R.E.C.A.R

Recursive Explore and Check Abstraction Refinement

Jean-Marie Lagniez, Daniel Le Berre,
Tiago de Lima and Valentin Montmirail

CRIL, Université d'Artois and CNRS, France

{lagniez,leberre,delima,montmirail}@cril.fr

UNIVERSITÉ D'ARTOIS

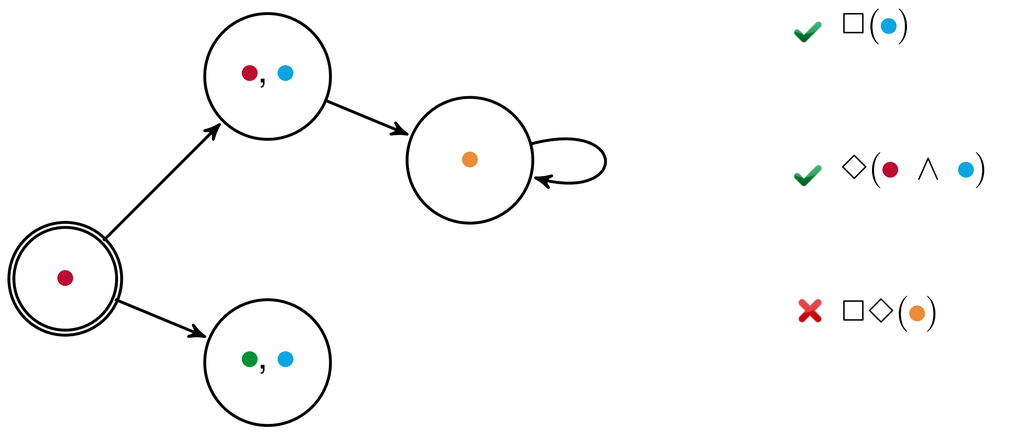
Motivation and Contributions

- Modal Logic K Satisfiability Problem is **PSPACE complete**.
- How to solve a PSPACE problem with a SAT solver? By using the latest features of SAT solvers: unsatisfiable cores and incremental SAT.
- Contribution: A CEGAR-like framework called RECAR and an instantiation for modal logic K within the solver MoSaiC

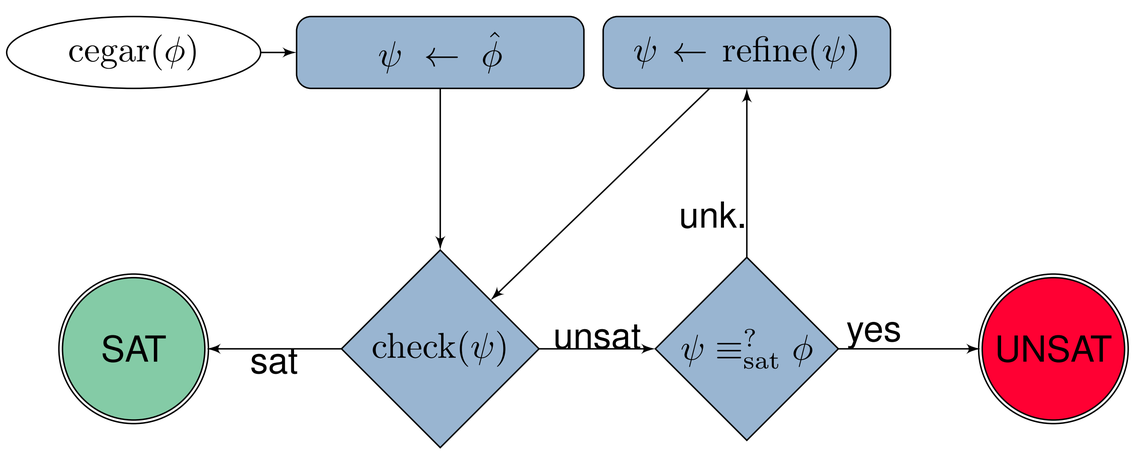
Context

- A lot of AI problems are solved using propositional logic
- But representing a problem in this logic is a tedious task.

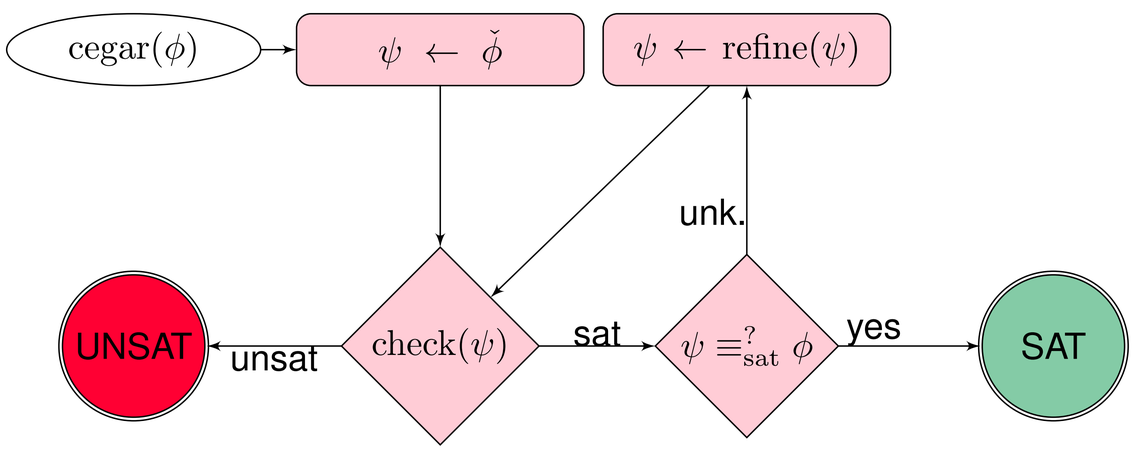
  Modal Logics are **more expressive**. They allow to reason about:
  - What is possible; What somebody thinks; ... ($\Diamond$)
  - What is necessary; What somebody knows; ... ($\Box$)
- They represent in a compact way those problems



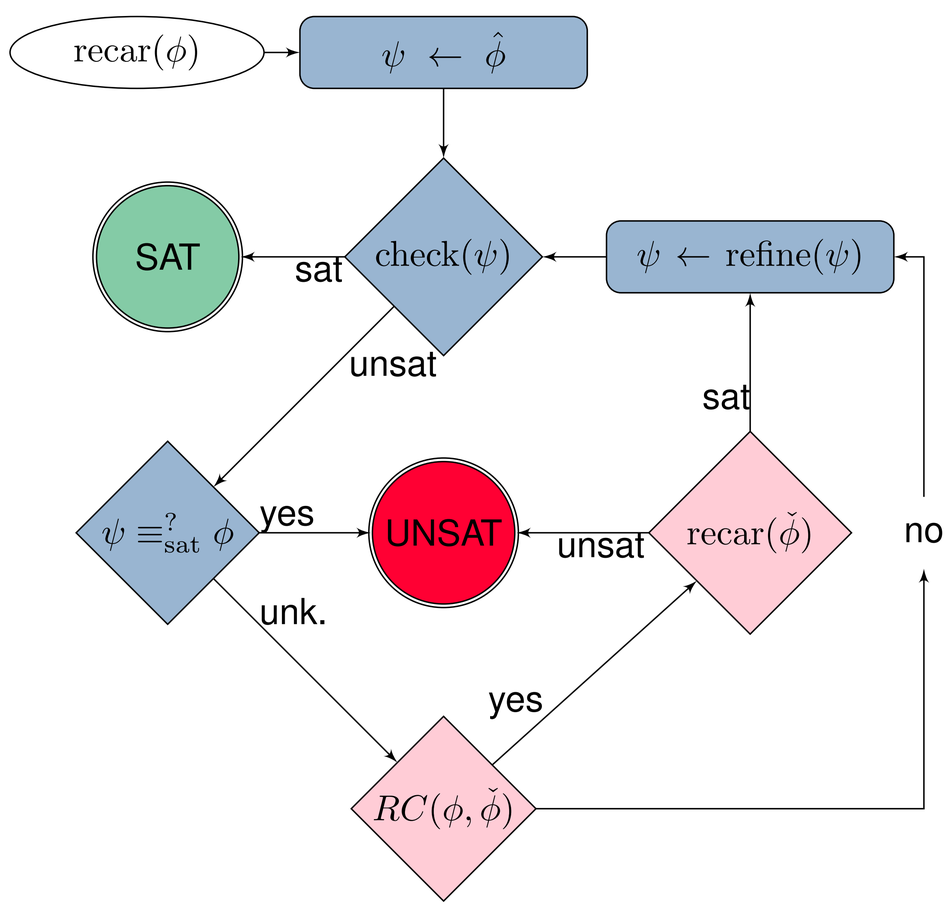
CEGAR with over-approximations



CEGAR with under-approximations



RECAR: Recursive Explore and Check Abstraction Refinement



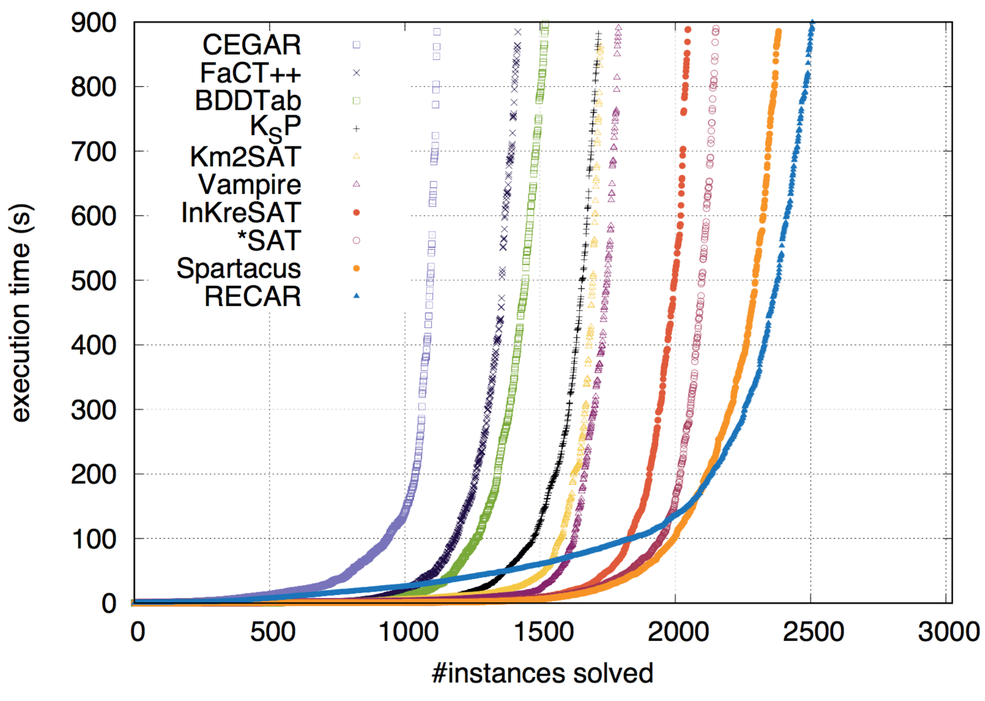
Experimental Settings

2 configurations of MoSaiC: CEGAR vs RECAR

Many state-of-the-art solvers for modal logic K satisfiability problem

CentOS 6.0, bi-proc. XEON, 4 cores, 3.3 GHz, 32GB, 900 seconds.

Experimental results: MoSaiC against SOTA solvers



MoSaiC solves more benchmarks than the other solvers on the benchmarks considered.

Conclusion and Future Work

- ✔ RECAR is an efficient merge between CEGAR-over and CEGAR-under
- ? RECAR for other PSPACE problems
- ? Extend MoSaiC for others modal logics