Practical assignment 1
Group 9

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1 Preparation : Analyze party domain

(a)

In order to have the pareto frontier in the party domain, we ran a negotiation of two random agents in that domain. The pareto frontier is the pink line in Figure 1. In Figure 2, one can see the parameters used to draw the graph of Figure 1

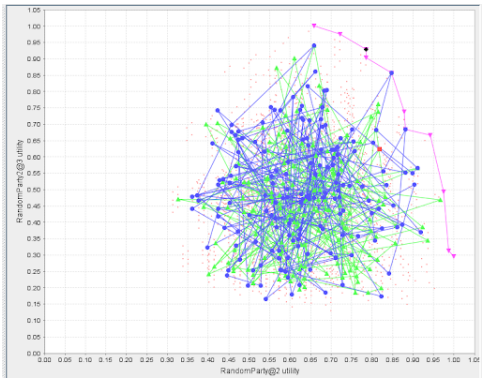

FIGURE 1 – The pareto frontier of two random agents in the party domain

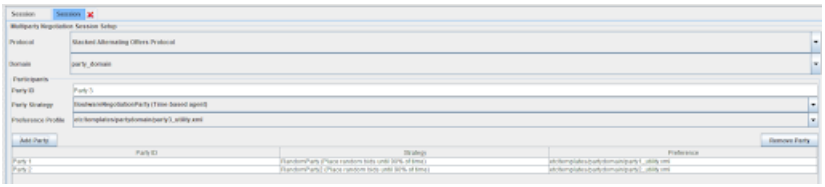

FIGURE 2 – The parameters used to draw the pareto frontier

(b)

Using the party domains party1 and party2 we ran a negotiation session with the SimpleAgent (ANAC2017) running against itself (Figure 3). A Pareto optimal outcome is never reached because of the way SimpleAgent bids. It always bids the optimal bid for itself so the bids never change and an agreements is never reached.

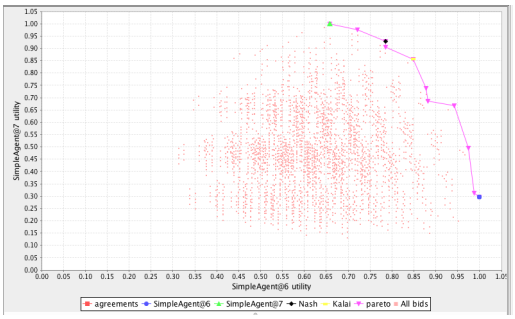

FIGURE 3 – Two simple agents running against each other

Doing the same but using the BoulwareNegotiationParty against the ConcederNegotiationParty, we see (in Figure 4) that the ConcederNegotiationParty always concedes in its bids while the BoulwareNegotationParty only concedes once the negotiation session is almost over to make sure that an agreement is reached. Because of this, a pareto optimal outcome is reached if the negotiation session goes on long enough. The BoulwareNegotationParty will always attempt to get to an agreement along the Pareto optimal frontier and with enough bids then the ConcederNegotiationParty will end up accepting a bid there. However if there are very few bids then we can see that BoulwareNegotationParty ends up making an agreement that isn't on the frontier.

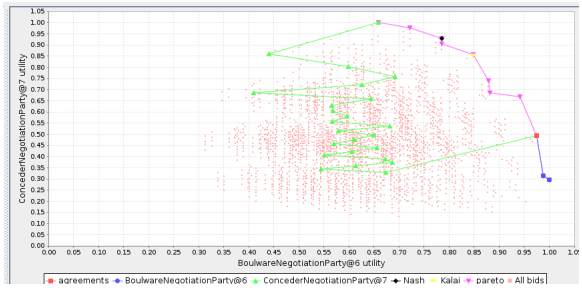

FIGURE 4 – Boulware against Conceder

2 Design and implement a negotiation strategy

(a)

One can find here a more in-depth explanation of our choices in Figure 5

Agent Type	Performance Measure	Environment	Actuators	Sensors
Negotiation party	Maximising utility, Fairness, Agreement reached or not	Negotiation assignment setup	Bid, quit, accept bid, reject bid	Bid, bid assessment, time/rounds left

FIGURE 5 – PEAS description of the environment for planning a party

Performance Measure : We want the result of negotiations to be as close as possible to our preferences (maximising our utility). Even if the outcome is not optimal for us, we would prefer to reduce our utility of the final agreement to quitting the negotiation which would result with an utility of 0 for both parties.

Environment :According to the question the environment is restricted to the negotiation assignment setup, which is the Genius Environment.

Actuators : The only actions the agent can take are negotiation actions. We can bid against the opponent, we can accept the last bid that our opponent did or, on the contrary, we can reject the opponent's bid in case it does not fit with our acceptance strategy and finally we could quit the negotiation, although, at least initially, we would not consider this last action because of the mentioned above.

Sensors : The agent's sensors are simply what it can perceive during the negotiation. The agent can receive a bid from its opponent and, therefore, assess its utility for that bid. It can also sense how much time or how many rounds are left in the session to be able to take that into account in the strategy to follow.

(b)

The BOA framework mainly consists of three strategy models. The Bidding strategy, the Opponent model and the Acceptance strategy. The bidding history is a very important part of the BOA framework even though it is not one of its name components. It is the first thing that is updated when a bid is received.

The Bidding strategy is also called an offering strategy. It is a mapping which maps a negotiation trace to a bid. It is the component that will try to offer the best possible bid with regards to the opponent model and the bidding history.

The Opponent model should be able to estimate the opponent's utility of a given bid. It learns from the behaviour of the opponent and tries to understand how the opponent generally behaves. It has a close relation to the Bidding strategy as the bidding strategy consults with the opponent model when coming up with a bid.

The Acceptance strategy decides when the action of the opponent should be accepted. If the acceptance strategy decided not to accept, it provides a counter bid instead that is originated from the Bidding strategy. The acceptance strategy has the power to end

the negotiation prematurely if it is not going down the preferable path.

(c)

For our acceptance strategy, we decided that having any agreement is better than having no agreement. Thus, we need to make sure that although we would like to accept bids that have a high utility for us, we also don't want to rule out bids that have a somewhat lower utility.

To do this we decided that any bid that is higher than $U = 0.8$ is accepted by default. Otherwise we accept bids according to a function of time. We normalise the rounds or time left so that they are on a scale of 0 to 1, where 0 is no time left and 1 is all the time left. We then accept bids that have a utility higher than the time left. However to make this a bit smarter we want the time function to be the square root of the time so that it decreases slower.

This can be visualised as : if ($U \geq mininum(0.8, \sqrt{T})$, then accept bid ; Where T is the normalised time left.