

# **Assignment 2 - Negotiation and Communication**

Group 11

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## Introduction

In this assignment we have developed another component of the earlier festival assignment. By simulating some merchandise auctions we have worked to get more experience with GAMA and agent negotiation. We have also gotten a good introduction to FIPA protocols.

## How to run

Run GAMA 1.7 (or newer). Create a new project and import the files from the zip. Select one of the files to view the implementations of the base task, challenge 1 or challenge 2.

## Species

### Auctioneer

An agent that will try to sell merchandise in an auction. When spawning, the agent will set the price for the product to sell and then broadcast the auction to all *participant* agents, who in turn can choose to join the auction. When enough participants have joined, the auctioneer will start the auction. The auctioneer leads the auction according to the auction type, communicating with the bidders along the way, until the product is sold.

### Participant

Receives broadcasts for new auctions. If an announced auction is for an item the participant is interested in, the participant will announce his interest in joining and partake in the auction until the product is sold.

## Implementation

This assignment was developed from scratch. Using the example code provided in the tutorial slides we got started with the usage of the FIPA protocols. We started by developing the Auctioneer and initial variables. As development proceeded, we worked linearly, starting with the auctioneer inform call, and continuing with receiving this call on the participant's end. This continued until a basic shell was done and we were able to start testing of basic components and adding details for proper execution. After some details and debugging a basic implementation was done.

## Results

The results of the basic implementation was a simulation of a few agents taking part in a dutch auction. The price set by the auctioneer is in the range of 1500 - 2000 above the market value and the maximum price participants are willing to pay is in the range 500 below market value to 500 above market value. An example execution is represented in Log 1.

*broadcasting auction  
informing of auction!*

message[sender: Auctioneer0; receivers: [Participant0, Participant1, Participant2, Participant3, Participant4]; performative: inform; content: [selling item 1 at price: , 4650]; content]  
message[sender: Auctioneer0; receivers: [Participant0, Participant1, Participant2, Participant3, Participant4]; performative: inform; content: [selling item 1 at price: , 4650]; content]  
message[sender: Auctioneer0; receivers: [Participant0, Participant1, Participant2, Participant3, Participant4]; performative: inform; content: [selling item 1 at price: , 4650]; content]  
message[sender: Auctioneer0; receivers: [Participant0, Participant1, Participant2, Participant3, Participant4]; performative: inform; content: [selling item 1 at price: , 4650]; content]  
message[sender: Auctioneer0; receivers: [Participant0, Participant1, Participant2, Participant3, Participant4]; performative: inform; content: [selling item 1 at price: , 4650]; content]  
adding Participant(0) to bidders  
adding Participant(1) to bidders  
adding Participant(2) to bidders  
adding Participant(3) to bidders  
adding Participant(4) to bidders  
selling for 4650  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 4500  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 4350  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 4200  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 4050  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected

offer from: Participant(4) at price: 3455  
rejected  
selling for 3900  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 3750  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 3600  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3455  
rejected  
selling for 3450  
offer from: Participant(0) at price: 2818  
rejected  
offer from: Participant(1) at price: 3066  
rejected  
offer from: Participant(2) at price: 2829  
rejected  
offer from: Participant(3) at price: 2826  
rejected  
offer from: Participant(4) at price: 3450  
Participant(4)got the item  
seems auction is closed. leaving...  
seems auction is closed. leaving...  
seems auction is closed. leaving...  
seems auction is closed. leaving...  
seems auction is closed. leaving...

Log 1: A dutch auction in progress

# Challenge 1

For completion of challenge 1, we added the ability for multiple running auctions. We made Auctioneers start their auctions after a certain amount of time to allow participants to join, and made participants join auctions based on the sold item. As auctioneers keep track of bidders who have joined, we managed to have multiple running auctions where participants only take part in one auction at the time. For this we added the ability for auctioneers to sell different items with different market values. An execution of challenge 1 is represented in Log 2

Auctioneer 0 selling item: 1  
Auctioneer 1 selling item: 0  
Participant 0 interested in item: 1  
Participant 1 interested in item: 0  
Participant 2 interested in item: 1  
Participant 3 interested in item: 0  
Participant 4 interested in item: 0  
Auctioneer 0: broadcasting auction  
Auctioneer 1: broadcasting auction  
Auctioneer 0: adding Participant(0) to bidders  
Auctioneer 0: adding Participant(2) to bidders  
Auctioneer 1: adding Participant(1) to bidders  
Auctioneer 1: adding Participant(3) to bidders  
Auctioneer 1: adding Participant(4) to bidders  
Auctioneer 0: selling item: 1for: 4368  
Auctioneer 1: selling item: 0for: 4893  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 4218  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 4743  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 4068  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 4593  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3918  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 4443  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected

Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3768  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 4293  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3618  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 4143  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3468  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 3993  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3318  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 3843  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3168  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026  
rejected  
Auctioneer 1: selling item: 0for: 3693  
Auctioneer 0: offer from: Participant(0) at price: 2963  
rejected  
Auctioneer 0: offer from: Participant(2) at price: 2640  
rejected  
Auctioneer 0: selling item: 1for: 3018  
Auctioneer 1: offer from: Participant(1) at price: 3441  
rejected  
Auctioneer 1: offer from: Participant(3) at price: 2601  
rejected  
Auctioneer 1: offer from: Participant(4) at price: 3026

rejected  
 Auctioneer 1: selling item: 0 for: 3543  
 Auctioneer 0: offer from: Participant(0) at price: 2963  
 rejected  
 Auctioneer 0: offer from: Participant(2) at price: 2640  
 rejected  
 Auctioneer 0: selling item: 1 for: 2868  
 Auctioneer 1: offer from: Participant(1) at price: 3441  
 rejected  
 Auctioneer 1: offer from: Participant(3) at price: 2601  
 rejected  
 Auctioneer 1: offer from: Participant(4) at price: 3026  
 rejected  
 Auctioneer 1: selling item: 0 for: 3393  
 Auctioneer 0: offer from: Participant(0) at price: 2868  
 Auctioneer 0: Participant(0) got the item  
 Auctioneer 0: offer from: Participant(2) at price: 2640  
 rejected  
 Auctioneer 1: offer from: Participant(1) at price: 3393  
 Auctioneer 1: Participant(1) got the item  
 Auctioneer 1: offer from: Participant(3) at price: 2601  
 rejected  
 Auctioneer 1: offer from: Participant(4) at price: 3026  
 rejected  
 seems auction is closed. leaving...  
 seems auction is closed. leaving...  
 seems auction is closed. leaving...  
 seems auction is closed. leaving...  
 seems auction is closed. leaving...

## Log 2: Participants joining auctions with their item preference

## Challenge 2

To complete challenge 2, we added the ability for auctioneers to sell items using three different types of auctions, dutch, japanese and closed bid auctions. Prices for the items to be sold were set according to the auctioneer's auction type strategy. As these types were picked they were announced in the auction *informs* message. Participants got the ability to read the announced auction type and communicate according to the auction type protocol. Participants also adopted a good strategy for the chosen auction type. An execution of challenge 2 is represented in Log 3.

Auctioneer0 using auctiontype:2  
 Auctioneer1 using auctiontype:1  
 Auctioneer 0 selling item: 1  
 Auctioneer 1 selling item: 0  
 Participant 0 interested in item: 0 for price:2585  
 Participant 1 interested in item: 1 for price:3621  
 Participant 2 interested in item: 0 for price:2534  
 Participant 3 interested in item: 0 for price:3254  
 Participant 4 interested in item: 1 for price:3529  
 Auctioneer 0: broadcasting dj auction  
 Auctioneer 1: broadcasting closed auction  
 Auctioneer 0: adding Participant(1) to bidders  
 Auctioneer 0: adding Participant(4) to bidders  
 Auctioneer 1: adding Participant(0) to bidders  
 Auctioneer 1: adding Participant(2) to bidders  
 Auctioneer 1: adding Participant(3) to bidders  
 Auctioneer 0: selling item: 1 for: 346  
 Auctioneer 0: someone said:im in

Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 496  
Auctioneer 1: got offer: 2766 from: Participant(0)  
Auctioneer 1: got offer: 2617 from: Participant(2)  
Auctioneer 1: got offer: 2677 from: Participant(3)  
Auctioneer 1: Participant(0) got it!  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 646  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 796  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 946  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1096  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1246  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1396  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1546  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1696  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1846  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 1996  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2146  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2296  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2446  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2596  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2746  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 2896  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 3046  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 3196  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 3346  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in  
Auctioneer 0: selling item: 1 for: 3496  
Auctioneer 0: someone said:im in  
Auctioneer 0: someone said:im in



*Auctioneer 0: selling item: 1 for: 3646*  
*Auctioneer 0: someone said:refusing*  
*Auctioneer 0: someone said:refusing*  
*Auctioneer 0: Participant(4) got it!*

Log 3: Auctioneers broadcasting auctions of different type (0 = Dutch, 1 = sealed bid, 2 = Japanese)

## Discussion/Conclusion

While it took some time to get started with the basic implementation, we got the ball rolling after some reading and testing. Getting FIPA messages to work was easy but to properly follow the protocol was difficult until it was properly understood. The documentation was at times lacking, which required some experimentation in order to know how certain actions and variables worked. With the basic implementation finished, challenge 1 was made without larger issues as we already had some kind of concurrency in mind. The development of challenge 2 was a bit harder as we needed to think a bit about what actions and reflexes we could reuse, as the source code started to get a bit messy at this point.

Through the events encountered during this assignment we believe that we now have a better understanding of agent negotiation and FIPA message handling. We have also widened our understanding of GAMA in general and are ready to take on the next assignment.