MASTER'S THESIS (FALL 2018)

TOPIC: ***Design of a VCG-Based Double Auction Mechanism for Online Product Bundling***

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ABSTRACT

A double auction allows buyers and sellers to simultaneously submit their bidding prices and asking prices, respectively. When a double auction ends, the auctioneer determines a reasonable trading price for the auction winners. Although many mechanisms have been developed to implement double auctions, most of them could not satisfactorily meet major requirements such as individual irrationality, budget balanced, truthfulness, and economic efficiency. In this thesis, we first study the standard Vickrey-Clarke-Groves (VCG) mechanism for a conventional online auction, where one seller sells items to multiple buyers, who place bids without the knowledge of other bids. The winners are bidders with the highest bids, but they only pay a reasonable trading price lower than their bidding prices. Then, we design a VCG mechanism for a double-auction to trade multiple product units, where multiple sellers sell the same type of items to multiple buyers. In such an auction, buyers place their bids in a bundle of multiple units, but neither sellers nor buyers can see other bids. The VCG mechanism involves two major steps, which are to determine the winners by computing the allocation that maximizes the social welfare (a buyer can be matched with multiple sellers) and to calculate the trading price for the winners. We adopted the genetic algorithm, a type of evolutionary algorithm, to determine the winners that result in the optimal welfare, and introduced two ways to calculate the trading prices for winners based on the asking prices and bidding prices, respectively. The experimental results show that our approach provides an effective way for online double auctions, and is much more efficient to derive the near optimal solution than the brute force approach. The results also show that either way of calculating the trading prices produces reasonable results for the winners.