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Teaching statement

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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 and design strategic interactions. I have experience developing and teaching such courses, as well as popularizing research on microeconomics and game theory 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**, including their algorithmic counterparts, at all levels. I am especially interested in developing and teaching advanced courses on the following topics:

- **Trends in Economic Design / Market Design**
  If rules of interaction 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 per se but rather an interdisciplinary field mixing insights from economics, OR, CS, AI, and mathematics. In addition to a novel perspective on classical 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 on economic design 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 perspective on the field.

  Depending on the audience (undergrad/grad 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, so all the existing materials on the topic immediately become outdated. I want 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 with 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 the measures-with-given-marginals perspective is the future of the field. I want to contribute to popularizing this novel perspective by developing a course summarizing the existing sporadic results. To my knowledge, there have been no such attempts yet.

I can also contribute to developing a **Math** curriculum for economists and teaching math courses, which equip students with tools needed for research in economics.

2. Experience

Teaching and developing courses. I have experience teaching and developing courses from scratch.

At Princeton, I taught a math camp for incoming PhD students (ECO 500: Mathematics for Economists). My primary goal was to introduce an audience with diverse backgrounds to the art of mathematical proofs while reinforcing the fundamental concepts essential for success in first-year economics courses. Balancing these two objectives, I combined the existing materials with insights from colleagues and my vision. A distinctive feature of the course was its emphasis on active student engagement in proving mathematical statements. To facilitate this, I presented certain proofs in class, followed by similar statements broken down into a series of manageable lemmas. These were often accompanied by hints, encouraging students to engage in the proofs both individually and collaboratively. This approach of "learning-by-doing" in the context of proofs for economists received positive feedback from the students, underscoring its potential; see **teaching evaluations at Princeton**. I am enthusiastic about further exploring and refining this method.

As a postdoc at Caltech, I taught an introductory 20-lecture course titled "Algorithmic Economics" (CS/SS/EC 149) in 2022 and 2023. I developed this course for students with CS, math, and engineering background; see **my lecture notes** and **teaching evaluations at Caltech**. 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).

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 the role of information in dynamic games. Before that, I taught a course on mechanism design with Alexander Nesterov for undergrads at HSE University. As 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[1] and also advised several Ph.D. students informally. Besides research questions, students often feel lost and seek academic and life advice. I realized the importance of mentorship when I was considering switching my academic field, and senior colleagues' advice was invaluable. Since then, I have tried to help students with math or physics backgrounds 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 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 drives 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 that becomes more and more beautiful with each new brick.

[1] 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.

To illustrate the unity of ideas, in my courses, I emphasize methods rather than 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 problems they face and gives a range of tools to solve these problems efficiently.