SIGecom Winter Meeting Report

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We present a report on the inaugural SIGecom Winter Meeting which was held online on February 25, 2021. We highlight the goals of the workshop and summarize the format and content.

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Additional Key Words and Phrases: Workshops

1. INTRODUCTION

The first SIGecom Winter Meeting was held on February 25, 2021. The workshop lasted six hours, combining a lightweight technical workshop program with ample opportunity for socialization. The main goal of the meeting was to bring the SIGecom community together, albeit in a virtual environment, motivated in part by the relative lack of in-person gatherings the past year. We hope that this tradition will continue in future years!

The topic of the workshop centered around early contributions to auction theory by the recent Nobel prize winners, Paul Milgrom and Robert Wilson (see [Teytelboym et al. 2021]). The focus was on models beyond independent private value (IPV) settings, starting with common-value auctions and interdependent valuations and leading through the resulting insights about the importance of implementation details in market design.

In developing the program, we emphasized being inclusive to young researchers and those outside the core field, while also encouraging active participation and networking. To that end, the workshop began with a series of tutorials to bring everyone up to speed on classic results on the topic, followed by a light social program. The second half of the workshop included a sequence of invited talks, chosen to give an overview of current work on the topic from a variety of perspectives and approaches. When selecting the presenters, we aimed to achieve a good balance between talks by economists and computer scientists. By doing so, we wanted to expose the two communities to each other's research styles, and thereby contribute

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to bridging the gap between them.

The workshop took place on Gather.town, a virtual space designed to provide a sense of presence. This was the same platform used to host EC 2020. The space was divided into a small number of rooms, including an auditorium that linked to the Zoom webinar where talks were given. Attendees were encouraged to use the Gather.town program to socialize between talks and participate in the social games. Overall, we were satisfied with how well Gather.town aligned with our goal of generating interaction between the workshop participants.

Next we will briefly describe the different parts of the workshop program and how we attempted to tie them together.

2. TUTORIALS (2 HOURS WITH A BREAK)

To make sure all participants could get as much as possible out of the technical program, we began the workshop with a series of tutorials on the subject matter. We prioritized this part of the workshop in terms of time spent, since we felt it was crucial to both junior members of the field but also to providing a common framework for researchers from different backgrounds. Also, since the topic was chosen to be something many EC researchers wouldn't be directly familiar with, our hope was that even senior members of the community would find the content interesting.

The tutorial was split into three parts.

Part 1. The first part, presented by Piotr Dworczak, served as an introduction to the topic of auctions with interdependent values and correlated signals. Interdependent values arise when bidders' valuations for the object being sold depend on the signal realizations of other bidders; correlated signals arise when the signals observed by individual bidders are not independently distributed. Such a framework is natural when analyzing auctions for objects possessing qualities that are unknown but valued by all bidders (for example, the amount of oil in a tract auctioned off by a state government). We emphasized that this model emerged from the early research program, initiated by Bob Wilson and extended by Paul Milgrom, investigating whether auctions could serve as a foundation for price discovery in competitive markets.

The first part of the tutorial featured a real-time common-value auction. The goal was to illustrate the winner's curse—the central new phenomenon arising in auctions beyond the IPV setting. We showed the participants a picture with a large amount of cash, which we knew was worth approximately \$5.8MM. We then asked the participants to bid in a second-price auction, imagining the the winner will get the amount of cash shown in the picture. We received over a hundred bids, with a winning bid of \$25MM, and a second-highest bid of \$24MM. This extreme result (the winner would overpay for the object by a factor of 4) illustrated that bidding one's true estimate of the value is not an optimal strategy when the value is not known. This served as a segue to the second part of the tutorial that focused on explaining how bidders should optimally bid in such cases, and what implications we can draw about the performance of different auction formats.

Part 2. The second part of the tutorial was presented by Inbal Talgam-Cohen. Inbal focused on reviewing the classical results pertaining to auctions with interdependent and correlated values. She first explained how rational bidders should reason about the possibility of a winner's curse: In a second-price auction, the winner eventually learns the bid of the second-highest bidder, and hence each bidder should condition her estimate of the value on the event that she ties for winning the object. In a first-price auction, the winner only learns that she won the object; however, this in itself is an informative signal about the value of the object because the winner learns, in a symmetric separating equilibrium, that her signal realization was the highest among all the bidders. For all standard auction formats, similar reasoning can be used to derive the equilibrium strategies.

Inbal then described some of the key insights emerging from this analysis. [Wilson 1977] and [Milgrom 1979] demonstrated that, under some conditions, the equilibrium price in both first- and second-price auctions converges to the true value of the object as the number of bidders grows. [Milgrom and Weber 1982] showed how to compute equilibrium strategies and revenues for standard auction formats in the general symmetric model with affiliation (a strong notion of positive correlation of bidder's signals). The English auction yields a higher expected revenue than a sealed-bid second-price auction, which in turn dominates a first-price auction. This is a manifestation of the Linkage Principle which states that revenue can be increased under correlated signals by creating a statistical link between the winner's value and the price she pays—this is possible because certain auction formats (such as the English auction) aggregate other bidders' information into the eventual price that the winner faces. A similar argument can be used to show that a revenue-maximizing seller should be transparent about the object she is selling by publicly disclosing all her private information about its value prior to the auction.

At the end of the second part, Inbal reviewed some classical results about mechanism design in the correlated-signals environment. [Myerson 1981] showed an example in which the seller can extract all surplus when buyers' value are correlated, sharply contrasting with the results from the IPV setting. [Crémer and McLean 1988] greatly generalized this example, and demonstrated that full surplus extraction is possible generically even when the correlation of buyers' signals is arbitrarily small.

Part 3. Finally, Brendan Lucier gave a tutorial on robust auction design. One of the take-aways from Part 2 is that, when buyer valuations are not independent, it is possible to design single-item auction formats (like the Crémer-McLean auction) that extract all of the social surplus as revenue by exploiting correlation. But these designs feel very brittle; how should we think about designing auctions that are more "robust?" The tutorial began by discussing interim versus ex post solution concepts, and noting that the Crémer-McLean auction format is only interim individually rational and hence implicitly makes strong assumptions about the participants' beliefs. We then explored designs that insist on the stronger notion of ex post individual rationality and incentive compatibility, where truth-telling and participation are optimal even in hindsight.

In a model where values are privately-known but correlated, the famous Vickrey auction is ex post truthful and maximizes social welfare. But what about revenue?

We described the lookahead auction of [Ronen 2001], which augments the Vickrey auction with a final take-it-or-leave-it price offer. Specifically, the bidder with the highest bid is flagged as a provisional winner, but she is not actually given the item unless she agrees to pay a price that can depend on the bids of the other bidders. If values are correlated, the other bids could reveal a lot about the provisional winner's willingness to pay and hence increase the seller's revenue. We proved that any such auction is ex post truthful, and if the final price offer is calculated appropriately it will obtain at least half of the expected revenue of the optimal ex post truthful auction.

Finally, we discussed extensions to interdependent valuations. In this model a buyer may not know her own value for the item for sale; rather, each buyer has a signal, and a buyer's value is a function of the signals of all buyers. We showed that it may no longer be possible to maximize social welfare in an ex post truthful manner, unless the value functions satisfy a single-crossing condition. This condition basically means that, fixing the other signals, each buyer has a threshold on their signal above which it is efficient to allocate them the item. After introducing this condition, we showed how a natural extension of the Vickrey auction maximizes welfare in an ex post truthful way. We also briefly discussed strategies for extending the Ronen lookahead auction in a similar fashion.

3. SOCIAL PROGRAM (1.5 HOURS)

Following the tutorials, the schedule called for a long break to allow attendees the chance to discuss and participate in social events. Again, the goal was to bring in students and other young researchers who are most affected by the lack of community events this past year. The social content was intended to be lightweight and voluntary. They included a student fireside chat with Paul Milgrom and Bob Wilson, and a set of social games that encouraged interaction. We'll discuss each of these below.

Fireside chat with Paul and Bob. We held a 30-minute session lightly moderated by Piotr Dworczak, where the focus was to take questions from students. Topics ranged from connections between economics and computer science, to strategies for dealing with the pressures and setbacks of research, to the story of how Paul learned about the Nobel prize. The fireside chat was followed by socialization in a special "fireside" space in Gather.town, where Paul and Bob engaged with smaller groups of students.

Auction bidding games. We ran two virtual common-value auctions, tying into the theme of the workshop. We generated a common value (the same for the two auctions) according to a disclosed distribution, and used a script to email each participant a signal correlated with that value. Each participant could place a bid in each of the two auctions. The first was designed to simulate the incentives of a first-price auction: the winner was whoever bid closest to the true value without going over. The other was designed to simulate the incentives of a second-price auction: the winner was whoever bid closest to the true value, regardless of being above or below. Our intention was to make this a social game, so participants were encouraged to try and get others to share their signals. We observed a lot

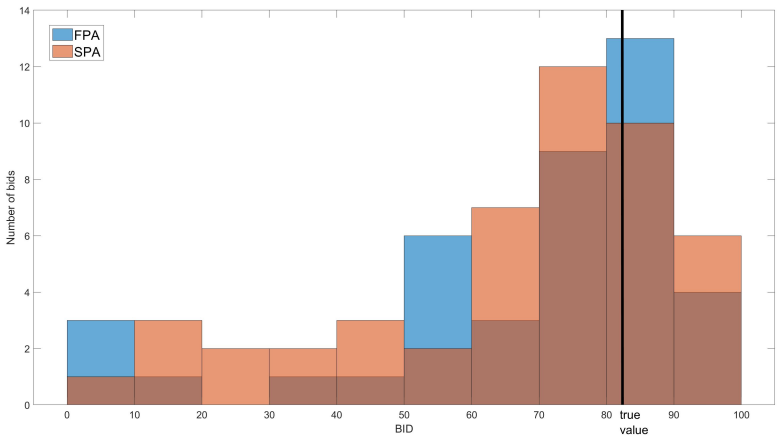

Fig. 1. The histogram of bids in the first- and second-price auction games

of discussion about signals, so this seemed to be a success! We also described the items up for auction as paintings by the organizers' children; while this was done mainly for fun and flavor, we did send the paintings to the winners.

The true value of both items was drawn from the uniform distribution on [$0, $100], and its realization was $81.77. The winner of the first-price auction game was Mehmet S. Ismail with a winning bid of $81.18; the winner of the second-price auction game was Nikita Kalinin with a winning bid of $82.00. Figure 1 illustrates the distribution of the bids in the two auctions (after discarding outlier bids that did not belong to the support of the value distribution). Because the number of bidders was large, under full information, it would be optimal in both auctions for an individual bidder to place a bid close to the true value: The concentration of bids around the true value serves as further evidence that bidders did share information prior to bidding, which was the main point of the game.

Social network game. To encourage participants to meet new people, we also designed a social game that explicitly rewards finding others outside one's immediate circle. The idea was to create a chain of participants, where every link of the chain corresponds to either co-authorship or having graduated from the same institution most recently. Importantly, the chain could not include any edges between non-neighbors! This was to encourage people to find others outside their "local cluster," and to not advantage senior members with a large set of coauthors. The winner of the game was Linda Cai with a chain length of 5.

During the workshop breaks, we observed groups discussing how to build chains; however, the eventual number of submissions was rather low, suggesting that perhaps the rules were over-complicated, or that participants were not provided sufficiently strong incentives to formally register their chains using the submission form. For this reasons, it is difficult to assess to what degree the game achieved its goal of fostering spontaneous interactions.

4. INVITED TALKS (2.5 HOURS WITH A BREAK)

The final session of the workshop was a sequence of invited talks. The focus here was recent work that is related to the workshop topic, either directly or by illustrating a line of work informed by these early papers on auction design. We strove for a mix of computer science and economic perspectives.

Paul Klemperer, Geometry and Auctions. Paul's talk, based primarily on his joint work with Elizabeth Baldwin ([Baldwin and Klemperer 2019]), focused on designing simple and effective bidding languages for combinatorial auctions. While the SMRA auction pioneered by Paul Milgrom and Bob Wilson for selling spectrum licenses allows the bidders to express combinatorial preferences, its dynamic implementation may take a long time and aid collusion—making it inappropriate for some applications, such as when the Bank of England had to offer multiple types of loans to financial institutions during the financial crisis of 2007. Paul described the design of a Product-Mix Auction in which bidders simultaneously submit their bids using a bidding language with a simple geometric interpretation. These bids are then used to compute the competitive-equilibrium outcome with the lowest equilibrium prices. The bidding language makes use of a "tropical geometry" which enables a simple graphical analysis of the bids, accommodates many types of substitutable preferences, and guarantees existence of competitive equilibria. Paul also presented alternative bidding languages which could be more suitable depending on the application; for example, the "arctic geometry" allows the bidders to express their preferences using budget constraints.

Kira Goldner, Interdependent Valuations: Beyond Single-Crossing and Single-Item. Kira spoke about joint work with Alon Eden, Michal Feldman, Amos Fiat, and Anna Karlin ([Eden et al. 2019]) that explores auction design for selling multiple items to buyers with interdependent valuations. In the tutorial, it was shown how to obtain high welfare or revenue when selling a single item to buyers that satisfy the single-crossing condition. But the single-crossing condition is restrictive and inherently single-dimensional, so extensions to combinatorial auctions seem to need something more. Kira presented an alternative to single-crossing, where valuations satisfy a submodularity condition over the set of all signals. This condition can be used instead of the single-crossing condition to construct an ex post truthful auction: the idea is to randomly sample a subset of the buyers' signals, then use that information to bound the values of the remaining buyers. Moreover, this approach extends to combinatorial auctions as well, leading to an auction that approximates the optimal welfare to within a constant factor while being ex post truthful.

Songzi Du, Informationally Robust Auction Design. Songzi presented his joint work with Benjamin Brooks ([Brooks and Du 2021]) on designing revenue-maximizing auctions for a common-value environment under the assumption that the designer only knows the marginal distribution of the common value but does not have a Bayesian belief about bidders' information about it. Instead, the designer seeks a mechanism that performs best under the worst-case scenario over all possible information structures. This robust approach to the design problem circumvents challenge of [Crémer and McLean 1988] whose surplus-extracting mechanisms rely

crucially on the designer knowing the distribution of buyers' signals. Songzi demonstrated that the maxmin mechanism takes the form of a "proportional auction:" Each potential buyer submits a one-dimensional bid, and the object is allocated to each buyer with probability proportional to the ratio of her bid to the sum of all the bids. Despite the adversarial choice of the information structure, this auction extracts all the surplus as the number of bidders goes to infinity.

Vincent Conitzer, Automated Mechanism Design for Correlated Valuations. Vincent's talk focused on his joint work with Michael Albert, Giuseppe Lopomo, and Peter Stone ([Albert et al. 2021]) on the interplay between automated mechanism design and robustness in the presence of correlation between buyers' values. Very delicate mechanism rules in the style of Crémer and McLean can pop out of optimization methods, and can depend very precisely on how the distributions are specified. But this can be problematic when our understanding of the distributions is noisy, such as when they are learned through samples. To that end, Vincent presented a visual interpretation of the Crémer-McLean lotteries, and showed how to use this perspective to develop robust optimization methods that degrade gracefully in the presence of noise. One can additionally ask that the resulting auction be ex post incentive compatible with a certain high probability, a natural intermediate solution concept between ex post and interim truthfulness, and the talk explored conditions under which such mechanisms perform especially well.

Susan Athey, Concluding Remarks. To close the technical program, Susan Athey provided personal and professional reflections on the impact of Paul and Bob's work in the field of market design. She shared her perspectives on how major applications of their auction theory analysis, including online platforms, Internet advertising, and of course spectrum auctions, built upon the insights from their contributions.

5. CONCLUSIONS

Over 500 participants registered for the workshop, and attendance in any given event oscillated between 100 and 200. We have received encouraging feedback from the workshop participants and presenters.

We ran a post-workshop survey among the participants to assess the degree to which the meeting fulfilled its purpose, and to identify scope for improvement in its future editions. On a 6-point scale (with 6 being the best score), 40% of responders assesed the overall event at 6, 40% at 5, and 20% at 4. Similar scores were given to individual parts, with slightly higher-than-average scores given to the tutorial part, and slightly lower-than-average scores given to the social program. Roughly 2/3 of responders thought that the social breaks were of the right length, with 2/9 believing they were too short, and 1/9 believing they were too long. 90% of responders said they are "very likely" to attend the second edition of the workshop next year. We also received the following comments and suggestions:

—The topic of the workshop was relatively narrow, so it could help (in terms of getting broader engagement) to organize a poster session. (As organizers, we thought of organizing a poster session but gave up on the idea due to insufficient time that we had to arrange the submission process—it could be an idea worth exploring in future years.)

—Social interactions were not as easy as one could hope, especially for students; however, several responders emphasized that the social games were helpful in that regard. Alternative suggestions included (i) a junior/senior lunch, (ii) assigning people to random groups to share ideas, brainstorm on content of the seminar, or simply socialize, and (iii) and increasing the time for "running around on breaks." Some acknowledged the difficulties due to time-zone differences—the workshop lasted into late evening European time. Others concluded that "things went as well as could be hoped for an online meeting."

—It would be worth adding panel discussion(s), with panelists commenting on what they think are currently important open research problems.

—Inviting Paul Milgrom and Bob Wilson provided a useful opportunity for students to interact with Nobel prize winners and learn from their experiences.

Overall, we view the inaugural SIGecom Winter Meeting as a successful event that paved the way for its future editions. We think that this type of community building is important, and we hope it will continue going forward. While the virtual format has some important limitations compared to in-person meetings, we believe that it provides a useful complement to traditional events by making access easy for everyone regardless of their location, resources, and connectedness. At the same time, we hope that our experiences summarized in this report will help future organizers improve upon the design of the Winter Meeting, in order to make it increasingly effective in fostering the social and professional connections within the Econ/CS research community.

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