CautiousOneShotAgent: An agent submitted to the ANAC 2024 SCML OneShot Track

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Abstract

This report provides an explanation of CautiousOneShotAgent for ANAC2024 SCML OneShot Track. CautiousOneShotAgent is an improved SyncRandomOneShotAgent to achieve better agreements. CautiousOneShotAgent can obtaine a higher score than SyncRandomOneShotAgent, other sample agents, and the winner of SCML2023 in my experiments.

1 Introduction

SyncRandomOneShotAgent is a sample agent for SCML2024 OneShot Track, which negotiates multiple partners synchronously to meet the required quantity. It is generally a good strategy because quantity is a much more important issue than price in SCML2024 OneShot Track. However, it still leaves some room for improvement, so I improved it to be more efficient and lower risk.

2 The Design of CautiousOneShotAgent

2.1 Concurrent Negotiation

The major update points of CautiousOneShotAgent from SyncRandomOneShotAgent are processes of selecting acceptable offers and making counter offers.

2.1.1 Selection of Acceptable Offers

Basically, CautiousOneShotAgent selects offers to reduce the difference from the required quantity. CautiousOneShotAgent selects a combination from a power set of received offers. For each case where the total quantity of offers is greater than, equal to, or less than the required quantity, the combination of offers that minimizes the quantity error is selected as a candidate combination. If there is more than one combination of offers that minimizes the over-quantity error, CautiousOneShotAgent selects the highest total price if it is a seller, or the lowest total price if it is a buyer. If there is more than one combination of offers that minimizes the under-quantity error, CautiousOneShotAgent selects the one with fewer partners, if such combinations also exist in more than one, CautiousOneShotAgent selects the highest total price if it is a seller, or the lowest total price if it is a buyer. By this procedure, the best candidate combinations of acceptable offers are selected like Figure 1. Then, for each of the best combinations of shortage and excess, whether the quantity errors meet the condition by the thresholds (Refer to Section 2.2). If only one of them meets the condition, CautiousOneShotAgent accepts the combination of offers. If both of them meet the condition, CautiousOneShotAgent accepts the combination of offers with a smaller quantity error.

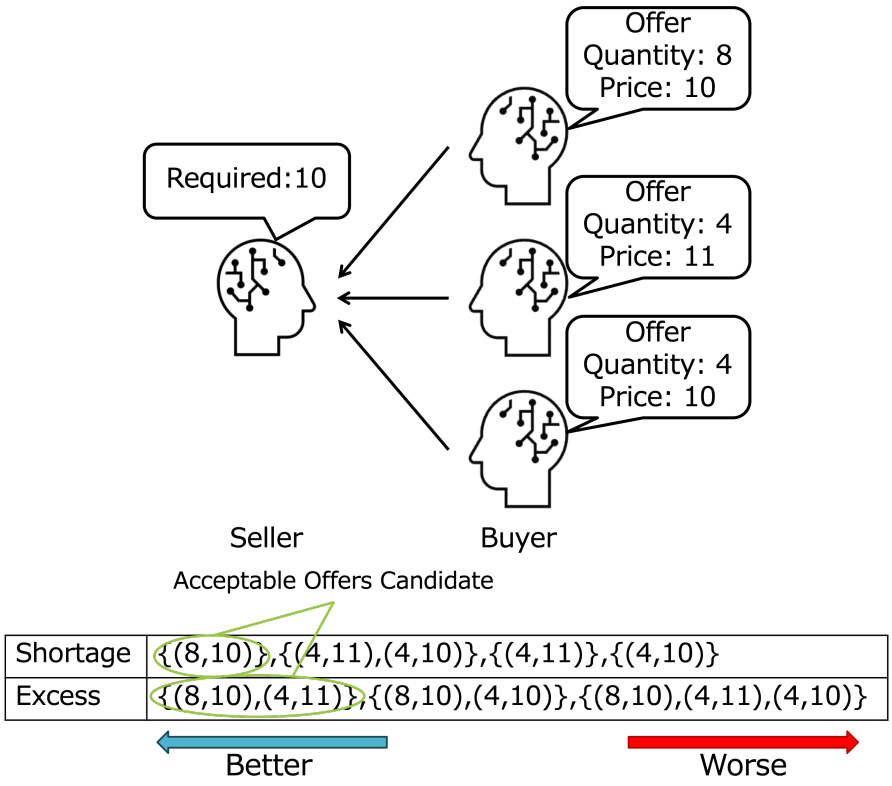

Figure 1: Selection of Acceptable Offers

2.1.2 Making Counter Offers

If the selected combination of acceptable offers lacks the required quantity, CautiousOneShotAgent sends counter offers to the remaining partners. The offering quantities are determined by distributing the remaining required quantity to each partner. Then, priority is given to the partner with the larger total trading quantity. The offering price is the higher one if CautiousOneShotAgent is a seller and the lower one if it is a buyer.

2.2 Risk Management

In SCML2024, the shortfall penalty is a larger risk than the disposal cost, so if CautiousOneShotAgent negotiates as a seller, over-quantity is a larger risk than under-quantity but if it negotiates as a buyer, under-quantity is a larger risk than over-quantity. To reduce the risk of shortfall penalty, the thresholds of quantity error are calculated by Equation (1).

$$th_{under} = \begin{cases} -0.4(1-r)^4 \times n_{lines} & \text{if selling} \\ -0.2(1-r)^4 \times n_{lines} & \text{if buying} \end{cases}, th_{over} = \begin{cases} 0 & \text{if selling} \\ 0.3r^{\frac{1}{4}} \times n_{lines} & \text{if buying} \end{cases}, \quad (1)$$

where n_{lines} is the production limit per a day and r is the relative negotiation round.

3 Evaluation

To evaluate CautiousOneShotAgent, I tested it in OneShot tournaments with sample agents, RandDistOneShotAgent, SyncRandomOneShotAgent, and RandomOneShotAgent and the winner of SCML2023, QuantityOrientedAgent. The configurations are $n\_steps = 100$ and $n\_configs = 5$. The results are shown in Table 1.

Table 1: Result of the OneShot Tournament

Agent	Score
CautiousOneShotAgent	**1.115**
SyncRandomOneShotAgent	1.071
RandDistOneShotAgent	1.068
QuantityOrientedAgent	1.051
RandomOneShotAgent	0.799

As Table 1 shows, the score of CautiousOneShotAgent is higher than those of any other agents.

4 Conclusions

In this report, I explained CautiousOneShotAgent's strategies that emphasize meeting the required quantity. These strategies enabled it to earn a higher score than other agents.