XCSP³ Competition 2022 – Results –

http://www.cril.fr/XCSP22/

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Olympic Games at FLOC'22

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In a nutshell, the main ingredients of the complete tool chain we propose for handling combinatorial constrained problems are:

- $\rm PyCSP^3:$ a Python library for modelling constrained problems; see <code>http://www.pycsp.org/</code>
 - 22 Jupyter notebooks for introducing the 22 popular constraints
 - more than 30 Jupyter notebooks for gently introducing, step by step, models of classical combinatorial problems
- XCSP³: an intermediate format used to represent problem instances while preserving structure of models; see http://www.xcsp.org/
 - Various tools are available on github (parsers, solution checkers)
 - Many available series of CSP/COP instances

Outline

1 2022 Competition

2 2022 Results

Purpose of Competitions

The goal of a competition is to:

- evaluate solvers in the same conditions
- help collecting publicly available benchmarks and data (results, traces, ...)
- help the community identify good ideas and strange results: the goal is to raise questions and get new ideas!

Competitions should not be misunderstood:

- The results are not an absolute truth: they depend on the benchmark selection, experimental conditions, ...
- A competition is not limited to a ranking: rankings are just an over-simplified view, but still relevant to motivate authors
- Competitions must be driven by the community: benchmark submission/selection advices, suggestions for improvements, ...

Perimeter of Constraints (mainly, XCSP³-core)

For the standard tracks:

- intension, extension
- regular and mdd
- allDifferent, allEqual, ordered and lex
- sum, count, nValues and cardinality
- maximum, minimum, element and channel
- noOverlap and cumulative
- circuit and instantiation
- slide

For the Mini-solver tracks:

- intension, extension
- allDifferent
- sum
- element

Tracks for the 2022 $\mathrm{XCSP^3}$ Competition

There are 4 Standard tracks and 2 Minisolver tracks.

Problem Goal		Exploration	Timeout
CSP	one solution	sequential	40 minutes
COP	best solution	sequential	40 minutes
Fast COP	best solution	sequential	4 minutes
Parallel COP	best solution	parallel	40 minutes

Table: Standard Tracks.

Problem	Goal	Exploration	Timeout
Mini CSP	one solution	sequential	40 minutes
Mini COP	best solution	sequential	40 minutes

Table: Mini-Solver Tracks.

Computer Infrastructure



- the cluster was provided by CRIL and is composed of nodes with two quad-cores (Intel Xeon CPU E5-2637 v4 @ 3.50GHz, each equipped with 64 GiB RAM).
- Hyperthreading was disabled.
- Each solver was allocated a CPU and 64 GiB of RAM, independently from the tracks.
- Timeouts were set accordingly to the tracks through the tool runsolver:
 - sequential solvers in the fast COP track were allocated 4 min of CPU time and 12 min of Wall Clock time,
 - other sequential solvers were allocated 40 min of CPU time and 120 min of Wall Clock time,
 - parallel solvers were allocated 160 min of CPU time and 120 min of Wall Clock time.

Note that:

- the selection has been conducted by C. Lecoutre, which is why ACE was decided to be *off-competition*
- two series (Crypto and DC) have been submitted in response to the call

At the end:

- the selection of instances for the Standard tracks was composed of 200 CSP instances and 250 COP instances
- the selection of instances for the Mini-solver tracks was composed of 150 CSP instances and 158 COP instances

Scoring/Ranking

The number of points won by a solver S is decided as follows:

- for CSP, this is the number of times S is able to solve an instance, i.e., to decide the satisfiability of an instance (either exhibiting a solution, or indicating that the instance is unsatisfiable)
- for COP, this is, roughly speaking, the number of times *S* gives the best known result, compared to its competitors. More specifically, for each instance *I*:
 - if *I* is unsatisfiable, 1 point is won by *S* if *S* indicates that the instance *I* is unsatisfiable, 0 otherwise,
 - if S provides a solution whose bound is less good than another one (found by another competiting solver), 0 point is won by S,
 - if S provides an optimal solution, while indicating that it is indeed the optimality, 1 point is won by S,
 - if S provides (a solution with) the best found bound among all competitors, this being possibly shared by some other solver(s), while indicating no information about optimality: 1 point is won by S if no other solver proved that this bound was optimal, 0.5 otherwise.

Outline

1 2022 Competition



Teams/Solvers (in alphabetic order)

- ACE (Christophe Lecoutre)
- ACE ABD (extension of ACE by Thibault Falque and H. Wattez)
- BTD, miniBTD (Mohamed Sami Cherif, Djamal Habet, Philippe Jégou, Hélène Kanso, Cyril Terrioux)
- Choco (Charles Prud'homme and Jean-Guillaume Fages)
- CoSoCo (Gilles Audemard)
- Exchequer (Martin Mariusz Lester)
- Fun-sCOP (Takehide Soh, Daniel Le Berre, Hidetomo Nabeshima, Mutsunori Banbara, Naoyuki Tamura)
- Glasgow (Ciaran McCreesh)
- MiniCPBP (Gilles Pesant and Auguste Burlats)
- Mistral (Emmanuel Hebrard and Mohamed Siala)
- Nacre (Gaël Glorian)
- Picat (Neng-Fa Zhou)
- RBO, miniRBO (Mohamed Sami Cherif, Djamal Habet, C. Terrioux)
- Sat4j-CSP-PB (extension of Sat4j by T. Falque and R. Wallon)
- toulbar2 (David Allouche et al.)

	Solver	#solved	#SAT	#UNSAT
1	Picat	138	103	35
2	Fun-sCOP-cad	112	86	26
3	Choco	102	80	22

See http://www.cril.univ-artois.fr/XCSP22/competitions/csp/csp

	Solver	Score	Optimum	Best Bound
1	Picat	136.5	121	137
2	CoSoCo	120.5	66	141
3	Mistral	94.0	51	115

See http://www.cril.univ-artois.fr/XCSP22/competitions/cop/cop

	Solver	Score	Optimum	Best Bound
1 2	CoSoCo Picat	107.5 103.5	49 87	125 104
3	Mistral	93.0	46	108

See http://www.cril.univ-artois.fr/XCSP22/competitions/cop/fast-cop

Parallel COP (250 instances)

	Solver	Score	Optimum	Best Bound
1	Choco	184.5	71	191
2	toulbar2	118.5	80	119

See

http://www.cril.univ-artois.fr/XCSP22/competitions/cop/parallel-cop

	Solver	#solved	#SAT	#UNSAT
1	Exchequer	88	58	30
2	miniBTD	72	45	27
3	Sat4j-res	69	47	22

See http://www.cril.univ-artois.fr/XCSP22/competitions/csp/mini-csp

	Solver	Score	Optimum	Best Bound
1	Mistral	93.0	34	99
2	toulbar2	86.0	51	87
3	miniRBO	74.5	41	78

See http://www.cril.univ-artois.fr/XCSP22/competitions/cop/mini-cop

To Conclude about the 2022 $\mathrm{XCSP^3}$ Competition

All Details on http://www.cril.fr/XCSP22/:

- many tables/diagrams and plots
- proceedings
- the full set of instances used in the 2022 competition
- the models and data used in the 2022 competition

Forthcoming:

- PyCSP³, version 2.1 in Autumn 2022
- 2023 XCSP³ Competition in Summer 2023