PenguinAgent: An agent submitted to the ANAC 2024 SCM league

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Abstract

We created an agent named PenguinAgent.Our strategy is to make a profit by reducing unnecessary costs. This agent prevents buying/selling excess quantities by calculating the required amount for each step. Additionally, it avoids losses by rejecting offers with inappropriate prices.

1 Introduction

Considering make a profit by running a factory, there are options such as reducing the cost of creating a product, adding value to the product, and making the factory larger. In addition, the costs incurred in manufacturing products in a factory, excluding the purchase cost of raw materials, include expenses such as the cost of factory land, equipment maintenance, employee wages, and inventory management of raw materials and products.

In the SCML world, the size of the factory and the products to be manufactured are fixed. Also, the only unnecessary costs incurred are the maintenance costs of raw material inventory and penalties paid for shortages of products to be sold. Therefore, reducing these costs associated with operating the factory is effective for generating profits.

From this reason, our agent, Penguin Agent, aims to reduce these costs by calculating the necessary quantities to buy and sell, ensuring that there is no excess purchase or sale.

2 The Design of PenguinAgent

It inherits StdSyncAgent.

2.1 Negotiation Strategy

2.1.1 Calculating needs

In this section, we explain the calculation of the necessary quantities to buy and sell.

First, regarding raw materials, we consider securing the daily production volume. Therefore, we subtract the existing stock of raw materials and the contracted quantities

at that step from the daily production volume.

$$
\begin{aligned}
&needs = dairy\_production - stock - contracted\_quantities_i \qquad (1)\\
&needs: \ necessary\ quantities\ of\ raw\ materials\ at\ step\ i\\
&dairy\_production: \ dairy\ production\ volume\\
&stock: \ existing\ stock\ of\ raw\ materials\\
&contracted\_quantities_i: \ contracted\ quantities\ at\ step\ i
\end{aligned}
$$

Second, for the required sales volume, if there is excess stock of raw materials, we want to produce more than the daily production volume. Therefore, we add the stock of raw materials to the daily production volume. However, if this exceeds the maximum daily production capacity, penalties are incurred for the shortfall, so we set the maximum value as the maximum daily production capacity(the number of production lines in the factory).

$$
\begin{aligned}
&needs = min(n\_lines, daily\_production + stock) - contracted\_quantities_i \qquad (2)\\
&needs: \ necessary\ quantities\ to\ sell\ at\ step\ i\\
&n\_lines: \ maximum\ daily\ production\ capacity\\
&stock: \ existing\ stock\ of\ raw\ materials\\
&contracted\_quantities_i: \ contracted\ quantities\ at\ step\ i
\end{aligned}
$$

2.1.2 Make Our Offer

In this section, we explain the offers sent from our agent to partners.

We calculate the required amount for that step and distribute 70% of the required amount among negotiable partners to make an offer. For the remaining 30% that did not receive an offer, we divide it into proportions of 50%, 30%, and 20% and make offers for 1, 2, and 3 steps ahead, respectively.

2.1.3 Counter Partner's Offer

In this section, we explain our agents' responses to offers received from partners.

First of all, we separate the received offers into those for the current step and those for future steps.

For offers for future steps, we record the accepted quantity for each step when accepting the offer. We accept the offer if the quantity of raw materials/sales in the offer, combined with the quantity already accepted, falls below the required amount.

For current offers, we find all subsets of the set of offers and calculate the difference between each subset and the required amount. Even if the offer quantity exceeds the required amount, we accept it if it exceeds by less than 10%. We then accept the subset of offers with the smallest difference. If we do not accept the offer for the current step, we send another offer to partners

2.2 Risk Management

In negotiations, there is a risk of being forced to buy from suppliers at a higher price than usual and of being sold to consumers at a lower price than usual. Also, it is possible to

obtain the maximum and minimum values of the products. Therefore, In our agents, we ensure that we do not incur losses by removing offers that are higher than the maximum value for raw materials and lower than the minimum value for sales when receiving offers.

3 Experiments

To evaluate the agent's performance, we experimented with the performance of the agent using the template. The parameters are as follows:

- n_configs = 5
- n_runs_per_world = 1
- n_steps = 100

We added GreedyStdAgent, SyncRandomStdAgent as competitors. The scores of each agent for the five experiments and their means are shown in Table1. This table shows that PenguinAgent has the best score all five times.

Table 1: Experiment Results

Experiments	PenguinAgent(My Agent)	GreedyStdAgent	SyncRandomStdAgent
1	0.99	0.70	0.48
2	1.00	0.66	0.57
3	0.94	0.66	0.53
4	1.13	0.67	0.50
5	1.03	0.75	0.51
Average	1.02	0.69	0.52

Conclusions

This report describes Penguin Agent.

Our strategy is to generate profit by reducing unnecessary costs associated with operating the factory. In our agents, we aim to prevent buying/selling excess quantities by calculating the required amount for each step. Additionally, this agent avoids losses by rejecting offers with inappropriate prices.

As a result of the experiments, our agent achieved better scores than the other agents in all five runs.