Bidding When Items’ Selling Prices Increases Over Time in Competitive Environment

MAS WS20 Assignment 3

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# Preface

In this assignment, students are instructed to implement a bidder with a competitive strategy such that the bidder having highest value *wallet* is designated the winner. There are 3 simultaneously running auctions at once, the first one *(Auction A)* is a selling auction where the bidder have to buy bundles containing items with designated frequency. These items in turn are sold at a second auction *(Auction B)* where the auctioneer buys fixed bundles of them. There is also another auction *(Auction C)* where a free market for only bidders is operating where they sell a single instance of an item each round.

The most important aspect of the auction is the difference between supply and demand. Auctioneer at B continuously increases the prices by 5 if the bundle is not sold by any bidder, and if it is sold decreases by the same amount. However, a bundle at Auction A at most contains 2 possible bundles while Auction B has 16 simultaneous bundles to sell, which means for any two bundles decreasing in value, there are 14 other bundles increasing. Thus, in order to reach a competitive price, the bidders will have to account for future value of an item, thus bid more than its selling price at that time.

# Implementation

## Getting Buy / Sell Value for an Item

Value of each item is dynamically got from the current prices of respective items at Auction B. For example, one of the item’s price, named *Resource A*, is deduced by the 3 bundles that it is contributing solely, without any other item. Resources B, C and D values are also deduced by their own respective bundles and Resource B’s contribution value. Each item’s expected maximum contributing values are calculated as such. They are stored in *projectedMaxItem*.

## Buying Strategy

For each item in the offered bundle by Auction A, the aforementioned strategy is used such that each item’s value estimated is added to get the value of the bundle itself. Each item is also assigned a respective supply / demand value in a way that it will reflect the price increases in the future. The calculation of the value is by the following equation:

Calculated values are the following:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | C | D | E | F |
| 0.87 | 0.66 | 0.94 | 0.94 | 0.97 | 0.93 |

Thus, the value, multiplied by *expectedSellRoundToAdd*, while confusing in name, reflects the future selling price to the current offered bundle. Using several bidders with differing meta-parameter, the multiplier is assigned as 5, meaning selling 5 rounds later if necessary.

## Selling Strategy

There can be several strategies, such that buying low and selling at the highest, which happens around the end of Auction B is one such. However, it is deemed to have a better competitive strategy in order to achieve high performance overall. Selling a bundle happens when the expected value of a bundle is more or almost equal than the sum of items’ designated maximum values.

Selling happens continuously in order to have competitive prices along the auction, if wallet has less than certain number of credits (2000 in this case).

# Testing

The testing was first done with this agent and an adaptive agent where this agent has won. Then, further testing was done to tune hyperparameters, where agent with has won. This was the final version submitted.