

**CS49 Project Proposal: Optimal Auctions via the Multiplicative Weight Method**  
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We chose this paper because we are interested in the applications of computer science to economic problems. Asymmetric information problems, in particular, are interesting because they come up frequently in daily life. Auctions are a useful scenario that we can examine to study the behaviors of various agents in these situations with asymmetric information. Kevin is interested in seeing potential parallels between auctions and trading problems, and applications of any relevant findings in this paper to similar problems in trading, and vice versa. Edward is interested in game theory and applications of any techniques involving multiple adversaries to advancements in the fields of machine learning and deep learning.

In our project, we will explore the auction paper. We will first understand the general context of auctions and Bayesian Incentive games via various resources, like the original 1981 Myerson paper referenced in our paper as well as short lectures on youtube from various researchers on Bayesian Incentive games. We plan to spend about a week on this. Then, we want to understand the algorithm and the role of MWU in solving this auctions problem, i.e. the bulk of this paper, which we plan on spending about 2 weeks on. We then will especially investigate situations with non-linear utility functions, which arise as a result of certain types of auction rules and buyer constraints. We would also like to make connections between the strategies realized by multiplicative weight update and the Kelly criterion, another betting/bidding strategy, which we estimate will take one more week. Finally, if all else goes well, we hope to implement a program capable of simulating various bidding conditions, which would pull buyer behaviors randomly from various distributions, and realize/output actual seller profit/gain and buyer gain for all actors.