Other models for Combinatorial Auction

According to *The Winner Determination Problem*[1] the optimal and exact solutions are NP-complete. For example, we can convert the problem in stable set problem, we will go with approximate solutions mainly two greedy approaches.

1. Choose the biggest offer that has no conflict with the currently accepted bids
2. Choose the biggest offer based upon the average price of an item (also making sure we don't conflict with already accepted offers)

Another approach according to *The Winner Determination Problem* is to restrict the possible states, for example not allowing more than 3 items in a bid, but our dataset is not compliant with this rule.

Another solution is based on search algorithms that can be slower in some instances (because the problem is NP) but work fast on other instances, a lot of techniques have been described in *Optimal Winner Determination Algorithms*[2]. The basic idea is to enhance a search algorithm with domain-specific knowledge about the Combinatorial Auction and sort solutions and take branching decisions on heuristics.

For this approach, we still need to research the options but we gravitate towards a *Branch on Bids*[2] similar to *CABOB*[2]. Another approach we are exploring is *An Algorithm for Optimal Winner Determination in Combinatorial Auctions*[3]

There are problems we don't address, for example:

- how to offer feedback for future bids (for example reply to a bidder what is the amount he needs to offer to get the bid)
- iterative approaches, compute the best value based on an older value in the case of an iterative auction

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[1] "Chapter 12 The Winner Determination Problem." https://www.cs.cmu.edu/~sandholm/winner-determination-final.pdf. Accesat pe 1 nov.. 2019.
[2] "Algorithm for optimal winner determination in combinatorial ...." https://www.cs.cmu.edu/~sandholm/oralg.aij.pdf. Accesat pe 1 nov.. 2019.
[3] "Algorithm for optimal winner determination in combinatorial ...." https://www.cs.cmu.edu/~sandholm/oralg.aij.pdf. Accesat pe 1 nov.. 2019.

This problem and more are discussed in *Bidding and Allocation in Combinatorial Auctions*[4], Iterative Combinatorial Auctions[5] and *Combinatorial Auctions: A Survey*[6]

One approach we will not try to replicate was expressed in *iBundle*[7]

[4] "Bidding and Allocation in Combinatorial Auctions 1 Introduction." https://www.cs.cmu.edu/~sandholm/cs15-892F15/Bidding%20and%20allocation%20in%20CAs.ps. Accesat pe 1 nov.. 2019.
[5] "Iterative Combinatorial Auctions - Computer Science." http://www.eecs.harvard.edu/~parkes/pubs/ibundle00.pdf. Accesat pe 1 nov.. 2019.
[6] "Combinatorial Auctions: A Survey - Semantic Scholar." https://pdfs.semanticscholar.org/88bb/0df1d8670622775a1194c70f583a27c8e5b5.pdf. Accesat pe 1 nov.. 2019.
[7] "Iterative Combinatorial Auctions: Theory and Practice." http://www.eecs.harvard.edu/~parkes/pubs/ibundle00.pdf. Accesat pe 1 nov.. 2019.