DS 574 Algorithmic Mechanism Design **Project Description**
Fall 2025 Prof. Kira Goldner

Final Project

The course project will involve engagement with a current topic of research in algorithmic mechanism design. You can choose to do the project by yourself or with a partner. You should strive to produce something novel, such as a new algorithms, models, or theorems; or a new survey of work that has not been synthesized together before. The project involves several deliverables:

1. (8 points) A proposal describing related work and the intended topic and scope of the project.
2. (27 points) A brief in-class presentation.
3. (45 points) The final write-up (typset in LaTeX):
    - For research: a technical report describing the problem you considered, related work, your approach, your results, and open questions.
    - For a survey: a technical report describing the the general research area you studied, the related work, approaches, connections among them, and remaining open questions.

Your project proposal should be **submitted on Gradescope by 11:59pm on September 25**, and should include:

- (2 points) Names of group members (1-2 people).
- (2 points) A description of what you plan to do.
- (2 points) Brief work plan, including dates for various intermediate tasks.
- (2 points) For groups of size greater than one, a description of how you will split the work, and how you will coordinate. (e.g., Regular meeting times? When?) You may optionally assign yourself to evaluate each other's and your own contributions after you hand in the final write-up.

Below are two broad categories of project types, with some suggested topics for each type. You are welcome to use these suggestions or design your own project related to the content of this course.

1 Survey

The idea here is to do *a lot* of reading and *very good* writing about a set of related papers on a topic that we did not cover in class.

For the following topics, start with the listed papers, and add any especially relevant ones that come up in citations.

Transaction Fee Auctions in Blockchain.

- Tim Roughgarden. "Transaction Fee Mechanism Design." EC 2021. (Longer full version available online too under "Transaction Fee Mechanism Design for the Ethereum Blockchain: An Economic Analysis of EIP-1559.")
- Follow-ups by Elaine Shi et al.
- Ron Lavi, Or Sattath, and Aviv Zohar. "Redesigning Bitcoin's fee market." TEAC 2022.

Data Markets.

- Anish Agarwal, Munther Dahleh, and Tuhin Sarkar. "A Marketplace for Data: An Algorithmic Solution." EC 2019.
- Related follow-up.
- Alessandro Bonatti, Dirk Bergemann, and Tan Gan. "The economics of social data." RAND 2022.
- Ayelet Gordon-Tapiero, Katrina Ligett, Kobbi Nissim. "On the Rival Nature of Data: Tech and Policy Implications." CSLAW 2025.

Budgets. (Much more economic.)

- Mallesh Pai and Rakesh Vohra. "Optimal auctions with financially constrained buyers." JET 2014.
- Jean-Jacques Laffont and Jacques Robert. "Optimal auction with financially constrained buyers." Economic Letters 1996.
- Yeon-Koo Che and Ian Gale. "Optimal Mechanism for Selling to a Budget-Constrained Buyer." JET 2000.
- Shuchi Chawla, David L. Malec, and Azarakhsh Malekian. "Bayesian mechanism design for budget-constrained agents." EC 2011.
- Yunan Li. "Mechanism Design with Financially Constrained Agents and Costly Verification." Theoretical Economics 2021.

Unit-Demand. Objective: Update the existing survey in the context of modern duality frameworks and prophet inequalities and the understanding they bring to CHMS '10 and the surrounding work.

- Chawla, Shuchi, and Balasubramanian Sivan. "Bayesian algorithmic mechanism design." ACM SIGecom Exchanges 13.1 (2014): 5-49. **(Original survey.)**
- Chawla, S., Hartline, J. D., Malec, D. L., and Sivan, B. "Multiparameter mechanism design and sequential posted pricing." STOC 2010.

- Yang Cai, Nikhil R. Devanur, S. Matthew Weinberg. A Duality-Based Unified Approach to Bayesian Mechanism Design. SIAM Journal on Computing 2021.
- Chawla, S., Hartline, J. D., and Kleinberg, R. D. 2007. "Algorithmic pricing via virtual valuations. EC 2007. "
- Chawla, S., Malec, D. L., and Sivan, B. "The power of randomness in bayesian optimal mechanism design." GEB 2012.

Max Min Correlation Robustness.

- Gabriel Carroll. "Robustness and Separation in Multidimensional Screening." Econometric 2017.
- Xiaohui Bei, Nick Gravin, Pinyan Lu, and Zhihao Gavin Tang. "Correlation-Robust Analysis of Single Item Auction." SODA 2019.
- Moshe Babaioff, Michal Feldman, Yannai A. Gonczarowski, Brendan Lucier, Inbal Talgam-Cohen. "Escaping Cannibalization? Correlation-Robust Pricing for a Unit-Demand Buyer." EC 2020.

2 Original Research

Your project can also be a research project that solves (or begins to solve) open problems in the mechanism design literature. Your final write-up should be at least 6 pages and include a summary of existing work, your new results with proofs, along with a discussion of challenges faced, other approaches attempted, and suggestions for future work.

If you are interested in working together with me on a research project, I strongly encourage you to talk to me one-on-one, and we can discuss some ongoing or early-stage research projects that are a part of my own agenda. I am actively looking for students and collaborators, and I have many mechanism design research problems that I'm happy to share.

Possible project topics:

- Research questions related to any of the above under "survey."
- Looking at how to use mechanism design in a specific domain of "social impact."
- Bringing models from behavioral economics into mechanism design.
- [some specific area] $\cap$ mechanism design—I may not know that much about any given intersection, but I should be able to point you toward references. (e.g., privacy, fairness, cryptography, law, etc.)

Incentives in Academia.

- Nihar Shah. "An Overview of Challenges, Experiments, and Computational Solutions in Peer Review (Extended Version)." https://www.cs.cmu.edu/~nihars/preprints/SurveyPeerReview.pdf

AI Alignment.

- Lewis Hammond et al. "Multi-Agent Risks from Advanced AI." https://arxiv.org/pdf/2502.14143
- Vincent Conitzer et al. "Social Choice Should Guide AI Alignment in Dealing with Diverse Human Feedback." https://arxiv.org/abs/2404.10271
- Raphael Koster et al. "Human-centred mechanism design with Democratic AI." https://www.nature.com/articles/s41562-022-01383-x