

ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Assignment 2 – Negotiation and Communication (FIPA)

Group 18:

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Assignment Summary:

In this assignment, we were tasked with simulating a festival where guests can enter a Dutch Auction and compete to win the auctioned item. In a Dutch Auction, the first guest to agree to the prize given by the Auctioneer is the winner.

How to Run:

Run GAMA 1.8 and import the folder Assignment2_Festival_Auctions as a new GAMA project (right click User Models). Double click the desired model to run (Basic, Challenge1, Challenge2 or Creative), and then press MAIN to run the simulation.

Species: *(only agents used in the Basic assignment will be described here)*

1. **initiator:** This agent represents the auctioneers. They will be moving around and will eventually start a Dutch Auction. Once in this state, he will publicly announce the prize of his wares for all to participate.
2. **participants:** These are the festival guests. Once an auction is announced, they will participate and try to win by being the first to act.

Implementation: *(This will only discuss the implementation for the Basic assignment. All Challenges and Creativity tasks will be explained in future sections)*

1. First we designed the **initiator**. Every 10,000 cycles, they will initiate an auction. They publish a price for the item and wait for replies. They **inform** and **start a conversation** with the other agents when they publish.
2. Next were the **participants**. Every participant has a budget that determines if they can participate or not (previewing the creativity part!). If they are able to participate, they will **propose** the published price. If they can't they will **refuse**.
3. The initiator is also able to **accept** or **refuse** proposals based on the order they arrive. **The first proposal to arrive wins.**

Results:

Once all participants have **proposed** or **refused** the price published by the initiator, it has to make a choice. The initiator will look at the order in which **he received the participant proposals** and declares the first proposal's sender as the winner for the auction. If the price is too high for all participants, it will proceed to decrease the price of the auctioned item and publish it again. If **no one proposes after the price has been reduced by 50%**, the auction ends.

Challenge #1:

For this challenge, there is more than one initiator, and each has a starting **topic** for its auctions. These are obtained from a list during the initialization of the program. In the same way, every participant has a particular **preference** and will only take part in auctions that coincide with its tastes. This preference is also determined at random during the initialization of the program.

Creative Implementation:

For the creativity assignment, we decided to simulate an auction house, not a single auction within a festival. This means the following:

1. There will be multiple auctions at the same time.
2. All participants will listen to all auctioneer's offers.
3. **All participants have different budgets and conditions that they must meet:** they will only participate if they still have enough money to go home (at least 5% of their original budget) after a victory. **If this cannot be guaranteed, they will not participate.**
4. All participants have specific preferences and will only take part in auctions that interest them, *even if other initiators are speaking to them at the same time.*
5. All participants in an auction can reject the proposed price. In this case, the initiator will begin to lower the price until a certain threshold. If the threshold is passed and no buyer obtained, the initiator ends the auction.
6. **If an auction ends without a winner**, the initiator can toss away its item, leave the auction house, and make way for a newcomer. This means the initiator needs to find a new auction house to sell its product.

7. **If an auction ends with a winner**, the initiator will hand the participant its item. The participant will buy the item and subtract the paid price from its budget. **The participant will continue trying to participate in other auctions with this decreased budget.**
8. **If an auction begins and no participant is interested in it, the initiator will toss its product, get a new one, and announce it later.** The initiator, like a true salesman, **will not** leave the auction house until at least one participant was interested in its products.

Once all these behaviors have been put together, we can notice that our auction house **is a loop**, as in: **it is open 24/7**. As long as participants have enough money to keep going, they will be approached by auctioneers (initiators) who will try to sell them their product. We believe we should receive a bonus point for this creativity assignment because of the following reasons:

1. All agents follow a basic utility function: All agents have different budgets and **consider their current situation to see if it's favorable for them before participating in an auction**. Here we are using concepts from lectures and the future Assignment #3.
2. Conditions change as time passes in the auction house: **All agents' conditions change as time passes in the auction house!** Basically, the more a participant buys, the less purchasing power he has for other auctions. Eventually, his budget will be too small, and he won't be able to purchase other items anymore, simulating a real-life scenario and a need for agents to adapt to their current conditions.
3. Time and priorities are constantly being monitored in order to avoid process clashes: This is **key** when running these looped auctions. If time (cycles) and agent priorities are not monitored constantly, the following scenarios may happen:
 - An initiator may decide to reset an auction before all agents have answered
 - An agent may decide to reply to an initiator message before all other agents have publicly heard the auction
 - Cfps, refuses, proposals, and other system lists are **cleared constantly while GAMA is running**. Managing these in coordination with agent reflexes that depend on these requires many shared control variables that need to be kept in check to keep the program running in a loop.
 - Many others

Qualitative/Quantitative questions	Answer
Time spent on finding and developing the creative part	20+ hours
In what area is your idea mostly related to...	1. Utility functions 2. Agent adaptability and priority management 3. Time (cycle) management within GAMA
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:

1. The Basic part of this assignment was mostly to get acquainted with the FIPA protocol in GAMA and to understand how basic agent conversations work.
2. Cfps, proposals, refusals, accept_proposals, and other system lists are constantly changing while GAMA is running the simulation. Every time an initiator replies to a proposal, it disappears from the proposals list. If CFP messages are not published constantly, they are steadily deleted from the CFPS system list. These and other intricacies need to be managed constantly
3. As in Assignment #1, the more we try to simulate real-life behavior with GAMA, the more careful and meticulous we have to be. Managing agent times and priorities in GAMA is extremely challenging, as GAMA can sometimes act *too fast* or *too slow* and this is not constant between different cycles. Subtle changes to the code can greatly affect the flow of "time" within the simulation. Because of this, the creativity assignment was *hugely* time consuming, as we tried to simulate situations that arise within a real auction house.