

# EconCS: Algorithms for Social Good

## Instructors:

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## Overview:

What's the best way to match kidney donors with patients? Is ranked-choice voting everything it's made out to be, or is there a better way to vote? How do we design an auction so that people don't underbid?

These questions lie at the intersection of computer science and economics. Over the course of six weeks, we'll attempt to answer these questions, or at the very least, come to understand them better. Computer science has opened up a dazzling array of techniques and algorithms to approach new problems – some of society's most interesting and important questions are now within reach.

## Prerequisites:

There are none, but we'll be introducing some relatively challenging concepts and will make use of mathematical notation frequently. This will all be introduced in class though, so don't worry if you haven't seen it before!

## Course Materials:

You won't need to bring anything to class, but we will post **optional** supplementary readings after each lecture for those of you who are interested in learning more!

## Class Logistics & Rules:

Class will be virtual and conducted via Zoom for an hour each week. We will try to make the experience as interactive as possible!

Please be respectful of your classmates and your instructors, and adhere to all HSSP guidelines. If you have any questions, don't hesitate to reach out.

## Tentative Schedule

- **July 9th** – Introduction to Game Theory & Mechanism Design (Luca)
  - We'll cover the basics of game theory and mechanism design in this class and visit some of the essential definitions and concepts – Nash equilibria, strategy-proofness, and more!
- **July 16th** – The Matching Problem (Phyllis)
  - Matching markets try to match two groups of individuals according to their preferences. These could be students and teachers, kidney donors and recipients, or buyers and sellers of different goods. How do we come up with the optimal matching?
- **July 23rd** – Auction Theory (Luca)
  - What's the best way to run an auction? How do we make sure people are bidding what they truly value the item at? We'll take a look at several standard auction formats, including one that helped its designer win the Nobel Prize in Economics!
- **July 30th** – Voting I (Phyllis)
  - You've probably heard of ranked-choice voting, but how about Kemeny? We'll explore several different voting rules and see how they compare on a variety of different axiomatic criteria.
- **August 6th** – Voting II (Luca)
  - We'll continue where we left off on voting and take a look at an unfortunate impossibility result ): Then we'll turn to practice and examine how gerrymandering has affected our elections and what we can do to detect and stop it.
- **August 13th** – Fair Allocation (Phyllis)
  - How do you fairly divide goods between people when each person has a different value for each good?