

# Teaching statement

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links: [homepage](#), [CV](#), [RS](#), [job-market poster](#), [Google Scholar](#)

My teaching preferences and style have been shaped by my research on information economics, economic design, and their algorithmic aspects, and by my interdisciplinary background. In my teaching, I like demonstrating the interplay of ideas from economics, OR, and CS to analyze multi-agent systems. I have experience developing and teaching such courses as well as popularizing research on multi-agent systems at all levels from middle-school students to seasoned researchers.

## 1. TEACHING INTERESTS

I am well-prepared and enthusiastic to teach **Microeconomics** and **Game Theory** at all levels as well as their managerial, operations, and algorithmic counterparts. I would also be interested in teaching courses on **Pricing & Auctions**, **Electronic Commerce**, **Operations Management**, and deterministic & stochastic **Optimization with Economic and Managerial Applications**. I can contribute to developing curriculum and teaching **Math** courses equipping students with tools needed for research in economics and operations. More broadly, I am interested in courses demonstrating how mathematical, OR, and CS tools can be used to model and improve real-life economic and managerial processes.

I am especially interested in developing and teaching advanced courses on the following topics:

- **Trends in Economic Design / Market Design**

If rules of interaction in a multi-agent system are designed poorly, the agents may have incentives to game the system which often leads to poor outcomes. The goal of economic design is to find rules ensuring fair and efficient outcomes robust to strategic behavior.

Modern economic design is no longer a part of economics but rather an interdisciplinary field mixing insights from economics, OR, CS, AI, and mathematics. In addition to a novel perspective on classic topics — auctions, matching markets, fair & efficient allocation of resources, preference aggregation, contract design, and pricing — there is a flow of new problems coming from the digital economy, online marketplaces and decentralized multi-agent systems (Web3 & blockchain).

The literature is growing exponentially and with contributions by various communities. As a result, there are no books, no comprehensive surveys, and only a few courses attempting to capture the state of the art. I am eager to develop such courses conveying my own perspective on the field.

Depending on the audience (undergrad/grad/MBA students, their background and interests), the course can either be case-based or centred around methods, it can

either show the interplay of ideas from various fields (econ, OR, CS, or AI), or focus on a particular approach, and it can either highlight the variety of applications or elaborate on a few particular topics.

- **Information Economics, Learning, and Decisions under Uncertainty**

Information economics studies how available information affects our decisions, especially, in strategic environments. This is one of the most actively developing subfields of microeconomics and so all the existing materials on the topic get immediately outdated. I would like to develop courses reflecting the most recent insights.

Depending on the audience, the course can focus on a particular direction such as social learning (how information about a new product spreads over a social network) or information design (how to supply information selectively to incentivize the desired behavior of the recipient) and highlight either general methods or management applications such as designing marketing campaigns or recommendation systems.

- **Majorization and Optimal Transportation Methods in Economics**

There is recent evidence that various problems of economic theory exhibit deep connections to mathematical theories of majorization, optimal transportation, and the theory of measures of given marginals underlying them both. Methods from these theories proved to be extremely useful in information design and Bayesian mechanism design. I believe that approaching these problems from measures-with-given-marginals perspective is the future of the field. I would like to contribute to the popularization of this novel perspective by developing a course summarizing the existing sporadic results. To the best of my knowledge, there have been no such attempts yet.

## 2. EXPERIENCE

**Teaching and developing courses.** I have experience developing courses from scratch. At Caltech, I taught an introductory 20-lecture course titled “Algorithmic Economics” (CS/SS/EC 149) in 2022, and will be teaching it again in 2023. I developed this course for students with CS, math, and engineering background; see [my lecture notes](#) and [teaching evaluations](#). The audience was a mixture of graduate students and undergrads, approximately half of whom had no previous exposure to game theory. To accommodate this diversity and make the course interesting for everyone, I made it completely independent of concepts taught in game theory classes. My goal was to give a glimpse of ideas that economic and CS researchers are currently passionate about, demonstrate how complementary these ideas are, and make it possible for the students to understand half of the talks at top conferences in the field such as the ACM Conference on Economics and Computation (EC).

When I was a postdoc at the Technion, I taught a course on “Information in Games” for graduate students in industrial engineering & management. The course was co-taught with Rann Smorodinsky and my responsibility was to develop the section on information design and on the role of information in dynamic games. Prior to that, I taught a course on mechanism design with Alexander Nesterov for undergrads at HSE University. When

I was a grad student, I taught Calculus, Linear Algebra, and Probability to a group of gifted students (winners of Olympiads in math and physics) at the Physics department of St. Petersburg State University.

**Supervision, mentorship, and outreach.** Helping talented students to realize their potential is rewarding. I was an advisor for several bachelor's & master's theses and multiple course works<sup>1</sup> and also advised several Ph.D. students informally. Apart from research questions, students often feel lost and seek both academic and life advice. I realized the importance of mentorship when I was considering changing the field myself and my senior colleagues' advice was invaluable. Since then, I have tried to help students with math or physics background to find beauty in economics and their unique way in this field. I have mentored dozens of undergrad and grad students, was a mentor at EC'22 mentorship workshop, and plan to continue and expand this effort in the future.

I have been popularizing research on game theory and economic design at all levels. I gave mini-courses on games for gifted middle-school students; I co-organized several international schools on fair division and mechanism design at HSE University and gave many popular and survey talks and several tutorials, aimed at seasoned researchers and students; I was one of the organizers of the Russian Game Theory Olympiad for students and of the Victoria Kreps memorial prize for young Russian game theorists and economic theorists.

### 3. PHILOSOPHY

I've been lucky to study, work, and teach in each of the four communities: economics, mathematics, computer science, and physics. This interdisciplinary experience demonstrated to me how similar or sometimes complementary the ideas from these fields are. However, standard courses may not highlight this interconnectedness even within one field.

I believe that showing how similar ideas originate and work in surprisingly different problems is one of the critical goals of teaching. Understanding the links between various branches of science helps students to look at problems from different angles. This becomes a strong competitive advantage nowadays when cross-fertilization between fields is a driver of innovations. Understanding the unity of ideas can also be incredibly inspirational as different courses are no longer a collection of disjoint facts but a building, which becomes more and more beautiful with each new brick.

To illustrate the unity of ideas, in my courses, I put an emphasis on methods rather than on results and present these methods in a tractable and operationalizable way. For students interested in research, this approach helps to adapt and apply the ideas to their own research agenda; for future industry professionals, this gives a broader perspective on managerial problems they face and gives a range of tools to solve these problems efficiently.

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<sup>1</sup>Topics included: machine-learning for detection of corrupted procurement auctions, extreme belief correlations in multi-agent information design, pseudomarket mechanisms for fair division of indivisible goods, rent-division mechanisms with shared rooms, analysis of users' preferences on Spliddit.org, auction sniping in online RPGs.