Practical assignment 3
Group 9

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Question 2.e

By analyzing the HardHeaded Opponent Model trying to find a way to improve it we noticed that the weight of a values are increased only if the same value is repeated two times in a row. But if the values are repeated more often than other values, but not consecutively the weight of those values are not increased at all. E.g. if for one issue we get the bidding values, a,b,a,c,a,d then the issue should have increased preference since the bids change relatively little. In our opinion the weight of these issue should be increased accordingly to the number of distinct values.

We should also take into account that the first bids from an opponent are always quite good for the opponent, since it is unlikely the opponent will take the chance on bidding unfortunately in the beginning and risk losing then. Supposing that the opponent follows a conceding strategy over time, the most repeated values in the first bids should have a greater value than the most repeated ones after the opponent starts conceding harder due to the negotiation deadline being closer in time. This happens because those repeated values on the conceding part of the opponent's strategy, correspond with the ones of the reservation values, values with weights below which the opponent does not accept to bid.

Taking all this into account, we decided to change the weights of the issues according to their apparition on the opponent's bids, comparing the changes in the last 5 bids. Being able to identify the most important value, and also maintaining the most weighted value for an issue in the beginning part of the negotiation. So that the analysis done is not wasted in the ending part of the negotiation. This we did by multiplying the time left with the added weight, so it has less effect as time passes.

Question 2.f

Since our opponent model will be by definition imperfect, trying to find the best bid using only the opponent utility seems like a bad idea. In order to solve this problem, we want to take into account the Hamming distance of our bids to the last opponent bid (in other words, it is the number of issue values that differs between the two bids). Indeed, the Hamming distance will give us information about how close we are to the opponent bid. The problem is that the Hamming distance alone doesn't take into account the weight of the issues, thus we want to use a combination of the Hamming distance and the utility estimation of our opponent model.

The new problem that arises is knowing how important the Hamming distance should be compared to the utility estimation. We will use a simple weighted average that can be parametrised by a parameter w. The formula that we are using is the following :

$$bidValue = \frac{w * (1 - Hamming(bid, oldOpponentBid)) + opponentUtility(bid)}{w + 1}$$

In order to find the best bid, we just have to take the bid with the highest $bidValue$.

Our new OpponentModel is time dependent which mean that we will at each time step update the model.