Distributed Artificial Intelligence and Intelligent Agents ID2209

Assignment 2

Group 22
Ayushman Khazanchi
Vasigaran Senthilkumar
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Introduction

In Assignment 2, we were tasked with implementing different types of auctions using the FIPA protocol. In the auctions there is an auctioneer or a group of auctioneers and the participants in the auctions. There must be one winner at the end of an auction. Based on the different types of auctions, the auctioneers manipulate the selling prices on which also the winners are decided. The mandatory part of the assignment was to implement a Dutch auction. As part of challenge 1, we assigned auctioneers selling products of different genres (clothes, CDs, paintings, sculptures) and participants taking part in the auction based upon their interests. Additionally, as part of challenge 2 we implemented a Sealed-Bid auction and a Vickrey auction.

How to run

Note: This section assumes user knows how to run Gama IDE and how to run experiments within the IDE.

Main task can be run from dutch.gaml
Challenge 1 can be run from multiple.gaml
Challenge 2 can be run from sealedBid.gaml and vickrey.gaml
Creative implementation can be run from english.gaml

Species

Auctioneer Agent

The Auctioneer agent is a species of type Auctioneer. The Auctioneer initiates the auction by informing the participants and sending out the requests to the participants. The agent changes the value of the price on the type of the auction and the response from the participants of the auction. The auctioneer can also call off the auction or decide the winner of the auction based on the circumstances.

Participant Agent

The participant agent is a species of type Participant. It participates in the auction by responding to the proposals sent by the auctioneer agent. The participant agent behaviour differs between the different types of auctions. In the challenge 1 we also capture the genre or interest of the participant and the participant only takes part in the auction if they're interested in the genre of that auction.

Implementation

The main task is done in dutch.gaml. The auctioneer agents and the participant agents participate in the Dutch auction. The auctioneer starts the auction by setting a price. The

auctioneer also has a minimum price which is the minimum price that auctioneer will accept for the sale of the merch. The auctioneer calls off the auction if there is no chosen winner even after the price goes below the minimum price. The Participant agents are initialised with a maximum price value for each agent before the auction. The participant agents bid only if their own maximum price is greater than the price set by the auctioneer and sent by start_conversation and the fipa protocol. If the auctioneer reads two or more agents replying in 'reply_messages' reflex is positive, then the auctioneer increases the price by 7. If everyone was sending a negative response (no bid), then the auctioneer reduces the price by 5. If there is only one participant agent with a bid, then the agent is declared as winner.

Challenge 1

As part of challenge 1, we have implemented multiple auctions to happen. We added 4 Auctioneer agents instead of 1. The Auctioneer agents additionally have the attribute of genres. The four agents run four types of auctions: clothes auction, CD auction, painting auction, and sculpture auction. Participant agent also gets initialized with a genre for itself. The auctions are started by the auctioneers, and they also send their respective genre to all the participants through start_conversation. Then the participants whose genre matches with the genre sent by the Auctioneer agent participates in that auction only using send_response. The agents that participate in the auction are identified by the auctioneer agent and the winner is declared for each type of auction.

Challenge 2

Sealed-Bid Auction
The challenge 2 is done in sealedBid.gaml and vickrey.gaml. In the sealedBid.gaml a Sealed-Bid auction is implemented. The auctioneer agent sends the request to all the participant agents to inform them that the auction is active and that the partcipant agents can send the bid. The participant agents set a bid price and send it as a response. The auctioneer agent reads the response from all the agents and then declares the agent with the highest bid as the winner.

Vickrey Auction
In the vickrey.gaml, a Vickrey auction is implemented. A similar implementation to the Sealed-Bid is done here. However, in the Vickrey auction the winner is chosen with the highest bid but the price that is paid is actually the second-highest bid.

Creative implementation

As part of creative implementation, we have implemented an additional English auction. In the English auction the auctioneer starts with the lower price which in our case is 0. The participant agents set a maximum price in the auction. This is the price above which they are not willing to pay. The participants are in the auction as long as the auctioneer quotes a

price less than maximum price for the participant agent. When there is only one agent with participation in the auction, the agent is declared the winner.

Below is a table analysing total value spread across each auction type run over 4 cycles.

Auction Winning Prices (4 Cycles)					**Total**
Dutch Auction	90	88	92	93	363
Vickrey Auction	88	66	64	84	302
Sealed-Bid Auction	92	60	99	73	324
English Auction	93	43	81	54	271

Discussion / Conclusion

We enjoyed working on the simulation. We understood how different auctions work and were able to relate the same with the lectures. The difference in the logic of same types of agents between different types of auctions was quite fun to implement. Also, we understood the implementation and usage of FIPA protocol for proposal and negotiation.