Challenge 2017

Peter J. Stuckey

Challenge 2017

20 benchmarks * 5 instances = 100 instances

20 minutes time limit

Scoring system:

each instance compares each pair of solvers

1 point for every solver you beat

If both prove optimality/satisfiability/unsatisfiablitiy in time t1 and t2

Solver 1 gets t2/(t1+ t2) points

Five categories:

single engine fixed search: single solving algorithm, must follow given search strategy

single engine free search: search however you want

single engine parallel search: free search on 4 CPUs with hyper threading (8 threads)

open parallel search: parallel search including portfolio solvers

local search: free search for local search (nominated) solvers

Entry System

VM based solver installation

- solver writers download VM
- install solver in VM
- run test script on 2016 challenge subset
- upload VM
- we run same script on 2017 problems
- This year we remembered to ask permission to make the VMs available

2017 Benchmarks

NEW

city-position	placement problem	combinatorial, MIN
community-det	supervised community-detection	real world, MAX
crosswords	make a puzzle	combinatorial, MAX
groupsplitter	scheduling into groups	combinatorial, MIN
hrc	hospital resident couples assignment	real world, MIN
ma-path-finding	multi-agent path finding	combinatorial, MIN
opt-cryptanalysis	cryptanlysis optimization version	real world, MAX
rel2onto	mapping relations to ontologies	real world, MIN
routing-flexible	pipe routing in plant design	real world, MIN
steelmillslab	slab design	benchmark, MIN
tc-graph-color	transition of graph coloring	combinatorial, MIN

OLD problems (mainly new instances)

cargo, gbac, jp-encoding, mario, opd, rcpsp-wet, road-cons, tdtsp, travelling-tppv

Globals

- alldifferent
- bin_packing_load
- count
- cumulative
- diffn
- element
- global_cardinality
- increasing
- inverse
- lex_greatereq
- regular
- table

The official contestants

choco 4 and 5: Java based trailing FD solver
concrete: Scala based FD solver
haifaCSP: C++ FD learning solver
izplus: C based hybrid FD/local search solver
jacop: Java based trailing FD solver
mistral: C++ based trailing FD solver
or_tools: C++ based FD solver
or_tools LCG: C++ LCG based FD solver
oscar: local search solver for MiniZinc (Scala)
picat-CP: trailing CLP(FD) solver
picat-SAT: translation to SAT approach to FD solving
sicstus-prolog: prolog based trailing CLP(FD) solver
sunny-cp-less: portfolio solver (no G12 solvers involved): **choco**, **gecode, haifaCSP, jacop, izplus, minisatID, mistral, opturion_cpx, or_tools**, **picat**
yuck: local search solver for MiniZinc (Scala)

The unofficial contestants

cbc: open source MIP solver (new linearisation)
chuffed: C++ based trailing lazy clause generation solver
g12-fd: Mercury and C based trailing FD solver
gecode: C++ based copying FD solver
gurobi: commercial MIP solver (new linearisation)
sunny-cp: portfolio solver using **chuffed, gecode, g12fd, g12_cpx, g12-lazyfd, gurobi, choco, haifaCSP, minisatID, mistral, opturion_cpx, or_tools, izplus, picat**
LCG-glucose: C++ LCG solver based on glucose SAT solver

The hard worker(s)

Andreas Schutt

- Managing entrants
- Running the competition and the preliminary round checking
- Handling submitted problems (fixing them up and suggesting instances to judges)
- Setting up the VM
- Scripts, webpage
- Checking validity (examining the results in detail)

Gleb Belov, Thibaut Feydy, David Hemmi, Guido Tack,

- Problem checking
- Setting up the machines
- Installing local solvers

Thank you for all your hard work!

Fixed search category

picat-CP-fd: 247.88

choco5-fd: 286.15

g12_fd-fd: 297.90

sicstus-fd: 318.59

or_tools-CP-fd: 462.78

choco4-fd: 492.10

jacop-fd: 547.50

gecode-fd: 573.79

LCG-glucose-fd: 639.55

chuffed-fd: 659.97

or_tools-LCG-fd: 671.78

BRONZE Medal

SILVER Medal

GOLD Medal

Local search category

oscar-free: 37.00 BRONZE Medal

yuck-free: 65.00 SILVER Medal

izplus-free: 145.00 GOLD Medal

Free search category

cbc-free: 439.47
oscar-free: 506.32
g12fd-free: 577.96
picat-CP-fd: 610.30
yuck-free: 613.13
concrete-free: 647.46
sisctus-fd: 709.48
haifaCSP-free: 817.02
choco5-free: 860.24
or_tools-CP-free: 878.87
jacop-fd: 1013.45
or_tools-LCG-core-free: 1026.75
choco4-free: 1045.76
gecode-free: 1054.53
mistral-free: 1075.44
picat-SAT-free: 1103.03
LCG-glucose-free: 1131.48
gurobi-free: 1181.00
or_tools-LCG-free: 1208.75
izplus-free: 1282.68
chuffed-free: 1334.93

Positions on 20 problems	*1st*	*2nd*	*3rd*
cbc-free		*1*	*1*
oscar-free	*2*		*1*
yuck-free		*2*	*1*
concrete-free		*1*	*1*
choco5-free		*1*	
or_tools-CP-free		*2*	*1*
choco4-free	*2*	*1*	*1*
jacob-fd			*2*
or_tools-LCG-core-free	*1*	*2*	*3*
mistral-free	*1*		*1*
picat-sat-free	*1*	*1*	*2*
LCG-glucose-free	*3*	*1*	
gurobi-free	*5*		*3*
or_tools-LCG-free	*2*	*4*	*1*
izplus-free		*2*	*1*
chuffed-free	*3*	*2*	*1*

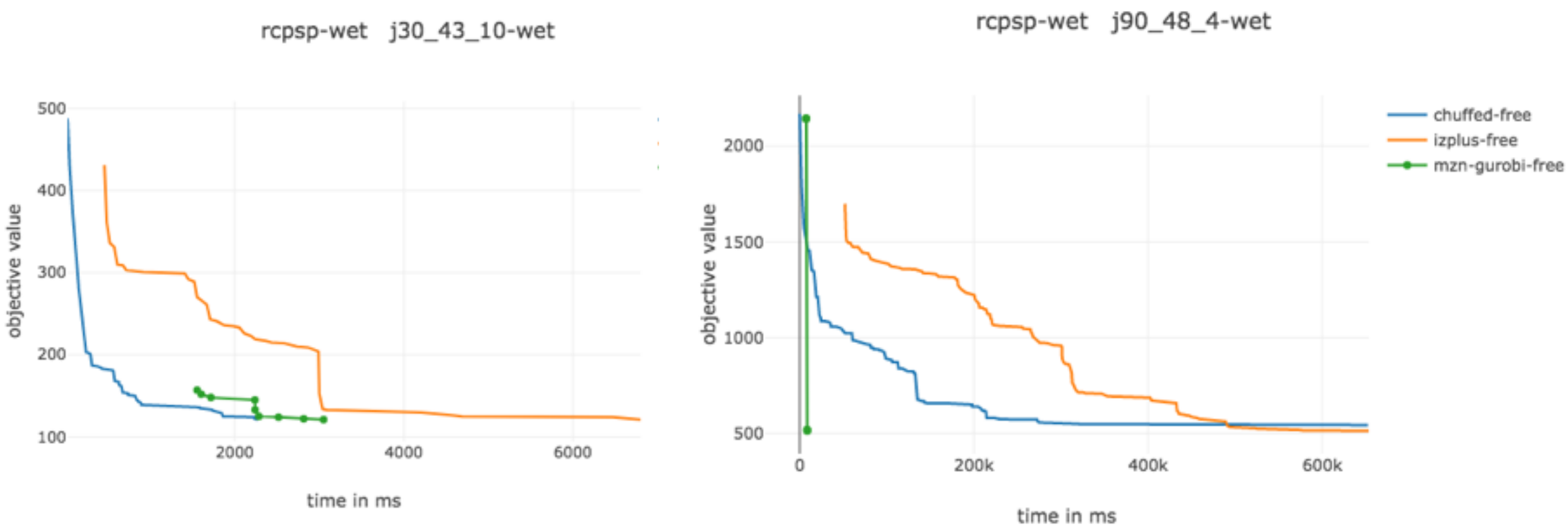
Free search category (incomplete)

cbc-free: 423.00	
oscar-free: 520.00	
g12fd-free: 577.96	
picat-CP-fd: 621.50	
concrete-free: 657.44	-1
yuck-free: 676.50	+1
sisctus-fd: 737.50	
haifaCSP-free: 823.60	
or_tools-CP-free: 874.50	-1
choco5-free: 905.52	+1
or_tools-LCG-core-free: 914.19	-1
jacop-fd: 1019.00	+1
choco4-free: 1024.70	
picat-SAT-free: 1046.48	-2
gecode-free: 1063.00	+1
gurobi-free: 1066.82	-2
LCG-glucose-free: 1066.82	
or_tools-LCG-free: 1085.52	-1
mistral-free: 1142.01	+4
chuffed-free: 1255.92	-1
izplus-free: 1338.48	+1

Is mistral doing local search?

Primal Integral+

1 = no solution
0.75 = worst solution *w* found
0.25 + 0.5x = solution with value $x = (v-b)/(w-b)$
0.25 = best solution *b* found
0 = optimal solution proved



Peter J. Stuckey and Guido Tack *MiniZinc 2.0*

Free search category (integral)

cbc-free: 87M
oscar-free: 83M
concrete-free: 71M -3
yuck-free: 71M -1
g12fd-free: 67M +2
picat-CP-fd: 67M +2
sisctus-fd: 59M
haifaCSP-free: 55M
or_tools-CP-free: 52M -1
choco5-free: 52M +1
or_tools-LCG-core-free: 49M -1
mistral-free: 47M -3
gurobi-free: 46M -5
jacop-fd: 45M +3
choco4-free: 44M +2
picat-SAT-free: 43M
gecode-free: 42M +3
LCG-glucose-free: 38M +1
or_tools-LCG-free: 38M
izplus-free: 34M
chuffed-free: 26M

Parallel search category

cbc-par: 458.15
oscar-free: 481.78
g12fd-free: 531.27
picat-CP-fd: 559.06
yuck-free: 563.22
concrete-free: 607.24
sisctus-fd: 670.58
haifa-CSP-free: 761.26
choco5-free: 788.20
jacop-fd: 937.77 -1
or_tools-LCG-core-free: 981.93 -2
mistral-free: 1000.44 -3
picat-SAT-par: 1025.27 -3
or_tools-CP-par: 1081.59 +4
or_tools-LCG-free: 1150.05 -4
izplus-par: 1164.51 -4
gurobi-par: 1192.16 -1
choco4-par: 1242.54 +6
chuffed-free: 1265.27 -2
gecode-par: 1349.62 +6
LCG-glucose-par: 1419.08 +4

BRONZE Medal
SILVER Medal
GOLD Medal

Peter J. Stuckey *MiniZinc Challenge 2017*

Open search category

cbc-free, **oscar-free,** g12_fd-free, **picat-CP-fd, yuck-par, concrete-free, sicstus-fd**

haifa-CSP-free: 782.98 -1

choco5-free: 826.55 +1

jacop-fd: 979.42

mistral-par: 1044.85 -1

or_tools-LCG-core-free: 1047.88 +1

picat-SAT-free: 1082.68

or_tools-CP-par: 1140.52

izplus-par: 1226.37 -1

or_tools-LCG-free: 1233.95 +1 BRONZE Medal

gurobi-par: 1281.30

choco4-par: 1317.22 SILVER Medal

chuffed-free: 1345.14

gecode-par: 1436.49

sunny-cp-less-open: 1488.42 GOLD Medal

LCG-glucose-par: 1519.75

sunny-cp-open: 1668.27

Summary

A year for parallel solvers

choco4, OR_tools-cp, gecode, lcg-glucose

The mysterious **izplus** remains very competitive

More portfolio solvers! More local search solvers!

Have a look at the solutions over time graphs!

Please send us more real world benchmarks

Conclusions

Congratulations to the winners

	Fixed	Local	Free	Par	Open
GOLD	*OR_LCG*	*iZ_plus*	*iZ_plus*	*Choco4*	*sunnycp*
SILVER	*JacoP*	*yuck*	*OR_LCG*	*iZ_plus*	*Choco4*
BRONZE	*Choco4*	*oscar*	*picat-SAT*	*OR_LCG*	*OR_LCG*

Many thanks to our judges for helping select the instances and making rulings when required

Jimmy Lee, Barry O'Sullivan, Roland Yap

Enter your solver next year, send us some problem instances!

final word

Learn MiniZinc

- https://www.coursera.org/learn/basic-modeling

Use MiniZinc

Make all your benchmarks available in MiniZinc

- and add them to CSPlib (after the challenge!)

Try out different solvers on the same model

- Maybe you should be using SAT, ASP, SMT or MIP for your problem?