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Abstract

An auction was originally a method to trade the special goods such as curios or antiques, which do not have a fixed price. In a wide interpretation, an auction is a kind of trade system in economic activities. We can see the various trade systems (auctions) in real world. For example, the trade of limited edition, stock trading, and a sale of personal computer are a kind of auction. An auction price would reflect a market price more clearly than a fixed price because it is decided by buyers. Many types of auctions are practiced in different situations.

During last decade, the Internet has rapidly spread, and thus it has quickened the growth of the trading on the Internet. The Internet allows a business to reach a large number of potential customers and suppliers in a shorter time and a lower cost. As a result, an auction business also expands rapidly on Internet (e.g. Yahoo auction). An electronic auction has become a large system to trade any good. However, this rapid growth of electronic auction can cause different troubles. In realizing an electronic auction scheme, we need to consider from three points: bidder privacy, correctness of system, and efficiency.

In an electronic auction, it is important to satisfy anonymity for an authority in order to protect the information of who wants a good and a bidder's history of bidding. Such information may be bought and sold through illegal channels. Therefore, nobody should be able to gather the useful trading information with personal data. In anonymous bidding anybody should be able to verify the validity of a winner, while in secret bidding anybody should be able to verify the correctness of a winning bid. Furthermore, each bidder should be able to place a bid efficiency on Internet. In this thesis, we realize the following three kinds of auction schemes:

An English auction scheme: This scheme aims at both the efficiency of bidding and anonymity of bidder. In an electronic English auction, efficiency of bidding is important because a bidder repeatedly places a bid in real time. Therefore the proposed scheme realizes the efficient bidding. Furthermore there is no single authority who can break anonymity of bidder.

A first-price sealed-bid auction scheme: This scheme aims at both a single auction manager and introducing a feature of entertainment. Many participants can enjoy the opening phase by decreasing winner candidates little by little. The cost of bids opening is more efficient compared with the other previous schemes. Anybody can publicly verify the auction results.

A second-price sealed-bid auction scheme: This scheme aims at both the secrecy of the highest bid with public verifiability. The secrecy of the highest bid should be satisfied in order to keep winner's privacy. Anybody can publicly verify that a winning bid is the second highest bid with keeping the highest bid secret.