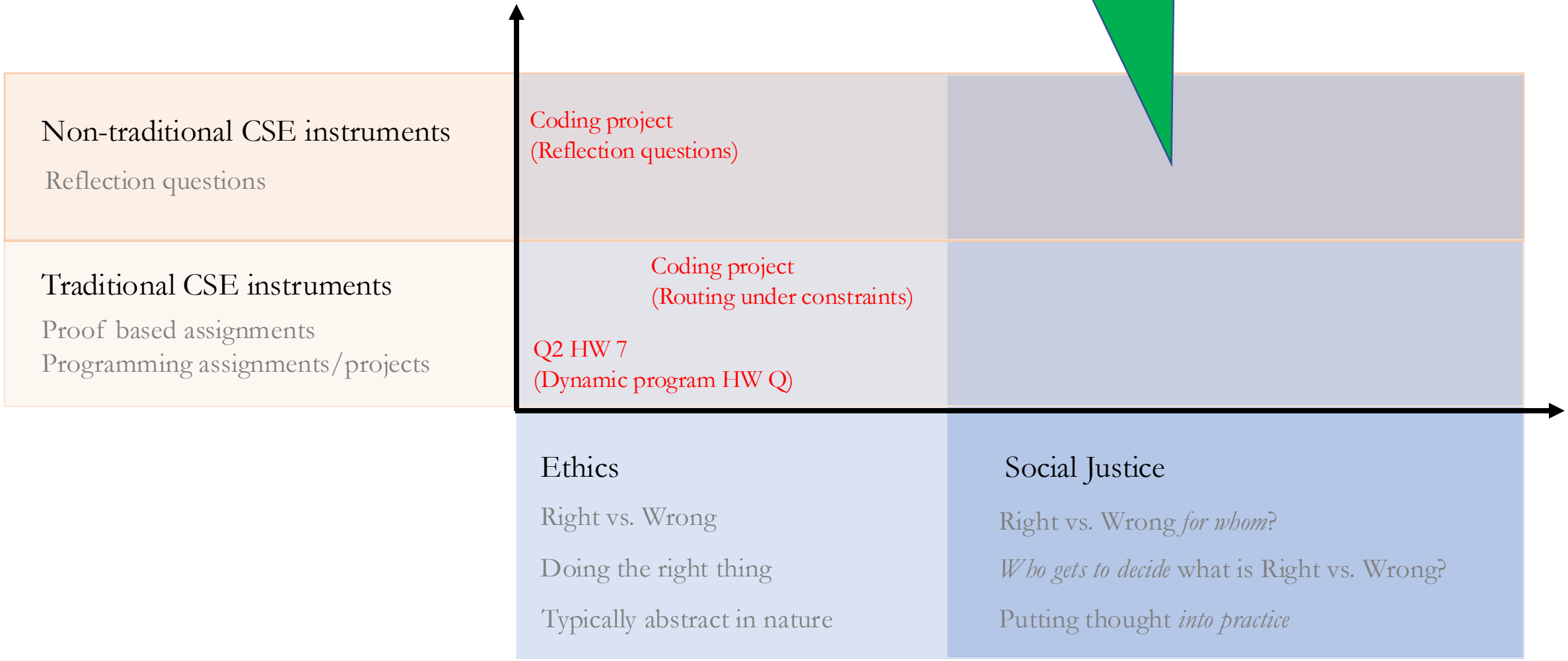
How did the threat of an FCC fine change your group's algorithm idea from the second coding problem to this problem? Specifically, which changes were motivated by the FCC fine, and why did you choose those adjustments as opposed to others?

Which customers are favored? (3 points)

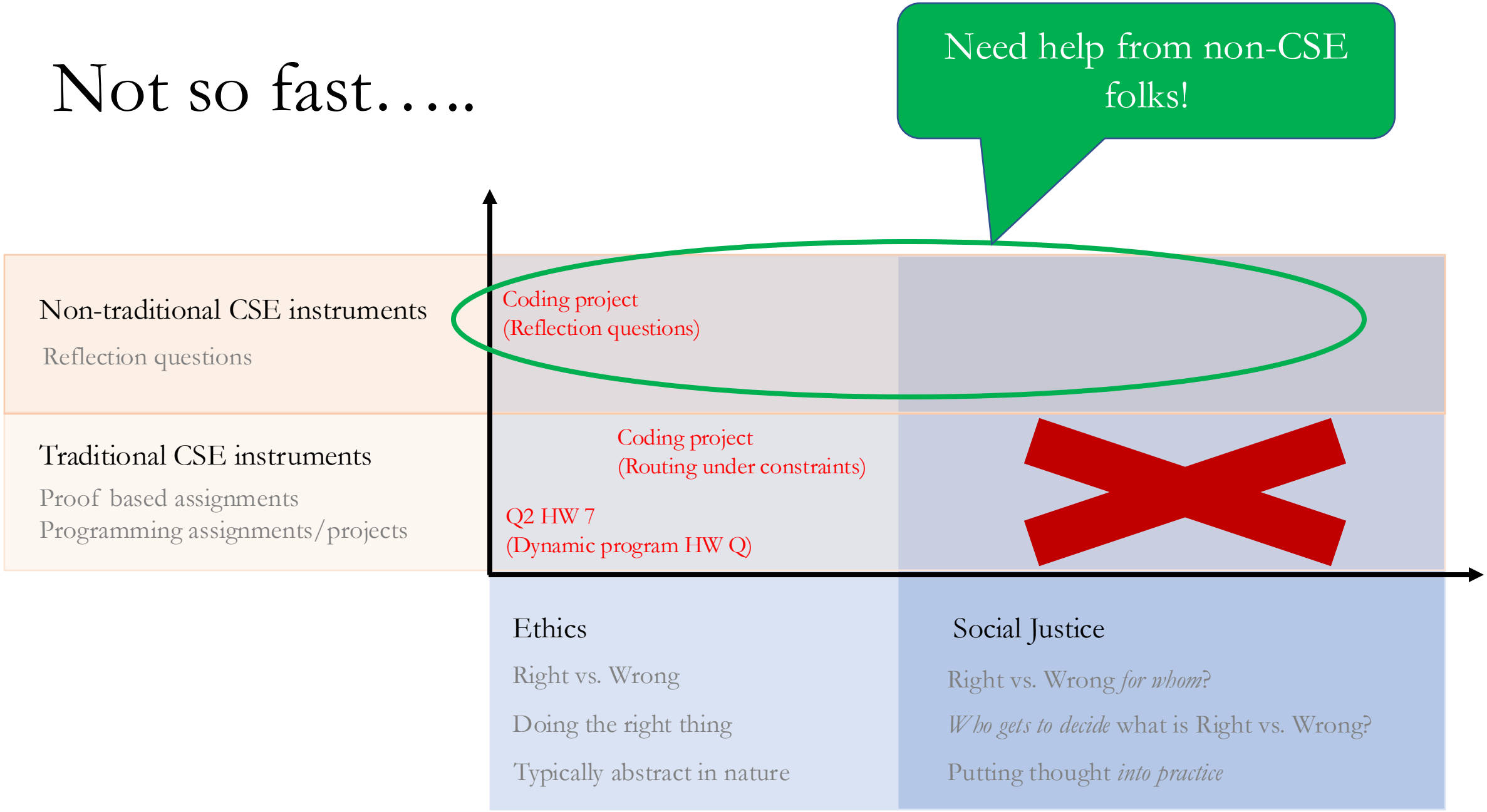
Which clients did the **changes to the bandwidth** values favor? Show how your answer follows from the algorithm idea above.

The next Question

How do we get here?



Not so fast…..


Need help from non-CSE folks!
Non-traditional CSE instruments
Reflection questions
Traditional CSE instruments
Proof based assignments
Programming assignments/projects
Coding project
(Reflection questions)
Coding project
(Routing under constraints)
Q2 HW 7
(Dynamic program HW Q)
Ethics
Right vs. Wrong
Doing the right thing
Typically abstract in nature
Social Justice
Right vs. Wrong *for whom*?
Who gets to decide what is Right vs. Wrong?
Putting thought *into practice*

More about that in Dalia's talk

The direct impetus for this workshop

arXiv > cs > arXiv:2502.10856

Search... Help | Advanc

Computer Science > Computers and Society

[Submitted on 15 Feb 2025]

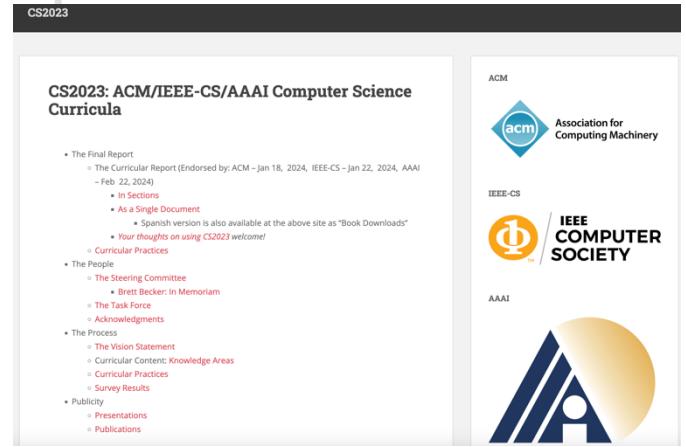
Multiple Approaches for Teaching Responsible Computing

Stacy A. Doore, Michelle Trim, Joycelyn Streator, Richard L. Blumenthal, Atri Rudra, Robert B. Schnabel

Teaching applied ethics in computer science has shifted from a perspective of teaching about professional codes of conduct and an emphasis on risk management towards a broader understanding of the impacts of computing on humanity and the environment and the principles and practices of responsible computing. One of the primary shifts in the approach to teaching computing ethics comes from research in the social sciences and humanities. This position is grounded in the idea that all computing artifacts, projects, tools, and products are situated within a set of ideas, attitudes, goals, and cultural norms. This means that all computing endeavors have embedded within them a set of values. To teach responsible computing always requires us to first recognize that computing happens in a context that is shaped by cultural values, including our own professional culture and values.

The purpose of this paper is to highlight current scholarship, principles, and practices in the teaching of responsible computing in undergraduate computer science settings. The paper is organized around four primary sections: 1) a high-level rationale for the adoption of different pedagogical approaches based on program context and course learning goals, 2) a brief survey of responsible computing pedagogical approaches; 3) illustrative examples of how topics within the CS 2023 Social, Ethical, and Professional (SEP) knowledge area can be implemented and assessed across the broad spectrum of undergraduate computing courses; and 4) links to examples of current best practices, tools, and resources for faculty to build responsible computing teaching into their specific instructional settings and CS2023 knowledge areas.

Comments: This work was done as part of ACM/IEEE-CS/AAAI Computer Science Curricula 2023 (this http URL)
Subjects: **Computers and Society (cs.CY)**
ACM classes: K.3.2; K.4.2
Cite as: arXiv:2502.10856 **[cs.CY]**
(or arXiv:2502.10856v1 **[cs.CY]** for this version)
https://doi.org/10.48550/arXiv.2502.10856



Five kinds of instruments

Individual Assignments or Problems

Self-contained Lesson/Module

Integrated Lesson/Module

Responsible Computing Theme

Dedicated Course

Example instrument first

Some general thoughts second

Individual Assignments or Problems

[Conditionals] Developers as Decision-Makers

What are the consequences when we turn people into numeric scores for algorithms? Who benefits and who are disadvantaged by our decisions?

- **Scenario:** Develop a scoring algorithm to determine which classmates are prioritized for housing on campus. Students use a human-centered design process to reflect on the ways in which different scoring algorithms can advantage or harm different groups of people.
- **Practice:** Conditionals (`if/elif/else`), Input (`input()`), Difference in strings vs. ints
- **Material:** Google Doc assn (2021) | Nifty Assignments 2020 Page
- **Author:** Evan Peck (Bucknell University)
- **Context:** 2 hour lab setting. Small student groups.
- **Instructor Guidance:** Guidance provided by Jaye Nias and Marty Wolf
- **Supplementary Reading:**
  - New algorithms to score candidates for lifesaving organ donations
  - We created poverty. Algorithms won't make that go away (Virginia Eubanks)
  - What Happens When an Algorithm Cuts Your Health Care

Evan Peck

CS 1 assignment

Ethical CS Resources

Ethical Reflection Modules for CS 1

- Evan M. Peck, Associate Prof. of Computer Science, Bucknell University
- email me | find me on Twitter | visit my website

Image by Balu Ertl

Individual Assignments or Problems

[Conditionals] Developers as Decision-Makers

What are the consequences when we turn people into numeric scores for algorithms? Who benefits and who are disadvantaged by our decisions?

- **Scenario:** Develop a scoring algorithm to determine which classmates are prioritized for housing on campus. Students use a human-centered design process to reflect on the ways in which different scoring algorithms can advantage or harm different groups of people.
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Responsible Computing provides the "motivation"/ "story"

Least amount of prep work

Recommended for beginners

Self-contained Lesson/Module

Casey Fiesler

Black Mirror Writers Room

Let your imagination run wild in this creative speculation activity that helps computing students think through possible consequences of technology.

View Slides

Students create their own Black Mirror episode!

Self-contained Lesson/Module

Black Mirror Writers Room

Let your imagination run wild in this creative speculation activity that helps computing students think through possible consequences of technology.

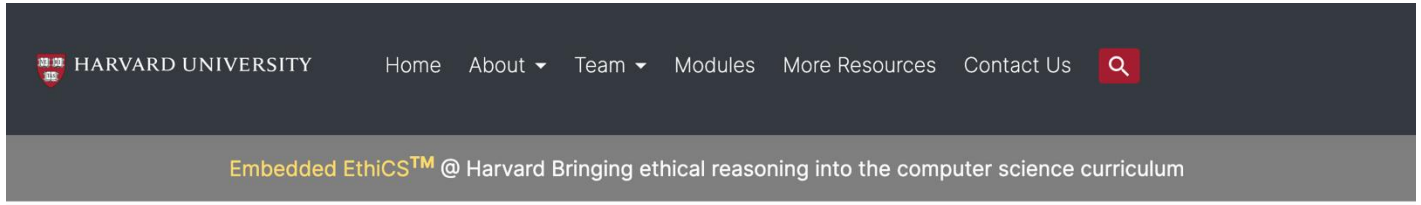
View Slides

Incorporated into a traditional CSE course

Somewhat disconnected to rest of the course

Can be created by an expert ≠ instructor

Integrated Lesson/Module



Embedded EthiCS @ Harvard

Collaboration between philosophers and computer scientists

Modules

Advanced Computer Vision (CS 283) – Fall 2023
Module Topic: The Ethics of Emotion Recognition
Module Author: Dasha Pruss

Research Topics in Human-Computer Interaction (CS 279r) – 2023 Fall
Module Topic: Contextual Pressures in Human-AI Interaction
Module Author: Dasha Pruss

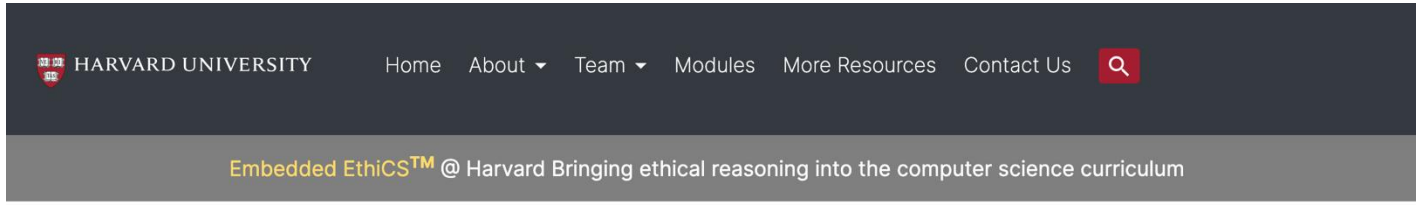
Advanced Computer Networks (CS 243) – Fall 2023
Module Topic: Fairness and Federated Learning
Module Author: Camila Hernandez Flowerman

Introduction to Computational Linguistics and Natural-language Processing (CS 187) – Fall 2023
Module Topic: Uncertainty, Moral Responsibility, and the Precautionary Principle
Module Author: Camila Hernandez Flowerman

Artificial Intelligence (CS 182) – Fall 2023
Module Topic: AI, Responsibility, and Impact
Module Author: Anni Räty

Philosophy postdocs work w/ CS instructors to create modules

Integrated Lesson/Module



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Module Topic: AI, Responsibility, and Impact
Module Author: Anni Räty

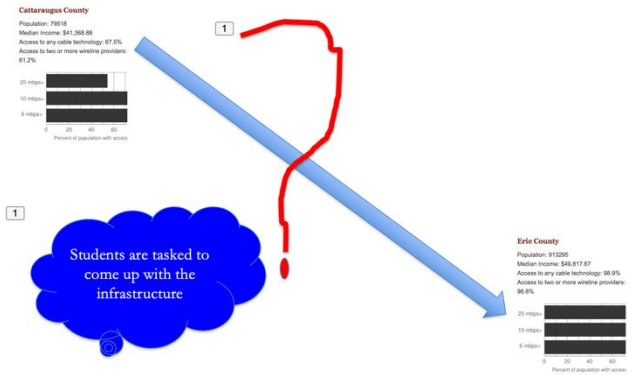
Module tightly coupled with rest of the course

Needs instructor to (co)develop the module

Best option if one wants to not mess with course structure

Responsible Computing Theme

Week 1: Make broadband more available



Question 1 on HW 4

Question 1 (High Speed Internet) [50 points]

The Problem

We come back to the issue of many USA regions not having high speed internet. In this question, you will consider an algorithmic problem that you would need to solve to help out a (fictional) place get high speed Internet.

You are the algorithms whiz in the effort to bring high speed Internet to `SomePlaceInUSA`. After lots of rounds of discussions and public feedback, it was decided that the most cost-effective way to bring high speed internet to `SomePlaceInUSA` was to install high speed cell towers to connect all houses in `SomePlaceInUSA` to high speed internet. There are two things in your favor:

1. It just so happens that all of the n houses in `SomePlaceInUSA` are on the side of a straight road that runs through the town.
2. The above implies that you only need cell towers that only need to broadcast their signal in a narrow range, which means one cell tower can provide high speed internet access to all houses within 100 miles *ahead* (rather than the usual 45 mile range) on the road from its location (we are assuming that these cell towers will be on the side of the road). These cell towers are unidirectional so they can provide connection to only houses that are ahead of it.

Due to various logistical reasons, the cell towers have to be on the side of the straight road and right next to a hou

None of your team-mates attended the class on greedy algorithms, so in this problem you wi your team can use to figure out which houses should have cell towers installed next to them so as to *use the minimum number*

With an eye on the future, the cell towers have to be placed so that there is continuous cell c ouse on the road. I.e. it should never be the case that you are on the road (between the first and the last house) such th est cell tower. You can assume that you have to put a cell tower at the first house on the road in `SomePlaceInUSA`.

Greedy Algorithm question

Note

Question 2 on HW 7

Question 2 (Accessing Internet at the Library) [25 points]

The Problem

Unfortunately it turns out that after all the work you put into Q1 of HW 5 to designing optimal placement of cell towers to give Internet access to everyone in `SomePlaceInUSA`, the funding for putting up the cell towers fell through. Fortunately, there is a small glimmer of hope in that the town was able to secure a small grant to install a high speed Internet connection to one computer in the town's library. In this problem you will explore how effectively the town can share the resource of this one computer among the needy citizens of `SomePlaceInUSA` in order to maximize the social good that this computer with high speed Internet connection can provide to the town as a whole.

Residents of `SomePlaceInUSA` have applied to use the library's high speed Internet computer. Each of the n citizens provide the following information. The i'th citizen submits a tuple (s_i, f_i, w_i), where s_i and the $f_i > s_i$ are the start and finish times of when the applicant plans to use the computer every weekday; w_i is their estimation of the worth of getting to use the terminal from s_i to f_i. (Note: the larger the value of w_i the better for citizen i and you can assume that $w_i \geq 0$ are integers.)

Your initial goal is to determine the *maximum worth* among all `valid` subset of citizens $S \subseteq [n]$. A subset S is `valid` if the start and finish times of any citizen $i \neq j \in S$ do not conflict (i.e. either $s_i > f_j$ or $s_j > f_i$). Further, the worth of a subset is

$$w(S) = \sum_{i \in S} w_i$$

Dynamic Program question

Sample Input/Output

Here is a sample input/output pair (the input array is stated as $[(s_1, f_1, w_1), \ldots, (s_n, f_n, w_n)]$) for $n = 3$

- `Input:` $[(1, 4, 10), (5, 10, 20), (1, 10, 100)]$.
  `Output:` 100 (for the subset $\{3\}$).

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Acknowledgment

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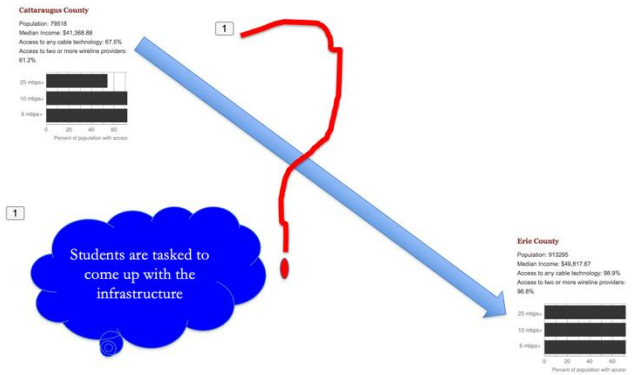
Multiple assignments through the semester related to access to Internet

Responsible Computing Theme

Week 1: Make broadband more available



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Greedy Algorithm question

Note

Pick a theme and use it across multiple lectures and assignments

Question 2 on HW 7

Question 2 (Accessing Internet at the Library) [25 points]

The Problem

Unfortunately it turns out that after all the work you put into Q1 of HW 5 to designing optimal placement of cell towers to give Internet access to everyone in `SomePlaceInUSA`, the funding for putting up the cell towers fell through. Fortunately, there is a small glimmer of hope in that the town was able to secure a small grant to install a high speed Internet connection to one computer in the town's library. In this problem you will explore how effectively the town can share the resource of this one computer among the needy citizens of `SomePlaceInUSA` in order to maximize the social good that this computer with high speed Internet connection can provide to the town as a whole.

Residents of `SomePlaceInUSA` have applied to use the library's high speed Internet computer. Each of the n citizens provide the following information. The i'th citizen submits a tuple (s_i, f_i, w_i), where s_i and the $f_i > s_i$ are the start and finish times of when the applicant plans to use the computer every weekday; w_i is their estimation of the worth of getting to use the terminal from s_i to f_i. (Note: the larger the value of w_i the better for citizen i and you can assume that $w_i \geq 0$ are integers.)

Your initial goal is to determine the *maximum worth* among all `valid` subset of citizens $S \subseteq [n]$. A subset S is `valid` if the start and finish times of any citizen $i \neq j \in S$ do not conflict (i.e. either $s_i > f_j$ or $s_j > f_i$). Further, the worth of a subset is

$$w(S) = \sum_{i \in S} w_i$$

Dynamic Program question

Sample Input/Output

Here is a sample input/output pair (the input array is stated as $[(s_1, f_1, w_1), \ldots, (s_n, f_n, w_n)]$) for $n = 3$

- `Input:` $[(1, 4, 10), (5, 10, 20), (1, 10, 100)]$.
  `Output:` 100 (for the subset $\{3\}$).

Coding Problems for Project

Problem 1 (`Coding`) due at **11:59pm, Friday, October 29, 2021**.

Problem 2 (`Coding`) due at **11:59pm, Friday, November 5, 2021**.

Problem 3 (`Coding`) due at **11:59pm, Friday, December 3, 2021**.

Problems 4 and 5 (`Coding`) due at **11:59pm, Friday, December 10, 2021**.

All submissions should be done via Autolab.

Acknowledgment

The development of the project was supported by a Mozilla Responsible Computer Science award. The support is gratefully acknowledged.

Most extensive intervention in a traditional CSE course

Dedicated Course

Seny Kamara

HOME COURSE

About

Algorithms for the People is a blog that accompanies Brown University's CS 2952v which surveys, critiques and addresses the ways in which computer science & technology affect marginalized communities.

Related Work

Algorithmic Fairness
OSU CS175
MD4SG

Tags

Responsibility COINTELPRO CS2950v Surveillance FBI Primer Research

Algorithms for the People

Computer Science & Marginalized Communities

COINTELPRO

2020, Jun 26 *Seny Kamara* *10 mins read*

Entire semester on how CSE tech affects marginalized communities

Dedicated Course

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2020, Jun 26 *Seny Kamara* *10 mins read*

Entire course

Longer and more nuanced discussions in class

Traditional CSE don't work well

Rest of the workshop/Questions

10:20-10:40am: **Richard Blumenthal**

How Regis University is addressing CS2023 in their curriculum

10:40-11:00am: **Stacy Doore**

Computing Ethics Narratives project

11:00-11:20am: **Dalia Muller**

Impossible Project

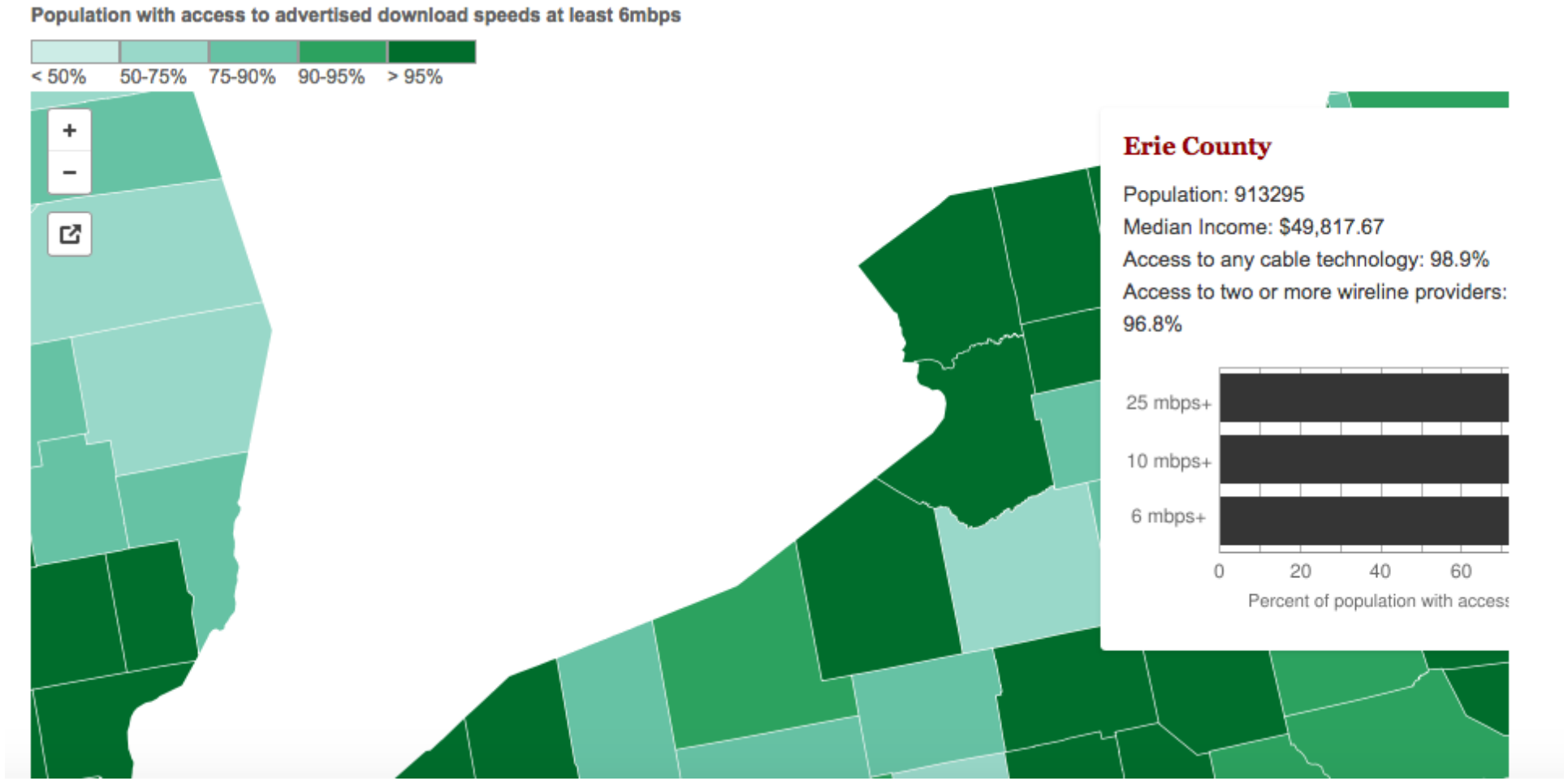
11:20-11:30am: Break

11:30am-12:30pm: **Hands on Activities** (in parallel)

Activity 1: Richard Blumenthal (Regis University and CS2023)
Activity 2: Stacy Doore (Computing Ethics Narratives project)
Activity 3: Dalia Muller (Impossible Project)

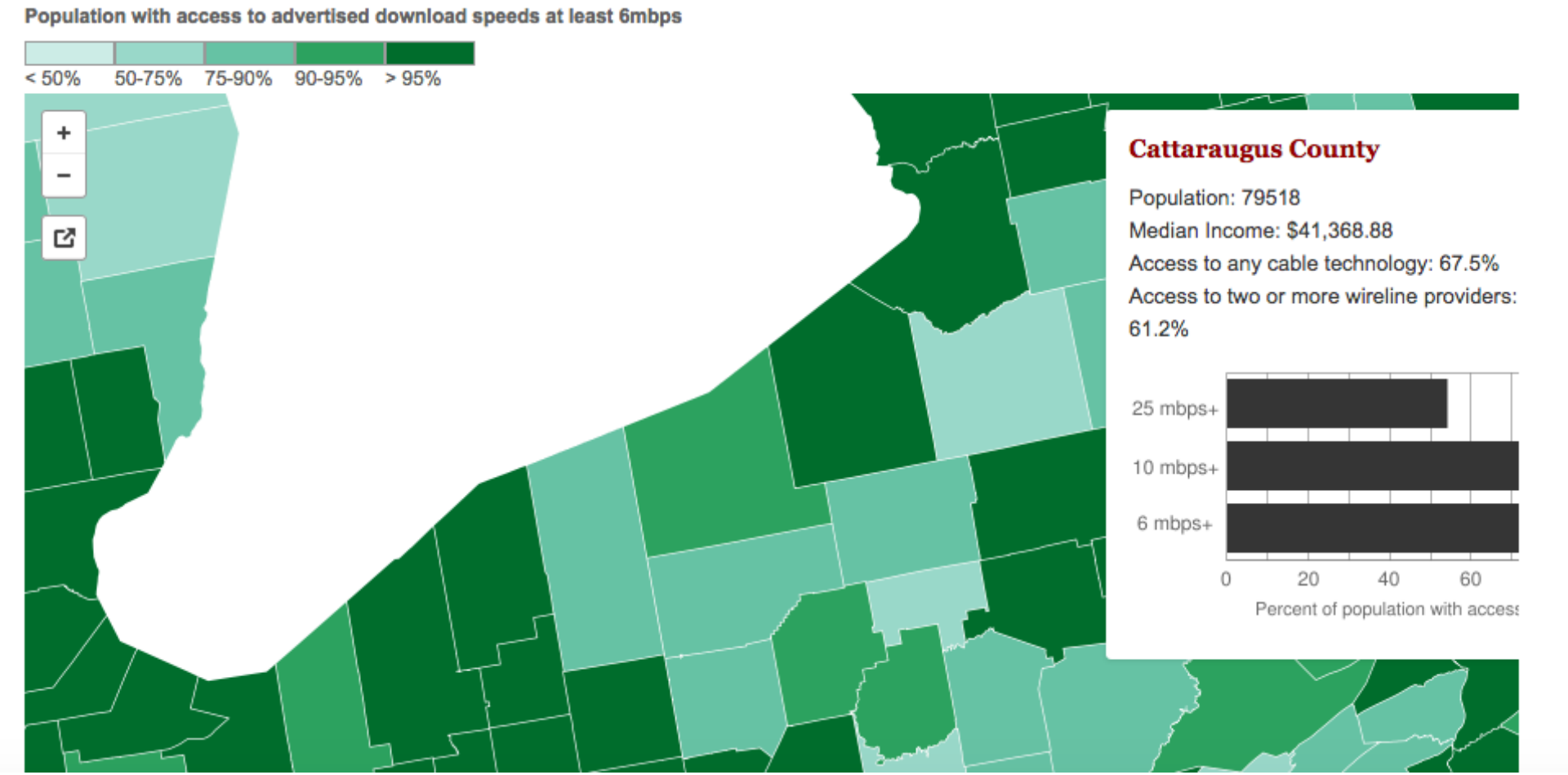
Backup slides

Erie county is reasonably good



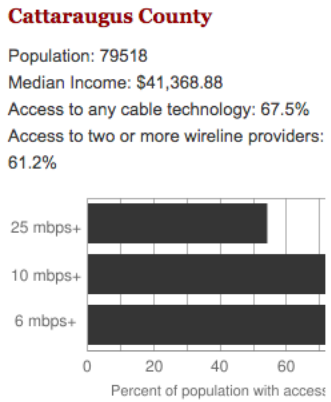
http://www.governing.com/gov-data/broadband-speeds-availability.html

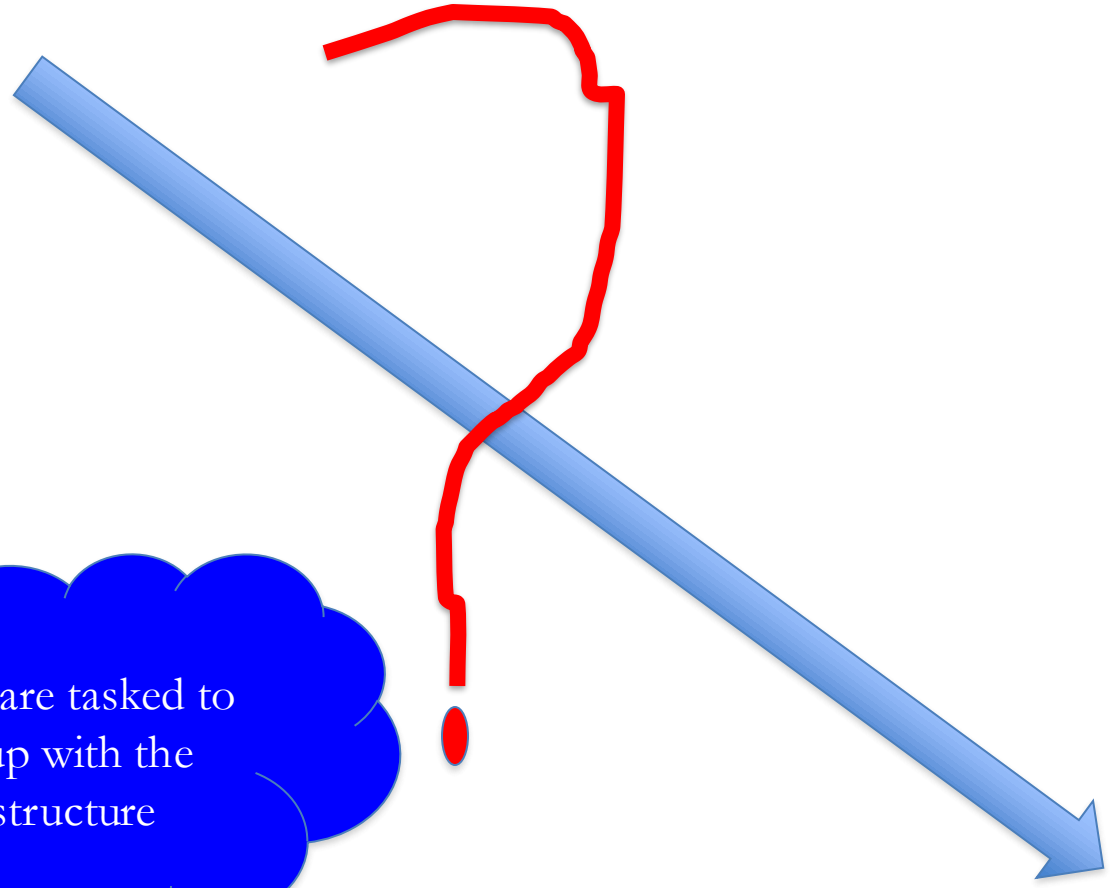
One county over



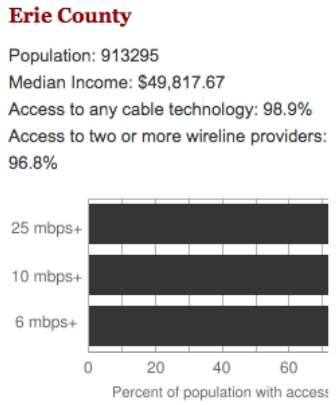
http://www.governing.com/gov-data/broadband-speeds-availability.html

Week 1: Make broadband more available

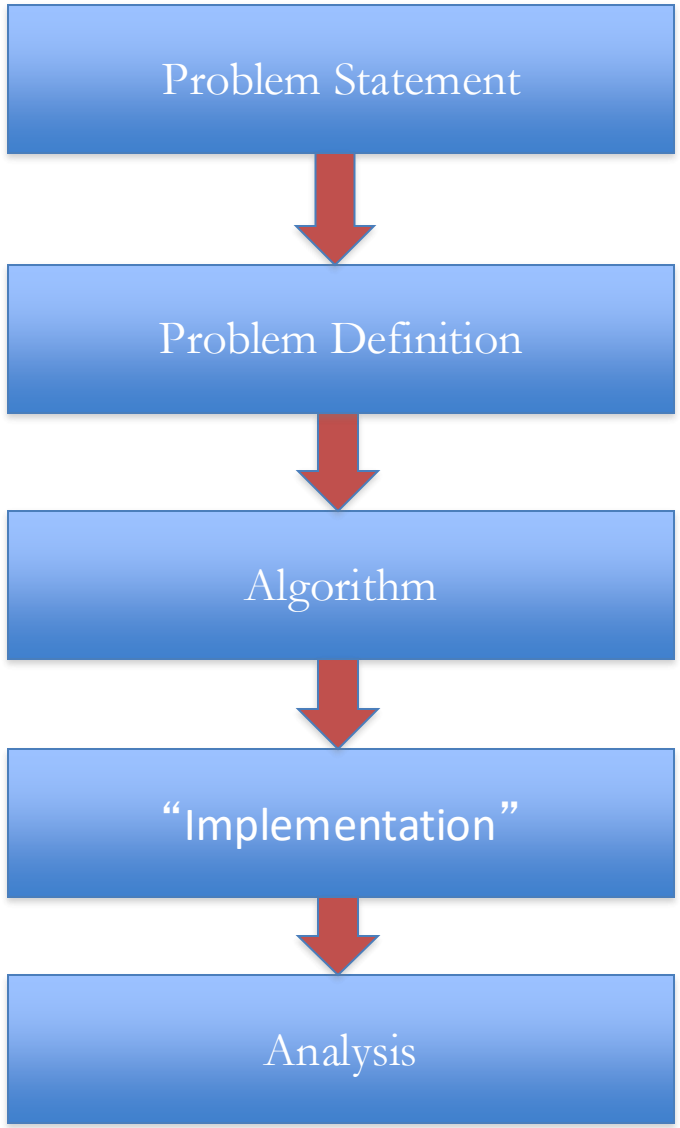




Students are tasked to come up with the infrastructure



Main Steps in Algorithm Design



Real world problem

Precise mathematical def

Data Structures

Correctness/Run time

Fast forward ~1.5 months

Homework 4

Due by **11:30pm, Tuesday, October 18, 2022**.

Make sure you follow all the homework policies.

All submissions should be done via Autolab.

The care package on minimizing the maximum lateness problem would be useful for Q3 and *might* be useful for Q2(b) as well.

Question 1 on HW 4

Question 1 (High Speed Internet) [50 points]

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Greedy Algorithm question