

Whagent: An agent submitted to the ANAC 2020 SCM league

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July 14, 2020

Abstract

Our agent named Whagent selects profitable contracts through negotiations. When Whagent negotiates contracts with the other agent, it changes its strategies depending on the types of the agent it is going to negotiate with. The types of the agent are SELLER, BUYER, and the other agents. In the strategies, Whagent decides whether it makes buy contracts or sell contracts first and adjusts the number of products, unit price, and delivery time of the contract. As a result, Whagent will make profits, or at worst it will always stay under the budget.

1 Introduction

According to the GAME DESCRIPTION in SCML2020, an agent's performance will be measured by its score; the profit is calculated as follows:

$$\text{Profit} = \frac{B_N + 1/2I_N - B_0}{B_0}, \quad (1)$$

where B_0 is the balance at the beginning of the agent and B_N is the balance at the end. I_N is the value of the agent's inventory at the end of the game and its value is based on the trading price. The inventory at the end of the game is worth half of I_N . So too much inventory may cause financial losses. Therefore agents should adjust production volume so that all the products produced can be sold soon.

In addition, if an agent breaks a contract, the breach occurs and it may cause its bankruptcy. And the buyers may commit a breach due to a lack of funds, and the sellers may commit a breach due to a lack of products. In SCML2020, when an agent commits an insufficient funds breach, it goes bankrupt immediately. When an agent commits an insufficient product breach, it has to buy additional products. So agents should avoid taking the risk of committing breaches. Therefore, we created an agent named Whagent that can only produce needed products and avoid committing breaches.

2 Agent Strategy

Whagent consists of three strategies: production strategy, trading strategy, and negotiation strategy. We created Whagent by improving SupplyDrivenProductionStrategy, PredictionBasedTradingStrategy, and IndependentNegotiationsManager. Having a lot of stocks is not profitable because the price of unsold products will be evaluated 50 percent lower than their trading value. Whagent can conclude contracts that will not leave stocks to make profits. However, the manufacturing cost to make products might exceed half the trading price of inventory. In this case, Whagent does not start production to keep itself profitable in the final step.

In the trading strategy, Whagent determines to negotiate criteria from its own production costs and catalog prices. And it can only accept contracts that met the negotiating criteria. As a result, Whagent won't make unexpected contracts and reduce the possibility of contract violation.

2.1 Acceptance Strategy

Whagent selects contracts when it signs them in the acceptance strategy. It can change its strategies depending on the type of the agent it is going to negotiate with. Specifically, I considered the following three cases.

1. my supplier is SELLER
2. my consumer is BUYER
3. my supplier/consumer is the other agents

The purpose of Whagent is not to breach the contract and to keep as little inventory as possible. Therefore, Whagent decides to make sell contracts before buy contracts. However, Whagent negotiates with BUYER in the case of 2. If Whagent decides to sell contracts with BUYER first, Whagent might not be able to decide buying contracts and it might violate the contracts. To avoid this, Whagent decides to buy contracts first when it negotiates with BUYER.

After that, Whagent checks the quantity, delivery time, and unit price of new contracts. If Whagent is satisfied with them, Whagent will sign them.

The outline of the acceptance strategy is shown in the figure below.(Figure1)

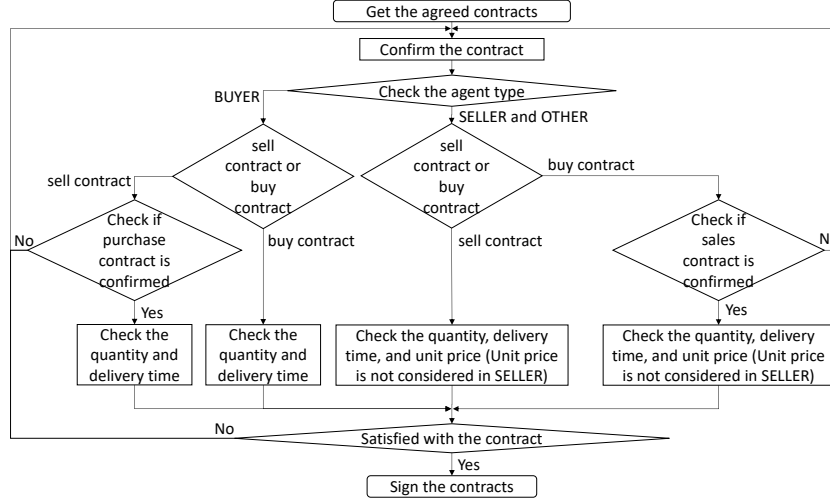


Figure 1: Acceptance strategy overview

2.2 Negotiation Choices

Whagent considers the accepting contracts according to the content and step of the negotiation. And it can choose business partners based on their breach level in financial reports. Whagent does not negotiate with the agents with a high breach level because they might breach contracts. Thus it confirms the latest financial report of negotiation partners, and start negotiations in the order of low breach level. This allows Whagent to reduce the possibility of being violated by negotiation partners. To avoid risks, Whagent prioritizes not to commit breaches. For this reason, Whagent limits the total number of buying products in one step within the number of own production lines.

The unit price of the contract is set lower for the purchase price and higher for the sale price in the function of `acceptable_unit_price()`. Whagent try to make profitable contracts as much as possible by including the own catalog price and production cost in the unit price.

In the strategy of the delivery time, Whagent only accepts earlier delivery time when it produces the parts side and only accepts later delivery time when it produces the products' side.

3 Evaluation

I evaluated Whagent in two types: tournament and world. The competitors of Whagent were DecentralizingAgent, IndDecentralizingAgent, ReactiveAgent, and MovingRangeAgent. The parameters are as follows:

- competition=std,
- reveal_names=True,
- n_steps=20,
- n_configs=2,
- max_n_worlds_per_config=None,
- n_runs_per_world=1,

The execution results of tournaments and world are shown below.

Table 1: Score of the execution result in the tournament

Experiments	1	2	3	4	5	Average
Whagent	0	0	0	0	0	0
Decentralizing	0.231687	-0.0139222	0.0928565	0.077611	0.0429814	0.08624274
IndDecentralizing	-0.520473	-0.0758619	-0.102405	0.00743911	0.0786295	-0.122534258
Reactive	0	0	-0.14565	0	-0.0844073	-0.04601146
MovingRange	-0.0666877	-0.17067	-0.135927	-0.0822496	-0.0952347	-0.1101538

In the experiments, Whagent’s scores are all zeros and DecentralizingAgent produced the most profit. The other three agents’ average scores were negative. Besides, all the agents sometimes got negative scores in the execution result except for Whagent. These showed that Whagent did not make a profit but did not lose budget, too. Also that Whagent sometimes made profits in the results of score_stats.csv or results of the world’s simulation.

4 Conclusions

In this report, we explained Whagent which we had created. In Chapter 3, It was shown that all the other agents sometimes got negative scores in the tournament. It suggests that Whagent can select only safe contracts and does not violate its contracts. This is my agent’s advantage. However, my agent often got scores of zero in SCM league live-competition. Whagent indicates that only avoiding risks does not help the agent remain profitable. To improve my agent, it is effective that Whagent can make aggressive negotiations and forecast trading price changes. Whagent would get more profits by negotiating profitable contracts positively with other agents.