

# Supply Chain Management League (SCML) 2022

## Challenge

**Design and build an autonomous agent that negotiates on behalf of a factory manager situated in a supply chain management simulation.**

The goal of a factory manager in SCML is to maximize its profit given its private production capabilities by negotiating trades with other agents. A factory manager can engage in several negotiations simultaneously, for which its utility functions are in general interdependent. These negotiations, and any ensuing contracts, are bilateral. Moreover, they are private to the agents involved.

The full description of the game is available [here](#).

## Changes from SCML 2021

1. Each agent's score in the collusion track will be the difference in its performance between when it controls three factories and when it controls one factory at the same production level, averaged across multiple simulations. This change reduces the dependence of an agent's score in the collusion track on its standard strategy.
2. In the one-shot track, agents based on the `OneshotSyncAgent` need not handle cases where the offers from partners are received in more than one call to `counter_all()`.

## Negotiation Protocol

Agents are factory managers that control factories with private manufacturing profiles which are revealed at the start of each simulation. Factory manager agents negotiate bilaterally with other agents to buy the necessary inputs to their manufacturing process, and to sell the outputs.

All negotiations are carried out via the alternating offers protocol. This protocol specifies that two negotiators take turns making offers. One agent starts the negotiation with an opening bid, after which the other party can take the following actions:

1. Accept the offer
2. Make a counteroffer, thus rejecting and overriding the previous offer
3. Walk away, thus declaring an end to the negotiation without having reached an agreement

This process is repeated until either an agreement is reached, or the deadline arrives. To reach an agreement, both parties must accept the offer. If no agreement has been reached by the deadline, the negotiation fails.

A single simulation runs for a predefined number of steps with an overall time limit of two hours. All negotiations are conducted for a predefined number of rounds of the alternating offers protocol (with a predefined time limit on each).

Factory manager agents are reset after each simulation. This means that they cannot learn from previous simulations. They can, however, accumulate information about agents during a simulation, as they know their negotiating partners' names.

## Platform

Entrants to the competition should develop and submit an autonomous agent that runs on [NegMAS](#). NegMAS is a Python-based negotiation platform in which you can create simulated worlds, like the SCM world, populated with agents capable of engaging in multiple negotiations.

In NegMAS, the alternating offers protocol is implemented as a special bilateral case of the multilateral [Stacked Alternating Offers Protocol](#) (slightly modified to allow for a limited number of rounds).

Participants will need to install the [SCML](#) library that runs on top of NegMAS and includes the SCML2020World and SCML2020OneShotWorld environments.<sup>1</sup> Using this library, you can run the SCM world with the same settings as the ones employed in ANAC 2021, or with personalized settings.

SCML also includes implementations of a few sample strategies, which can serve as guides to participating teams.

Participants can also install the [SCML-Agents](#) library which contains the source code and reports of all agents that qualified for the ANAC 2020 SCML track.

## Submission and Live Competition

An unofficial live competition will be run this year, beginning March 15th. All participants are encouraged to upload early versions of their agents to the [online submission site](#) and are **required** to upload a working agent by **June 10th**. A leaderboard will be maintained, displaying the relative performance of all submitted agents, but no identifying information about the participating teams will be available. This website is

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<sup>1</sup> It is also possible to run simulations using the discontinued SCML 2019 settings (SCML2019World).

also where the final versions of agents should be submitted for the official competition (at which point identifying information will become available).

Participants who fail to upload a preliminary version of their agent to the live competition website by July 10th will not be allowed to enter the official competition.

Participants must also submit the following by the deadline indicated in the “Important Dates” table below (through the [online submission site](#)):

1. Team member names, affiliations, and contact information.
2. A single zip file containing the following (Please use the provided [skeleton](#)):
  1. Agent source code.
  2. An academic report describing the agent in PDF (The academic report can be updated until June 17th).

Top finalists will be required to submit a poster/video presenting their agent for possible presentation at IJCAI. Once submitted, code and the academic report should be considered to be in the public domain and may be incorporated in full or part in future releases of [NegMAS](#) and/or [SCML](#) and/or [SCML-Agents](#) or any other media. In such cases, all contributors will receive proper attribution.

**Academic Report:** Each participating team must prepare a 2-page report describing the novel aspects of their agent according to academic standards (consider it an extended abstract). This report will be evaluated for soundness, novelty, and presentation quality by the organizers of this league, but will not affect the possibility of winning (as long as the agent is not judged to plagiarize an existing agent). Submission of this report is an integral part of the submission process, and agents without an associated report will be disqualified. *Additionally, agents with unusually interesting strategies — as described by the reports and judged by the organizing committee — may be invited to participate in the finals, regardless of their performance during the qualification round.*

At a minimum, the academic report should address the following points:

- **Negotiation choices:** how your agent chooses what to negotiate about, when, and with whom
- **Utility function(s):** how your agent calculates its utility for the various outcomes of its negotiations
- **Simultaneous negotiations coordination:** how your agent coordinates its behavior among multiple simultaneous negotiations (if it does)
- **Risk management:** any measures your agent takes to alleviate the risks involved in trading with other agents

- **Evaluation:** how your agent performs against some or all of the built-in default strategies
- **Collusion (If employed):** Did your agent employ a collusive strategy? If so, what was it, and was it effective?

Moreover, finalists will be required to submit a poster presenting their agent for possible presentation at IJCAI.

## Rules of Encounter

Agents will be disqualified for violating the spirit of fair play. In particular, the following behaviors are strictly prohibited:

1. Accessing any information about the simulation or other agents that is not available through the bulletin-board or public methods and properties of the Agent-World-Interface.
2. Accessing/modifying any “private” method/member in python (these variable names are usually indicated by an initial underscore).
3. Hacking or exploiting bugs in the software.
4. Communicating with the agent during the competition.
5. Altering the agent during the competition.

Moreover, agents that wreak havoc on the simulator (intentionally or otherwise) may be disqualified. Agents may be disqualified for violating the spirit of fair play. For more information, see the [ANAC Rules](#).

Organizers of the ANAC 2021 SCML competition will enforce these rules. We also reserve the right to disqualify agents under ANAC’s usual circumstances.

Finally, note that ANAC’s competition rules allow multiple entries from a single institution, but require that each agent be developed independently.

## Evaluation

There will be three separate tracks in SCML 2021. An agent’s performance in a track will be measured by its **score** in that track.

In the first, the **standard** track, at most one instantiation of each team’s agent will run in each simulation. Agents submitted by other teams will also participate, but again at most one instantiation of each. Some agents provided by the organizing committee may also control some of the factories in a simulation. The agent’s score will be the **median** of the profits accrued by all its factories in all its instantiations in all simulations.

In the second, the **collusion** track, multiple instantiations of the same team's agent will run during a single simulation. The exact number of instantiations of each may vary across simulations, and will not be announced in advance. In this track, it is possible for multiple instantiations of the same agent to collude with one another to try to corner the market, or exhibit other collusive behaviors. The agent's score in a given simulation will be its "consolidated financial statement," meaning the sum total of the profits and losses accrued by *all* of its instantiations in that simulation. The agent's score will then be the **median** of its score in all simulations.

In the third, the **OneShot** track, an agent's inventory and balance play a much smaller role, as they are reset at every step of the simulation. As in the standard track, at most one instantiation of each team's agent will run in each simulation. Agents submitted by other teams will also participate, but again at most one instantiation of each. Some agents provided by the organizing committee may also control some of the factories in a simulation. The agent's score will be the truncated mean<sup>2</sup> of the total profits it achieves in all steps across all simulations.

In all three tracks, ties will be broken using the agents' mean scores.

The three tracks will be conducted in two rounds, a qualifying round and a final round. All entrants that are not judged to break any of the SCML and ANAC submission rules will be entered into the qualifying rounds. Top-scoring agents in the qualifying round will then be entered in the final round. The organizing committee maintains the right to require that agents surpass a minimum score threshold to advance to the finals or to win one of the prizes.

The teams that build the top-scoring agents will be notified in July, with the final results and awards announced at IJCAI 2022 in Vienna. It is expected that finalists will send a representative to the ANAC workshop at IJCAI 2022, whether it is virtual or in-person, where they will be given the opportunity to give a brief presentation describing their agent. Three awards will be announced at IJCAI 2022 (with associated monetary rewards) corresponding to the three tracks (standard, collusion, and OneShot).

The organizing committee will determine the number of simulations needed in each round to ensure a fair comparison among all submitted agents. All participating agents that achieve scores that are not statistically different from the winners' will be inducted into the SCM league's hall of fame.

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<sup>2</sup> The truncated mean is the mean after removing the highest and lowest scores of each agent. The number of scores to remove will be adjusted by the organization committee to balance efficiency and robustness to outliers

The latest version of the agent submitted before the competition deadline will be used in the SCM league unless participants opt-out of the official competition.

## Resources

For more information about SCML, please refer to the following links:

1. [Youtube tutorials](#): A set of tutorials to get you started.
2. [Project skeleton for starting up your development](#): You are not required to use this skeleton, but it should be helpful as you get started.
3. [A detailed description of the SCM world](#) (standard and collusion tracks): Here, you can find the full description of the SCM world. This document also describes the specific settings of the simulator for these two tracks in the SCML 2021 competition.
4. [A detailed description of the SCM-OneShot world](#): Here, you can find the full description of the simplified SCM world used in the OneShot track.
5. [Participation Tutorial](#): Here, you can find a step-by-step description of the process of developing, testing, and submitting an agent for SCML 2021.
6. [SCML source code on GitHub](#): Here, you can (but are by no means required to) read the source code of the SCML library.

## Questions and Answers

Please check our [FAQ](#). You can post your questions there (preferable), or address any concerns you prefer to remain private to [Yasser Mohammad](#).

## Organizing Committee

- Yasser Mohammad, NEC, NEC-AIST, RIKEN & Assiut University (main contact)
- Katsuhide Fujita, Tokyo University of Agriculture and Technology & NEC-AIST
- Amy Greenwald, Brown University
- Mark Klein, MIT
- Satoshi Morinaga, NEC-AIST AI Collaborative Research Laboratory
- Shinji Nakadai, NEC-AIST AI Collaborative Research Laboratory

## Important Dates

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| <b>The official release of the league platform (python only)</b><br><i>scml 0.5.1+ negmas 0.9.1+</i>   | March 15st, 2022  |
| <b>The website opens for submission</b><br><i>A confirmation email will be sent upon successful submission (~2 business days)</i>                                    | March 15st, 2022<br>Tournaments start<br>March 15th, 2022 |
| <b>Registration on the competition website (Recommended)</b><br><i>Optional but highly recommended</i>   | April 30th, 2022  |
| <b>Preliminary submission deadline (REQUIRED)</b><br><i>Servers may be busy near the deadline. Please do not wait until the last minute to submit.</i>               | May 21st, 2022  |
| <b>Final submission deadline</b><br><i>Servers may be busy near the deadline. Please do not wait until the last minute to submit.</i>                                | <b>June 10th, 2022</b>                                    |
| <b>Academic Report submission deadline</b><br><i>An abstract of the report must be submitted by June 10th but the final report can be submitted until June 17th,</i> | June 17th 2022  |
| <b>Notification to finalists</b><br><i>A representative from each finalist team is expected to attend ANAC 2021 @ IJCAI.</i>   | <b>July 1st</b><br>(tentative)                            |
| <b>Event</b><br><i>Announcement of winners and league report during ANAC 2021.</i>   | during IJCAI  |

## Sponsors



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*The organizing committee would like to thank Brown University for hosting the online submission website at <https://scml.cs.brown.edu>.*