

Bid Construction Problems in Collaborative Transportation Services Procurement Auctions

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The bid construction problem refers to the challenges that companies face when preparing competitive bids for construction projects. This process involves estimating the costs associated with completing the project, determining a suitable profit margin, assessing risks, and formulating a bid that meets the client's requirements and also maximizes the chances of winning the contract.

To deal with the bid construction problem, **Mathematical Modeling** and **Numerical Analysis** play crucial roles in estimating costs accurately, optimizing bidding strategies, mitigating risks and effectively allocating resources. These approaches enable construction firms to make data-driven decisions and improve their competitiveness in the bidding process :

1) Numerical optimization techniques, such as linear programming, integer programming, or dynamic programming, can be applied to solve these models and determine the optimal bid price and resource allocation.

2) Numerical techniques can be used to analyze resource utilization and allocation to optimize project schedules and minimize costs. Critical path method (CPM) and program evaluation and review technique (PERT) can be employed for scheduling and resource allocation, considering dependencies and constraints among project activities.

The main objective of this research project is to design and evaluate a Mathematical Modeling and solution approaches for a main decisional problem inherent to the design of combinatorial auctions.

Collaborative transportation services procurement auctions involve shippers (buyers) and carriers (sellers) coming together to negotiate and procure transportation services. Our first objective is to adapt existing approaches to account for reputation by adjusting the profit generated by a new contract and the price offered in the bid with the information the carrier has on :

1) The shippers' past performance and the reliability

2) And based on their past commitments

This research project focuses on the integration of two concepts, centralization and reputation in combinatorial auctions for the procurement of the truckload (TL) services.

Centralization is presented as a form of collaboration between shippers who submit their requests in the same centralized auction. Each carrier submits combinatorial bids that may cover contracts from different shippers. Reputation encompasses attributes other than price used to judge a participant.

The carrier defines a set of lane service attributes for evaluating the reputation of each participating shippers. We assume that the carrier considers its previous experiences with a shipper to compute this reputation.

We consider a **mathematical formulation** to model and demonstrate the shipper's reputation.

There is a bid construction problem where the carrier aims to maximize its profit by bidding on new auctioned contracts. It is a combinatorial auction implying that a carrier can bid on a package of contracts in the same bid.