# CS 59300: Algorithmic Economics
# Fall 2024

## Instructor

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## Time and Location

Time: TBD.
Location: TBD.

## Description

This course explores, from an algorithmic perspective, problems that arise in the intersection of computer science and economics. How should we design algorithms that get their inputs from strategic agents, with different preferences over the possible outcomes (and will therefore misreport their input to manipulate the result)? How should we aggregate individual agents' preferences to arrive at a collective decision (in a computationally efficient manner)?

The course's topics include:

- *Game theory* (e.g., Nash equilibria and their computation, the price of anarchy). Weeks 1-2.

- *Mechanism design* (e.g., auctions, revenue and welfare maximization). Weeks 3-5.

- *Fair division* (e.g., allocation of divisible and indivisible goods, cake cutting). Weeks 6-8.

- *Social choice* (e.g., efficient voting rules, methods for dealing with manipulation in elections). Weeks 9-11.

- Other topics in algorithmic economics, like cryptocurrencies and topics in learning theory and game theory (e.g. revenue maximization from samples). Week 12-13.

The last two weeks of the course will include a midterm and student presentations.

## Resources

The course will mostly rely on resources online, but we will draw on the following books for some of the lectures: (1) Algorithmic Game Theory. (2) Twenty Lectures on Algorithmic Game Theory. (3) Handbook of Computational Social Choice.

## Prerequisites

The course is mainly intended for mathematically mature CS graduate students. Basic knowledge in algorithms, probability theory and computational complexity is expected. For example, CS 580 or equivalent. CS undergraduate students and graduate students in other relevant fields (e.g., mathematics, economics, operations research) are also very welcome, and should contact the instructor for permission.

## Work Load

There will be a midterm (25%) and a final project (40%), which includes a report and a class presentation. There will be 2-4 homeworks (25%). Class partition accounts for the remaining grade (10%).