

Department of Computer Science

Using Restarts on CP(FD)

Centria – Centre for Artificial Intelligence of UNL



CENTRIA



Luís Baptista

(PhD Student, supervised by
Professor Francisco Azevedo)

Degree in Computer Science,
IST/UTL, 1996

Master in Computer Science,
IST/UTL, 2000

Current research interests:
Artificial Intelligence,
Constraint Programming,
Restarts and Nogoods.

Objectives

The use of restart techniques in complete Satisfiability (SAT) algorithms has made solving hard real world instances possible. Complete algorithms for SAT and Constraint problems share many techniques; however, the use of restart techniques in complete algorithms for constraint programming with finite domains (CP(FD)) is not widely used.

In this PhD thesis we intend to: a) implement restart techniques to solve constraint problems with finite domains; b) study the interplay of restarts and other techniques already in use; and c) evaluate the use of restarts. Related with restarts, other topics should be studied: randomization, learning (nogoods) and heuristics.

Methodology

Study and analyze all the problems related with applying restarts to CP(FD). Using some constraint solver, implement restart strategies, randomization, heuristics, and learning strategies (nogoods).

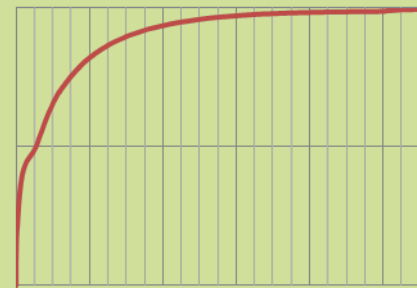
Evaluate each implemented functionality in an individual base, and evaluate the interplay of the functionalities, using well known CP(FD) benchmarks. The following subjects should be addressed: when to restart; how to maintain the algorithm complete; how much randomization and where; how to select variables and values based on information from the search and restarts; nogood recording; parameters for the different technique; performance of the different techniques for different classes of benchmarking; finding the best techniques for different classes/types/characteristics of problems.

Expected Results

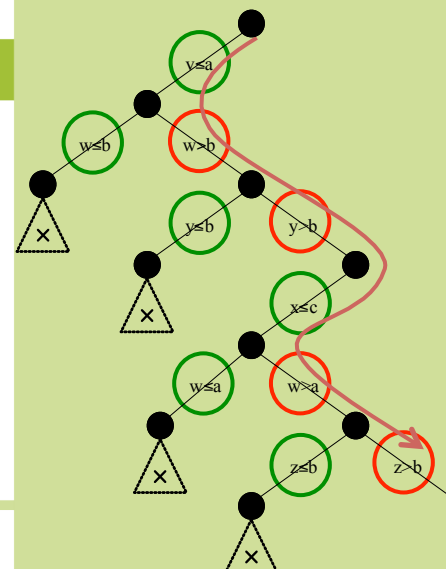
The use of restarts in CP(FD) solvers should improve complete search algorithms and, consequently, efficiently solve hard combinatorial problems.

Using a state of the art constraint solver, implement a software solution that uses novel techniques in CP(FD), i.e., restarts, learning (nogoods) and heuristics, based on information from restarts and nogoods.

The results already obtained show that the use of restarts can improve the performance of the search algorithm. And for harder instances, where restarts are not enough, the use of a new kind of nogoods from restarts, named ds-nogoods, and a new variable selection heuristic based on activity of variables in ds-nogoods, show promising results.



8-queens heavy-tail distribution



Restart and ds-nogood