Due May 12th.

The project is intended to give you an opportunity to dive deeper into a topic in computer science that you find interesting.

- Pick a topic at the intersection of theory of computation and another scientific field.
- Find a couple of sources to learn about the topic.
- Prepare a PDF document in the style of lecture notes with the following components:
  - A proper motivation for a general audience (why is the subject important/interesting) and an overview of the important concepts within that topic (this can be similar to a 15-155 lecture). You can get creative with how you present this (i.e. it does not have to be just text).
  - A write-up of the important definitions, results and proofs (this can be in the style of a 15-155 lecture notes).
  - Your own reflections/assessment on the overall approach.
  - Acknowledgments section clearly indicating what resources you used and how you have used them. (E.g. did you copy-paste a section from your source or did you write it using your own words?)
- Submit your project by May 12th by emailing Lichen Zhang.

Here are some sources and some motivating questions to start you out.

- Valiant's model of evolvability and connection to biological evolution. What is an essential feature of biological evolution? What might fail if PAC learning be used to model it? Here's Valiant's original paper. A talk on the topic by Valiant.
- The many facets of pseudo-randomness and randomness in computation. Here's Avi Wigderson's talk on the topic. Also check out David Zuckerman's paper.
- Madhu Sudan's talk on randomness, information and their relations to CS.
- Tim Roughgarden's talk on computational lens and the bounded rationality model in economics. Papadimitrious and Yannakakis study the bounded rationality model to tackle with the non computability of equilibria.
- Aaronsons's writings (here) on how quantum computing could shed light on new aspects of quantum mechanics beyond applications to computing.
- You can dive deeper into Quantum Computation.

- Aaronsons's essay on why philosophers should care about computational complexity.
- On physics and free will, once again, by Aaronson.
- Chazelle's work on studying connections between computing and the flocking of birds.
- The general area of computational social choice theory has many interesting topics. Here a nice article to start with.
- One interesting area covered by the book on computational social choice is fair allocation.
- In class, we discussed using Markov chain to detect gerrymandering. There has been a long line of development along that idea. Check out Wesley Pegden's page for more information. For more specific state-level study, check out this paper for an in-depth look at the state of Georgia.

There is, of course, much wider variety of topics and a lot of material available online. Feel free to explore.

If there is a topic that you particularly like and it is not covered by one of the tracks, then ask us if it would be a good idea to pick that topic and let us know what resources you intend to use. If you would like to do your project in a different style (i.e. rather than creating lecture notes, you would like to present all the material in a different way) then once again, discuss this with us.

In general if you would like help with choosing a topic or finding a resource to learn from (or evaluating whether you have found a good resource or not), please let us know (e.g. you can make a post on Piazza). We would be happy to help.

This project will be evaluated based on effort. Our expectation is about 15 hours of work. Your deliverable should showcase what you have learned and it should be understandable by a 15-155 student. This is not about assigning a letter grade but rather about taking advantage of a learning opportunity that you can be in charge of. We give you the freedom to explore whatever interests you and present your work in your own way. The only thing we ask is that you take it seriously, put in the work, and have fun in the process. Enjoy!