Master's Internship

Location

Laboratoire Spécification et Vérification
École Normale Supérieure de Cachan
Cachan, France

Title: Lossy VASS and Relevant Entailment

Context

Vector addition systems with states (VASS) are simple counter systems commonly employed to model concurrent, distributed systems. They are also a highly useful formalism of restricted computing capabilities, and are often employed as an intermediate step in complexity proofs.

A *lossy VASS* can see its counter values decrease nondeterministically. Their model-checking problems have been thouroughly investigated from the decidability viewpoint [1], and their reachability problem is known to be ExpSpace-complete by reductions to VASS coverability [3].

A related formalism is *relevance logic* [2], a substructural logic that attempts to capture the "natural" semantics of entailment, rather than the logical one. Its implicative fragment $\mathbf{R}_{\to}$ is known to be decidable, but its complexity is an open problem. For the related conjunctive implicative fragment $\mathbf{R}_{\wedge,\to}$, the problem is known to be Ackermannian-complete [4], the lower bound stemming from the complexity of reachability in lossy counter systems.

Objectives

- Investigate the relationship between lossy VASS and $\mathbf{R}_{\to}$.
- Study the complexity of provability in $\mathbf{R}_{\to}$.

The internship can be undertaken on its own or as the first stage of a PhD thesis.

Prerequisites

Basics in complexity; having followed MPRI course 2.9.1 is a plus but the necessary background can also be learned during the internship.

Contact

S. Schmitz
Tél: (+33/0) 147 407 542
Email: schmitz@lsv.ens-cachan.fr

References

[1] Bouajjani, A. and Mayr, R., 1999. Model Checking Lossy Vector Addition Systems. In *STACS 1999*, *Lecture Notes in Computer Science* 1563, pages 323–333. doi:10.1007/3-540-49116-3_30.

[2] Dunn, J.M. and Restall, G., 2002. Relevance logic. In Gabbay, D.M. and Guenthner, F., editors, *Handbook of Philosophical Logic*, volume 6, pages 1–128. Kluwer Academic Publishers. http://consequently.org/papers/rle.pdf.

[3] Rackoff, C., 1978. The covering and boundedness problems for vector addition systems. *Theoretical Computer Science*, 6(2):223–231. doi:10.1016/0304-3975(78)90036-1.

[4] Urquhart, A., 1999. The complexity of decision procedures in relevance logic II. *Journal of Symbolic Logic*, 64(4):1774–1802. doi:10.2307/2586811.