ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Assignment 2 – Negotiation and Communication (FIPA)

Group 27

Valeria Bladinieres Justo

Raúl Aznar Álvarez

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Festival

In this assignment, we were assigned the task of creating two types of agents in GAMA: Guests and Auctioneers. Auctioneers can auction items during the festival, and the Guest that wins gets the item. The communication between the Auctioneer and the Guests had to be done through the communication protocol called FIPA. The type of auction handled by the Auctioneers was Dutch Auction, where the Auctioneer starts their offer with much higher price than the expected market value. Then, if none of the Guests wants to buy the item, the Auctioneer has to lower the price. In the end, if the price lowers his expectance the item is not sold, otherwise the Guest who auctioned first above the auctioneer's lowest price wins the item.

How to run

Run GAMA 1.7 and open the file Project2, there will be 4 scripts project2.gaml, challenge1.gaml, challenge2.gaml and creative.galm. Open the file which wants to be checked and press main (left top of script window) to run the simulation. Note that changing parameters of number of guests can be done without any repercussions.

Species

Guest

This agent is wondering around at a random place in the festival, each one of them like or do not like the item cap, it is chosen arbitrarily. Then, at any time the agent can receive an invitation(informs) to go to an auction. Subsequently, if the agent likes the item they are selling, it goes to the where the auction will take place. Afterwards, the agent has a maximum price which it will bid for, and if the price of the item is higher, it will wait for the Auctioneer to lower it. The initiation of the Auction is done by CFP (call for proposal), and then if the Guest accepts the price it sends a propose, if the Auctioneers accepts it will get an acceptance from their part, otherwise it will receive a rejection.

Auctioneers

The Auctioneers can do an auction every 300 seconds, and the type of auction used is the Dutch Auction as explained before. First, the agent is responsible of sending to all guest an Inform, where it posts what item it is auctioning and the location of the place it is in. Later, when all the interested Guests arrive to the place where the action will take place, the Auctioneer sends the CFP (call for proposal) with a very high price in this case the double of the market value of the item. Afterwards, it waits for the response of any Guest, if none of them makes a proposal after 10 seconds it reduces the price by 10% of its price. It goes into a number of rounds until it receives a propose, if the case is that the item reaches the price of the market value, the Auctioneer informs all Guests that the price cannot go lower and the auction is canceled.

Implementation

First, we created all the needed agents in this case Guests and Auctioneers. Then we started designing each agent with their basics for the graphic design. Then the development of both agents was simultaneous, in order of how the protocol behaves regarding the Dutch auction and the agents.

Results

In *figure* 1 it can be observed the Guests that are interested are color purple and going to the place of the auction.

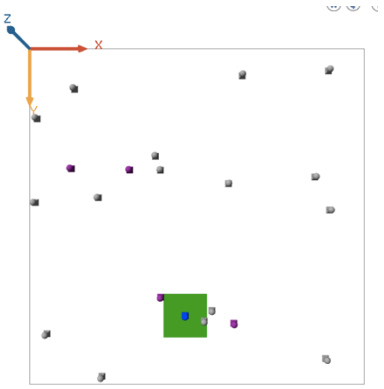

Figure 1: A screenshot of the final solution.

Figures 2 and 3 are an example of the FIPA protocol, where highlighted in red it can be observed the CFP to all interested agents, the round of the price reductions since it did not get a propose, and in the end the auctioneer receives a propose and the winner agent is announced.

```
Guests interested in buying the product: [Guest(1),Guest(2),Guest(12),Guest(13)]
Auctioneer0 sends a cfp message to all interested participants
Guest1 receives a cfp message from Auctioneer0
Guest1 could pay 280.1821176334982
---------------
Guest2 receives a cfp message from Auctioneer0
Guest2 could pay 207.9109852488098
---------------
Guest12 receives a cfp message from Auctioneer0
Guest12 could pay 192.02834166842678
---------------
Guest13 receives a cfp message from Auctioneer0
Guest13 could pay 155.9850372150729
---------------
Original price: 500
---------Price reduction--------
Reducted price: 450.0
Guest1 receives a cfp message from Auctioneer0
Guest1 could pay 280.1821176334982
---------------
Guest2 receives a cfp message from Auctioneer0
Guest2 could pay 207.9109852488098
---------------
Guest12 receives a cfp message from Auctioneer0
Guest12 could pay 192.02834166842678
---------------
Guest13 receives a cfp message from Auctioneer0
Guest13 could pay 155.9850372150729
---------------
```

```
---------Price reduction--------
Reducted price: 295.245
Guest1 receives a cfp message from Auctioneer0
Guest1 could pay 280.1821176334982
---------------
Guest2 receives a cfp message from Auctioneer0
Guest2 could pay 207.9109852488098
---------------
Guest12 receives a cfp message from Auctioneer0
Guest12 could pay 192.02834166842678
---------------
Guest13 receives a cfp message from Auctioneer0
Guest13 could pay 155.9850372150729
---------------
Original price: 500
---------Price reduction--------
Reducted price: 265.7205
Guest1 receives a cfp message from Auctioneer0
Guest1 could pay 280.1821176334982
---------------
Guest2 receives a cfp message from Auctioneer0
Guest2 could pay 207.9109852488098
---------------
Guest12 receives a cfp message from Auctioneer0
Guest12 could pay 192.02834166842678
---------------
Guest13 receives a cfp message from Auctioneer0
Guest13 could pay 155.9850372150729
---------------
Auctioneer0 receives propose messages
    Guest(1)has won the auction!!!!!!
```

Figure 2 and 3: log successful.

In *figure 4* a different case is presented, where the auctioneer informs the interested Guests about the cancelation of the auction, since the price lowered its expectations.

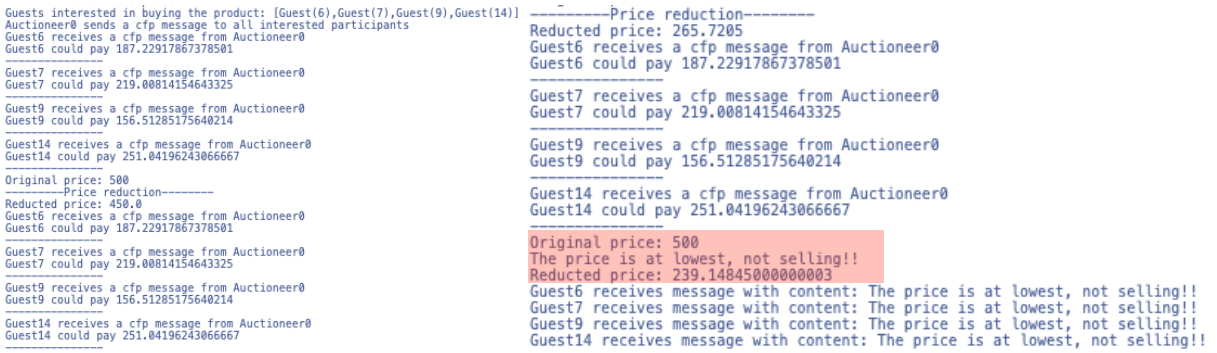

Figure 4 and 5: log unsuccessful.

Challenge 1

To complete the first challenge, we had to implement multiple Auctioneers in the festival. The auctioneers sell two types of elements caps and umbrellas. The Agents randomly choose which item they would like to purchase. The Auctioneers send out Informs about their auction giving some elements like their location and auction element. Subsequently, the Auctioneer waits for all the interested Guests to arrive and the auction begins, the same dynamic of the type of the auction serves as Dutch auction.

Challenge 2

The second challenge consists in using a different kind of auction. In order to do so, we created three auctioneers, selling the same product (with the same 'valued price') with a different method. In order to do so the guests randomly decide to which auction to go (if they want to purchase). Once all the interested possible purchasers to one specific Auction arrive, the auction starts independently from the others. We implemented Vickrey, Sealed and Dutch auction. The process restarts every 300 iterations. In addition, the 'benefits' for each auction are subtracted from the process. Who benefits more a method is difficult to establish, since always depends a little bit on how do you program it. Theoretically in sealed price, the bidders usually bid a bit lower than the 'real value' (we assume that is the value that each guest consider it has. Whereas in Vickrey the best strategy is to bid the value one believes it has.

We run some experiments. First, every guest price willing to pay is between (40-60%) of the real value. Meaning under 50% it will have 'no benefits'. Another factor to take into account is the number of guests we set. For a small number of guests, with that configuration, Vickrey is the worst for the Auctioneer, followed by Dutch and the best is sealed. With a larger amount of guests Vickrey and Dutch are very similar. Whereas sealed is the worst one.

If we change the percentages that they will bid to something more real, with a 40-60 for Vickrey and Dutch, 35-55 for Sealed. Small amount of Guests Dutch is the best one, as never get negative

values, if the value hits the established no one is a winner. Vickrey is far from Dutch as there are not many Guests so it gives no good benefit for the Auctioneer. Last is the sealed but not really far from Vickrey. With a larger amount

To sum up, defining which one is the method with the best benefit for the auctioneer or the guest. IS relative to many factors as the number of participants. See Figure6. Below.

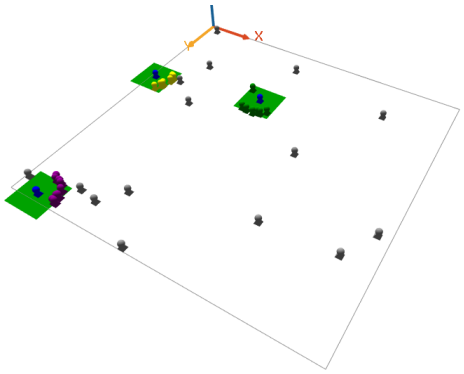

Figure 6: Agents buying to different auctioneers, with different auction methods.

Creative implementation

What can be worse than be in a festival with rain or extreme sun, and have nothing to protect from it? We wanted to simulate that environment so we create a possibility of 3 weather conditions: Rainy, Extreme Sun, Normal sun with clouds. Depending on that the prices change and what the guests want also changes. Rainy conditions make guests to want to buy umbrellas and the prices for umbrellas increase and the one for caps decrease. Normal conditions guests go to buy both things, and the price is same. And extreme sun people wants to buy caps but not umbrellas, so the prices for caps increase.

But we didn´t want to create something theoretical so we create an environment with the display simulating clouds moving, and sun. In addition we created some lights in order to simulate the light of the sun, or what it could be (blue shadow of the water when it rains). The weather can change every 600 iterations, to make the simulation more unpredictable☺.

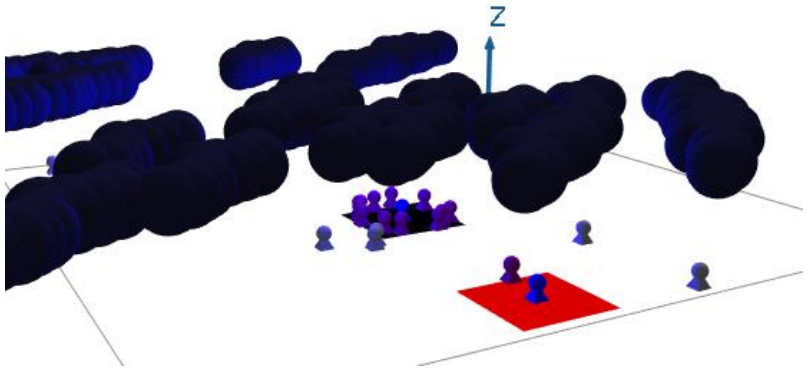

Figure 7: When is rainy, no one want to get wet, and they go to buy umbrellas!

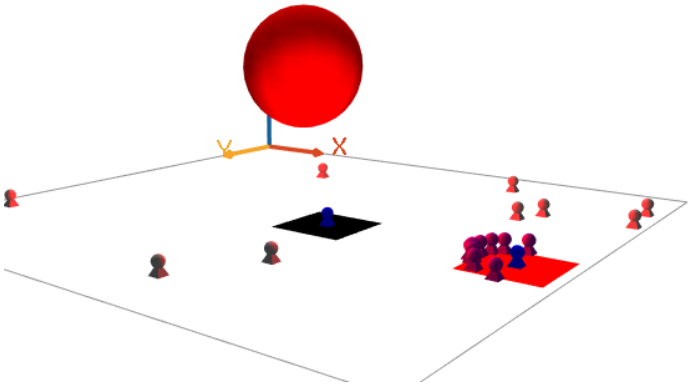

Figure 8: When is really warm, the Guests have to protect themselves from the sun buying caps.

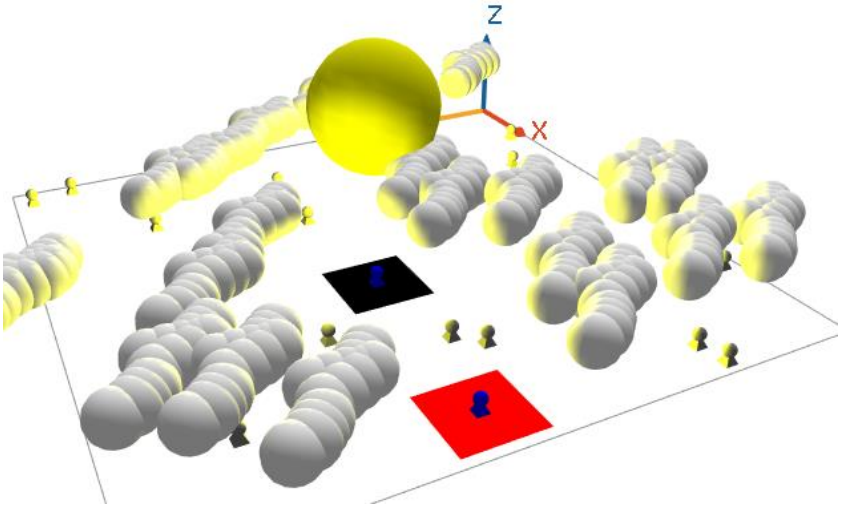

Figure 9: The weather is not always that bad.

Answer Qualitative/Quantitative questions

In what area is your idea mostly related to	Light implementation, weather conditions, conditioned thinking.
Time spent on finding and developing the creative part	8
On the scale of 1-5, how much did the extra feature add to the assignment?	5
On the scale of 1-5, how much did you learn from implementing your feature?	4

Discussion / Conclusion

Creating this project was more challenging than the first one, we encountered numerous problems regarding message exchange. The challenges where more complicated, but since they were similar the developing time was less. The creative idea was fun and interesting since we decided to take a different perspective and play between the visuals and the challenges. In general, the assignment was exciting and interesting, we learned how to use the FIPA protocol with different types of auctions(Dutch, Sealed and Vickrey) and always happy to learn more GAMA.