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Nomination for SAIS Best AI Master Thesis 2010

To whom it may concern,

I hereby nominate the master thesis “Constraint Programming for Random Testing of a Trading System” by Roberto Castañeda Lozano conducted at Cinnober Financial Technology AB. I am acting as examiner of the thesis work and am co-supervisor together with Lars Wahlberg (Cinnober AB) and Federico Barber (Polytechnic University of Valencia, Spain). Roberto Castañeda successfully defended his thesis on January 28, 2010.

Roberto’s thesis, for the first time, employs constraint programming as an important discipline in AI for oracles in random testing. More specifically, the thesis contributes a detailed formal model of a financial trading system and shows how the formal model can be implemented as a constraint-based model. These constraint-based models (guaranteed to be correct) are then used as test oracles in random testing of the trading system. The thesis evaluates the approach and proves its merits by showing that the application of the constraint-based oracle has led to the discovery of yet unknown faults and specification defects in a widely commercially deployed, complex financial trading system.

In my opinion, the thesis deserves the SAIS Best AI Master Thesis award for the following reasons:

- The thesis is extraordinarily well structured and well written, being accessible to a very heterogeneous audience: people familiar with trading systems, random testing, or constraint programming;
- It develops a technically challenging model for combinatorial double auctions that underlies the test oracle and that is used in a real-life application scenario;

- It is extraordinarily innovative as it introduces constraint programming as a formal framework for a correct test oracle. The application of formal system modeling to the random testing of financial trading systems is already an important contribution by itself;
- It successfully proves its significance by finding actual bugs in real systems;
- The idea for the thesis has been conceived entirely and independently by Roberto.

Last, but not least, the thesis provides true added value to Cinnober AB and possibly to the finance industry at large. With the words of Lars Wahlberg as supervisor at Cinnober AB:

Today's marketplace systems use complicated functionality for trading. Different order types, auctions and various transparency causes the functionality as a whole to be very complicated. Random tests are used as a complement to more formal and extensive functional testing, mostly to find defects that causes processes crash and simple errors in logic. Roberto's thesis has expanded the oracle design to also find defects in complex functionality (e.g. order priority), which is new in the finance industry (to my understanding). The thesis has also shown it is possible to define the functionality (often stated in natural language) in an exact and formalized mathematical way. A side effect of this was that Roberto's work also found some ambiguous statements due to use of natural language. Formal specification methods are used in for example aerospace, but the thesis has shown that it is maybe possible to expand this to the finance industry in a feasible and cost effective way.

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