S5s for SCML2024 Agent Starategy Report

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1 The Design

1.1 Introduction

The S5s agent aims to maximize profit by appropriately managing raw material inventory, manufacturing, and sales of products. This paper describes the agent's strategy in detail, covering its overview, proposal and acceptance strategies, acceptable price update strategy, and inventory management and production planning.

The paper is structured as follows. First, the proposal and acceptance strategies in negotiations are explained. Then, the update strategy for the acceptable prices is described.

1.2 proposal strategy

1.2.1 Input Product buy Negotiations

The agent determines the buy quantity Q and buy price P of input_product according to the progress of the simulation. The simulation is assumed to be conducted for N days.

- The agent prioritizes proposing the input_product that will be in shortage from the current step to $N/10$ days ahead.
- In the early stages of the simulation ($0 \leq t < 2/3N$, where t is the current step and N is the final step), the agent proposes to buy sufficient quantities of input_product to avoid future shortages. During this period, if the total daily delivery quantity is $0 \leq t < 0.3 * N$, the agent proposes $n\_lines/3$, and after that, it proposes the average sales quantity from the past.
- The agent is careful not to let the total buy quantity across all steps exceed 60% of the number of production lines L.

- In the later stages of the simulation ($2/3N \leq t < N$), the agent makes proposals only when there is a shortage of inventory, considering the risk of unsold products.
- If the negotiation step s is 10 or higher, the agent extracts the optimal delivery date from the contracts proposed in past negotiations and makes proposals within the range not exceeding the original proposed quantity.

Using these strategies, the agent aims to generate appropriate proposals in input_product buy negotiations.

1.2.2 Product sell Negotiations

1.3 Output_product Sell Negotiations

The agent determines the sell quantity Q and sell price P of output_product based on the inventory status and production plan. The simulation is assumed to be conducted for N days.

- In the early stages of the simulation ($0 \leq t < 2/3N$, where t is the current step and N is the final step), the agent proposes to sell output_product prioritizing the periods with available inventory. This helps to manage inventory appropriately and minimize opportunity loss.
- The agent makes proposals starting from the days with the least sales quantity, considering each day from the current date to $N/5$ days ahead.
- In the later stages of the simulation ($2/3N \leq t < N$), the agent proposes to lower the sell price to reduce the risk of unsold products.

Using these strategies, the agent aims to generate appropriate proposals in output_product sell negotiations.

1.4 Acceptance Strategy

The agent evaluates and decides whether to accept proposals from other agents based on the following strategies.

1.4.1 input_product Buy Negotiations

When the agent receives a buy proposal for input_product, it evaluates the proposal based on the following conditions:

- In the early stages of the simulation ($0 \leq t < 2N/3$, where t is the current step), the agent accepts the proposal if the following conditions are met:
- If the proposed delivery date T is within $N/10$ steps from the current step, the proposed quantity Q is less than the inventory level I_T, and the proposed price is higher than the acceptable price, the agent accepts the proposal.

- If the proposed delivery date T is within $N/5$ steps from the current step, the proposed quantity Q is less than the inventory level I_T, and the proposed price is higher than 1.2 times the acceptable price, the agent accepts the proposal.
- In other cases, if the proposed price is higher than the acceptable price, the agent accepts the proposal.
- In the later stages of the simulation ($2N/3 \leq t < N$), the agent accepts the proposal if the proposed quantity Q is less than the inventory level I_T.

$$Q < I_T \implies \text{Accept} \tag{1}$$

Using these strategies, the agent aims to evaluate and accept appropriate proposals in input_product buy negotiations.

1.4.2 output_product Sell Negotiations

When the agent receives a sell proposal for output_product, it evaluates the proposal based on the following conditions:

- If the proposed delivery date T exceeds the final step N, the agent rejects the proposal.

$$T > N \implies \text{Reject} \tag{2}$$

- If the proposed quantity Q exceeds the production capacity C_T at the proposed delivery date T, the agent rejects the proposal.

$$Q > C_T \implies \text{Reject} \tag{3}$$

- In the early stages of the simulation ($0 \leq t < N/2$, where t is the current step):
  - If the proposed delivery date T is the current step ($T = t$) and the inventory level I_T is greater than the proposed quantity Q, the agent accepts the proposal if the proposed price is higher than the acceptable price.
  - If the proposed delivery date T is within $N/10$ days from the current step and the proposed quantity Q is less than the inventory level, the agent accepts the proposal if the proposed price is higher than the acceptable price.
  - If the proposed delivery date T is within $N/5$ steps from the current step, the agent accepts the proposal if the proposed quantity Q is less than the inventory level I_T and the proposed price is higher than 1.2 times the acceptable price, or if the proposed price is higher than the acceptable price.

- In the later stages of the simulation ($N/2 \leq t < N$), the agent accepts the proposal if the inventory level is greater than the proposed quantity Q.

Using these strategies, the agent aims to evaluate and accept appropriate proposals in output_product sell negotiations.

1.5 Acceptable Price Update Strategy

The agent dynamically updates the acceptable purchase price for input_product and the acceptable sales price for output_product based on the past transaction records.

if selling:

$$p_{i,output}^{accept} = \begin{cases} p_{i-1,output}^{accept} * 0.95 & \text{if no signed sales contracts} \\ p_{i-1,output}^{accept} * 1.1 & \text{else if } p_{i,output}^{average} / p_{i-1,output}^{accept} > 1.1 \\ p_{i,output}^{average} * 0.9 & \text{otherwise} \end{cases}$$

if buying:

$$p_{i,output}^{accept} = \begin{cases} p_{i-1,input}^{accept} * 1.1 & \text{if no signed buy contracts} \\ p_{i-1,input}^{accept} * 1.05 & \text{else if } p_{i,input}^{average} / p_{i-1,input}^{accept} > 0.9 \\ p_{i-1,input}^{accept} * 0.95 & \text{otherwise} \end{cases}$$

i : current step

n_{lines} : number of production lines in the factory

$p_{i,output}^{accept}$: acceptable unit price of output products

$p_{i,input}^{accept}$: acceptable unit price of input products

$p_{i,output}^{average}$: average unit price of output products in previously executed sales contracts

$p_{i,input}^{average}$: average unit price of input products in previously executed buy contracts

Using these strategies, the agent dynamically adjusts the acceptable prices based on the market conditions and its own transaction history.

2 Evaluation

This section describes the evaluation of S5s. Table 1 shows the results of the competition with SyncRandomStdAgent, QuantityOrientedAgent. The configuration of this competition are n_steps:100,n_configs:10 and running 60 simulations.

Table 1: The results of competing with default agents

	AgentSDH	SyncRandomStdAgent	QuantityOrientedAgent
Score	0.96	0.95	0.41