

Solving XCSP problems by using Gecode

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Motivation



- XCSP → format to specify CSPs
- Gecode → good constraint solver
- Idea → x4g: a plugin to allow Gecode to solve XCSP problems

XCSP (1/2)



- Low level languages to specify CSPs, QCSPs, WCSPs, and MaxCSPs
- Lingua franca for solver evaluation and testing
- Target language of the International Constraint Competition
- Does not describe the search
- Alternative to FlatZinc (very similar)

XCSP (2/2)



- XML based language
- Two variant representations:
 - fully tagged → for XML tools
 - abridged representation → human readable
- Basic constructs: domains, variables, relations, predicates, constraints (intensional and extensional)
- no control flow constructs

XCSP Example



```
<domains nbDomains="1">  
  <domain name="d0" nbValues="2">1..2</domain>  
</domains>  
<variables nbVariables="2">  
  <variable name="A1" domain="d0"/>  
  <variable name="A2" domain="d0"/>  
</variables>  
<constraint name="c0" arity="2"  
  scope="A1 A2"  
  reference="global:alldifferent"/>
```

Gecode



- Gecode: Generic Constraint Development Environment
- Constraint solver written in c++
- State-of-the-art performances, modular, extensible, distributed under a very permissive license, portable, and well documented
- Supports the programming of new propagators, branching strategies, and search engines
- Winner of the MiniZinc challenge 2010

Support of XCSP



- Gecode/FlatZinc allows Gecode to support FlatZinc
- Possible solutions:
 - compile XCSP into FlatZinc
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- Avoids potential loss of information
- More flexible
- Less dependent on the Gecode/FlatZinc plug-in

x4g



- Parses an XCSP
- For every XCSP constraint → new Gecode constraints
- Translation straightforward (most 1 on 1)
- Returns a Gecode Space Object
- Supports only CSPs
- Supports only most used global constraints (alldifferent, among, atleast, ...)

Preliminary experiments (1/2)



- Select few problems from the International Constraint competition dataset
- Use Gecode default search strategy (DFS)
- Compare against Mistral (winner of the 2009 International Constraint Competition)

Preliminary experiments (2/2)



Problem	SAT/UNSAT	Gecode (s)	Mistral (s)
queenAttacking-3	USAT	0.044	0.006
queenAttacking-5	SAT	*	0.144
queens-10	SAT	0.026	0.006
queens-30	SAT	6.020	0.027
queens-80	SAT	*	3.689
graphColoring	SAT	0.028	0.006
graphColoring	USAT	0.248	0.075

* = not terminated in 30'

Future work



- Exhaustive experiments (all problems + different search strategies)
- Add support for more global constraints
- Support COPs
- Create compiler FlatZinc to XCSP
- Participate International Constraint Competition