Readings in auctions

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Abstract

This note gives pointers to what I think might be a good set of papers to read in order to obtain a grounding in auction theory, at least as it applies to work on the automated design of double auctions.

1 Introduction

I have split the material into a number of sections:

- Introductory material: general stuff on auctions and bidding.
- Classic work: some of the papers which laid the foundations for the study of double auctions, concentrating on more experimental work.
- Bidding mechanisms: much of the recent work from the AI side has looked at inventing clever bidding mechanisms. This section summarises that work.
- Heuristic approaches: since figuring out the best move is computationally hard, a better solution may be to pick a strategy which gives an approximation to the best move, though this means changing strategies dynamically.

The readings aren't intended to be comprehensive (that would be an intimidating list) but be indicative of what is out there, and provide a good grounding.

Each section also poses some questions. These don't have specific answers (at least not ones that I know about) but are things to think about while reading and discuss as we go along.

Most of this stuff is available on the web in one place or another (that is where I got it from), especially useful is JSTOR (`www.jstor.com`) and particularly so if you login from a Columbia IP address. The one set of papers you'll probably find hard to get are those in the Santa Fe collection [1], but I have a copy and can duplicate whatever you need.

2 Introductory material

Though I say so myself, our "bluffer's guide" [2] does a damn fine job of summarising some of the general auction theory literature. Most of it isn't about the stuff we'll be working on, but should give you enough of a start that you don't get too lost on looking at the primary literature. To get more specific, we need some work on double auctions. Friedman [3] gives a nice survey, albeit one that assumes some economics background, and the preface to the Santa Fe collection [4] has some interesting material in too. Finally, Cliff's epic paper on ZIP agents [5] has a very neat summary (in sections 2 and 4) of the economic background to double auctions, intended for a computer science audience.

Questions

1. When designing an auction, what kind of things should we aim that the auction do?
2. When designing a bidding agent, what kinds of things should be aim that the agent do?
3. How might bidding strategies differ between a call market and a continuous double auction?

3 Classic work

Since our perspective is on automatically designing auction mechanisms, rather than doing it analytically, what is most interesting for us is the theoretical work that has been carried out. The classics here are Smith's examination of equilibria in double auctions [6] (the start of the work that he was eventually awarded the Nobel prize for), Gode and Sunder's experiments on zero-intelligence agents [7], and the Santa Fe double auction tournament [8].

Two more recent papers that aren't really classics in the same way, but which have proved pretty influential, are the Cliff ZIP paper [5], and the Wurman *et al.* paper [9] that takes an abstract view of the whole auction process. This gets a bit over-technical in the middle, but persevere and try to get a sense for what the parameters capture.

Questions

1. To what extent does Cliff's work debunk the claims that Gode and Sunder make for the zero-intelligence agents?
2. How would you classify the Dutch and Japanese auctions using the parameters of [9]?

4 Bidding mechanisms

A lot of the work on double auctions by our CS bretheren has concentrated on building bidders that outdo, in some sense, the previous best bidder. That wasn't, in my opinion at least what Cliff was trying to do to Gode and Sunder, but it is one way of reading it, and everyone else seems to have followed that line. Thus, Gjerstad and Dickhaut [10] (okay, they are economists) came up with a mechanism (GD) that outperformed ZI, while Preist and van Tol [11] improved upon ZIP. Following this, Kephart and colleagues [12, 13] tweaked ZIP and GD and showed [14, 15] that their modified GD (MGD) outperforms the others as well as the Kaplan strategy from [8]

Questions

1. There seems to be a considerable variety of different conditions under which the experiments in the above papers are carried out. How much variety can you find?

2. What do you think explains the terrible performance of Kaplan in [14, 15]?

5 Heuristic approaches

One thing that all this work has exposed is that if you consider the double auction as a game (in the game theory sense), then there is no dominant strategy. There is no way to bid that seems to always be the best way to bid (even if you can define "best" in a suitable way). It all depends on what everyone else is doing. This has led some to suggest that the approaches we have looked at so far, which basically try to identify a particular bid to make based on what other people are bidding, are operating at too low a level. Instead we should try to pick a bidding strategy given what bidding strategies other people are using. The only people to have run with this idea so far are Bill Walsh and his colleagues at IBM who looked at what stable equilibria could be obtained when agents bid according to combinations of the strategies mentioned above [16], and then investigated how to choose best points within this huge sample space [17].

Questions

1. How do you interpret the results in [16] for the double auction?

2. How might one use this analysis in the context of evolving auction and bidding mechanisms?

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