

ID2209 - Distributed Artificial Intelligence and Intelligent Agents
Assignment 2 – Negotiation and Communication
(FIPA)

Group 12

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Auction simulation

In this assignment, we were tasked with creating an auction simulation in GAMA, by using communication via FIPA protocol.

How to run

Run GAMA 1.8 and import 'Basic Model.gaml' as a new project. Press 'BasicModel' to run the simulation. The same applies for the 'Challenges Model.gaml' and 'Creative Model.gaml', with the corresponding buttons 'ChallengesModel' and 'CreativeModel'. Note that changing parameters 'number_of_auctioneers' and 'number_of_participants' will affect the number of auctioneers and participants respectively.

Species

- **Initiators:** This agent starts communication with the Participants that are present in the auction. Depending on the type of auction, Initiators either send the price they are fixing, or they only evaluate the offers from Participants. Their only skill is FIPA.
- **Participants:** Participants choose one auction depending on which products they like. They move to the corresponding point and receive the starting message from Initiator, which they reply in one way or another depending on the type of auction and the maximum amount of money they are willing to pay. Skills are FIPA and MOVING.

Implementation

- We created a world with 1 Initiator and 30 Participants. We initialize them with random locations. By default, world's dimensions are 100*100.
- The first thing was to make the Participants be aware of the start of auctions once they reach the corresponding locations. For that, the 'start_conversation' within skill FIPA was used. A list of Participants is assigned to each Initiator, and the initiating messages are sent to all members of that list.
- After that, Participants receive the message of the starting bid, and they have to reply. They do that by sending a 'proposal' with a message containing either 'true' or 'false', where the first means they will afford the current bid, and the second means they will wait until the price is further lowered. They decide that by comparing the current bid to an initial random variable that refers to the maximum price each of them can afford.
- Finally, the Initiator receives the 'proposal' message from Participants. If any of them contains 'true', then the auction is over and the (first) one to send the 'true' message is the winner of the auction. If not, the Initiator lowers the price at a rate it randomly decides and the same process is repeated until someone wins the auction or until the bid reaches a minimum price without any winners.

Results

```
Participant0 is willing to pay a maximum of 130
Current bid in Dutch auction is 391
Currently 7 participants: [Participant(23),Participant(29),Participant(15),Participant(13),Participant(
Participant0 is willing to pay a maximum of 130
Participant13 is willing to pay a maximum of 254
Participant15 is willing to pay a maximum of 380
Participant20 is willing to pay a maximum of 165
Participant23 is willing to pay a maximum of 151
Participant28 is willing to pay a maximum of 175
Participant29 is willing to pay a maximum of 281
Current bid in Dutch auction is 360
Currently 10 participants: [Participant(23),Participant(29),Participant(15),Participant(13),Participant(
Participant0 is willing to pay a maximum of 130
Participant4 is willing to pay a maximum of 194
Participant13 is willing to pay a maximum of 254
Participant15 is willing to pay a maximum of 380
Participant15 says: "I would like to buy that for 360!"
Participant19 is willing to pay a maximum of 190
Participant20 is willing to pay a maximum of 165
Participant22 is willing to pay a maximum of 395
Participant22 says: "I would like to buy that for 360!"
Participant23 is willing to pay a maximum of 151
Participant28 is willing to pay a maximum of 175
Participant29 is willing to pay a maximum of 281
Dutch auction is over. Articles were sold to Participant(15) for 360
Dutch auction sold articles for 360
```

DUTCH


Challenge 1

We added a new attribute to Initiators, called 'genre', which can take the string values 'Art', 'Metals' or 'Vehicles'. Three Initiators are now created, each with a different 'genre', and also every participant is initiated with a favorite 'genre', and they will 'goto' the corresponding auction they like.

Challenge 2

We added a new attribute to Initiators, called 'type', which can take the string values 'Dutch', 'English' or 'Sealed'. Three initiators are now created, each with a different type, but participants go to a particular auction depending on which articles they sell and without knowing at all which type of auction they will be facing. A lot of 'if' statements were created inside both agents, since the dynamics of the different auctions are completely different. For instance, for the Sealed auction, each Participant sends a price, and then the Initiator is responsible for picking the highest one as the winner of the auction; whereas in the Dutch auction it is the Participant who decides if it is the winner of the auction by buying at the price offered by the Initiator. We also created a variable that measures the profits for each kind of auction in order for them to be compared.

Creative Implementation

We added thieves with probability 50% of stealing the product. When they steal a product they head to their car that we also added. At the same time all the rest of participants return to their houses, as soon as they realize that it is dangerous to stay close to the auction. We also added police that by the time they realize what's happening, they turn on their blue-red siren and chase the thieves. If at least 3 thieves reach the car, the car starts its engine and they escape. If the police reach a thief before he reaches the car, the thief is captured (die). All this is happening in a 3D environment.

<i>Qualitative / Quantitative questions</i>	<i>Answer</i>
Time spent on finding and developing the creative part	15 hours
In what area is your idea mostly related to...	Theft scene
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?	5

Discussion / Conclusion

Doing this assignment was not that messy as compared to the first assignment, since now we already know basic GAMA stuff, like how to use the *self* and *myself*, how to make agents communicate to each other... Overall, the code for this assignment is way cleaner than the code for the first assignment.

The new thing here was the usage of FIPA protocol, which honestly took quite a lot of time to learn and we did a lot of trial and error until getting the right behavior from it. Also, theory of auctions had to be applied, so this assignment required to take a look at the theory as well, although in this case it was straightforward and did not require excessive amounts of time.

The negative thing is, regarding Challenge 2, we only check the gained values of the different types of auction for one run, and then the next run may yield completely different results, since a limited number of participants is involved and random variables are involved. Therefore the results of the analysis are not consistent at all and a deeper study should be performed.