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UNDERGRADUATE PROJECT REPORT
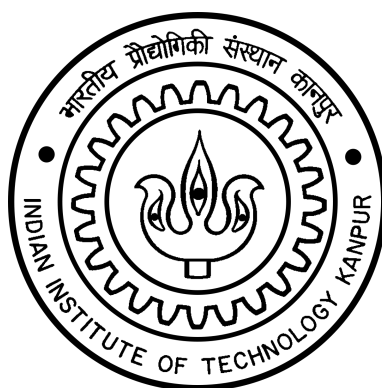

AuctionIt

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Abstract

An auction is a process of buying and selling goods or services by offering them up for bid, taking bids, and then selling the item to the highest bidder. So why are auctions important? In nutshell, it is important because certain goods might have some value to the seller, and therefore the seller might have some reserved price below which the she would not be willing to sell. If left to the market, the price might fall below that price. Also, there do exist willing buyers who are ready to pay the higher value. Moreover it has become a method of determining prices of goods.
Some salient features of using an auction are:

- Speedy Process, Quick Turnaround.

- Competitive Bidding.

- Auctions Work Well in Both Good and Bad Economic Times.

- No Negotiations.

- can get good idea of price.

- You Know Exactly When Your Property or Goods Will Be Sold.

- and may more...

Auctions have become an integral part of today's world, they are used extensively in almost every field. Some widely used auctions are spectrum auction, treasury auction, auction for advertisement, auctions for players such as in IPL or EPL leagues.

Considering the need for auctions, we hereby present a software, which is generic enough to conduct several different auctions called **Auctionit**.

Introduction

AuctionIt allows auction designers to create and host auctions, users can place bids on items in the auction and can see the results and price they have to pay at the end of the auction process. Auction Designers can modify and create new fields which allow them to get more data from the bidders that is relevant to the auction being held. They can also choose from pre-defined auction templates to quickly set up some of the more common auctions. They can also define their custom allocation rules and pricing rules. This allows to set up complicated rules for pricing and allocation and thus provides more freedom to the designer to create a wide variety of auctions. The software, categorizes auction designers and bidders as different types of users. These accounts are password protected to prevent misuse and to ensure the auction is not compromised while it runs.
Before we started designing AuctionIt, we studied about auctions. We read papers/lectures to understand the reasons why first price and second price auctions are so popular and widely used. We also read and learnt about the auction process for large scale real life auctions take place like treasury auctions or spectrum auctions. We read about auctions with multiple objects and how these large scale auctions deal with having multiple objects which may be similar and how they setup rules to prevent allocating a majority of a commodity to a particular set of bidders.

Theory Review

We read a paper on the problem of reallocation of the radio frequencies given to television stations, so as to clear spectrum for wireless internet access. The major challenges that are faced to conduct such an auction are:
1) The channels to sand their geographical locations need to be continuous for wireless so each owner becomes essential and can demand a higher price.
2) Spectrum interference is required to be tackled while maintaining price clearing and continuous real-location.

To overcome these challenges an Incentive auction is conducted. An incentive auction consists of two separate auctions - a backward auction to determine the price at which broadcasters will sell their spectrum usage rights and a forward auction to identify the prices companies will pay for wireless allocation. Both forward and backward auctions are VCG auctions and belongs to a class of deferred acceptance algorithm, forward auction's bidding increases with rounds while the back auction is a decreasing clock auction.

Treasury Securities auctions

Treasury securities :   Treasury securities or Treasuries are bonds issued by the government to meet their financial debts. Based on the period of maturity they are categorized into different types that are Treasury bills, notes, bonds, and Treasury inflation-protected securities.

Most of the treasury auctions come in one of the two categories of auctions: Discriminatory Price auction and Uniform Price auction.

Discriminatory-Price auction : In Discriminatory Price auction, allocation rule is that the bidder with the highest bid wins and the winner pays his own bid, so this reduces to the first-price auction in case of a single object auction.

Uniform-Price auction : In this, the allocation rule is same as Discriminatory Price auction, that is the winner with the highest bid wins but in this case, all winners pay an averaged uniform price and this cuts to the second-price auction in single item auction.

Treasury auctions are different from other auctions as the values of these securities in the secondary market in known before the auction and are independent of the private valuation of the bidders. These type of auctions are called common value auctions. This difference in valuation results in a phenomenon called 'winner's curse' which is a significant factor in choosing between the above two pricing rules for revenue maximization proper of the above two price rules.

Winner's Curse : In a common value auction the real value of the item is the same for all the bidders, but they bid differently according to their estimate of the secondary market value. If we take the average of all the bids as an estimate of the actual secondary market value, then the highest bidder incurs the highest loss by winning the item at such a high price.

From the definition of the winner's curse, it can be observed that the winning bidder will suffer more loss in the case of discriminatory price auction than uniform price auction. This causes the bidders to bid less than there valuation and results in lower revenue.

Hence the Uniform-price method is more efficient than the Discriminatory-price method regarding revenue generation, but several surveys reveal that Discriminatory-price method dominates in Treasury auctions in most parts of the world and so this is an example of a situation where theory and practice do not agree woth each other.

US Radio spectrum reallocation

The following is a study of the process used for the US radio spectrum reallocation given to television stations and clear spectrum for wireless internet service providers.

The spectrum reallocation process is a complex one and needs to handle multiple challenges like how many television channels to reallocate, which channels to reassign, how to determine compensation for reassignment, how to distribute the cleared spectrum to the wireless companies etc. One of the major problems is that the channels cleared and their geographical location needs to be continuous for the wireless broadband purpose. The continuity requirement of channels and their geographic location makes even small owners important, and thus each broadcaster can ask for a higher price, exploiting his/her importance for the whole project. Other than these multiple problems the computational issues are also a concern. It is computationally expensive to check for interference constraints, and these checks are required for each reassignment.

The auction to reassign spectrum, which came to be known as the 'incentive auction', involved bidding by both buyers and sellers.

Design Details

For the design, we can seperate AuctionIt into two major sections - the database and the main program/front end. The database consists of the following set of tables : -

1. **User** Table
   - The user table stores information about the user and also his login credentials such as username and password details.

2. **Designer** Table
   - The designer table stores the login credentials for the auction designers, it also stores a list of past auctions created by the designer with auction-id and revenue generated by the auction. If the designer has created custom allocation and pricing rules then we store their ids (from Table 7 and Table 8) for easy access while creating later auctions.

3. **Default Auction** Table

4. **Live Auction** Table

5. **Bid** Table

6. **Ranking** Table

7. **Allocation Rules** Table

8. **Pricing Rules** Table

Further improvements

References