Challenge 2018

Peter J. Stuckey

Challenge 2018

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

Docker based solver installation

- solver writers download VM
- install solver in docker container
- run test script on 2016 challenge subset
- upload docker
- dockers are automatically scheduled using a competition system using AWS
- Machines: 2.5 GHz Intel Xeon® Platinum 8175
    - sequential: m5.xlarge
    - par+open: m5.2xlarge

2018 Benchmarks

NEW

concert-hall-cap	planning	combinatorial, MAX
neighbours	rectangle labelling	puzzle, MAX
racp	resource investment problem	combinatorial,MIN
rotating-workforce	scheduling shifts	real world, SAT
seat-moving	simple planning problem	combinatorial, MIN
soccer-compute	find possible final team ranks	real world, SAT
steiner-tree.	width limited version	combinatorial, MIN
team-assignment	optimal team selection problem	real world, MAX
test-scheduling	test scheduling	real world, MIN
vrplc	vehicle routing + location congestion	real world, MIN

OLD problems (mainly new instances)

cargo, elitserien, gfd-scheduling, largescheduling, mapping, on-call-rostering, oocsp_racks, opt-cryptanalysis, proteindesign12, train

Globals

- alldifferent
- alldifferent_except_0
- bin_packing
- bin_packing_load
- count
- circuit
- cumulative
- diffn
- disjunctive
- element
- global_cardinality
- global_cardinality_closed
- increasing
- inverse
- lex_greatereq
- maximum
- network_flow_cost
- nvalue
- regular
- table
- value_precede_chain

The official contestants

choco 4: 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

or_tools LCG: C++ LCG based FD solver

oscar: local search solver for MiniZinc (Scala)

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
chuffed: C++ based trailing lazy clause generation solver
cplex: commercial MIP solver
gecode: C++ based copying FD solver
sunny-cp: portfolio solver using **chuffed, gecode, g12fd, g12_cpx, g12-lazyfd, gurobi, choco, haifaCSP, minisatID, mistral, opturion_cpx, or_tools, izplus, picat**

The hard worker(s)

Andreas Schutt

- Managing entrants, communication
- Running the preliminary round checking
- Handling submitted problems (fixing them up and suggesting instances to judges)
- Scripts, webpage

Felix Brandt

- Setting up new competition framework

Eddy Lam, Graeme Gange, Jip Dekker

- Checking submitted models

Guido Tack,

- Running the competition, scripting

Thank you for all your hard work!

Fixed search category

sicstus-fd: 85.01

concrete-fd: 93.79

choco-fd: 223.13 BRONZE Medal

jacop-fd: 225.30 SILVER Medal

gecode-fd: 244.28

or_tools-CP-fd: 365.78 GOLD Medal

chuffed-fd: 388.71

Local search category

oscar-free: 22.00 BRONZE Medal

yuck-free: 40.00 SILVER Medal

izplus-free: 129.00 GOLD Medal

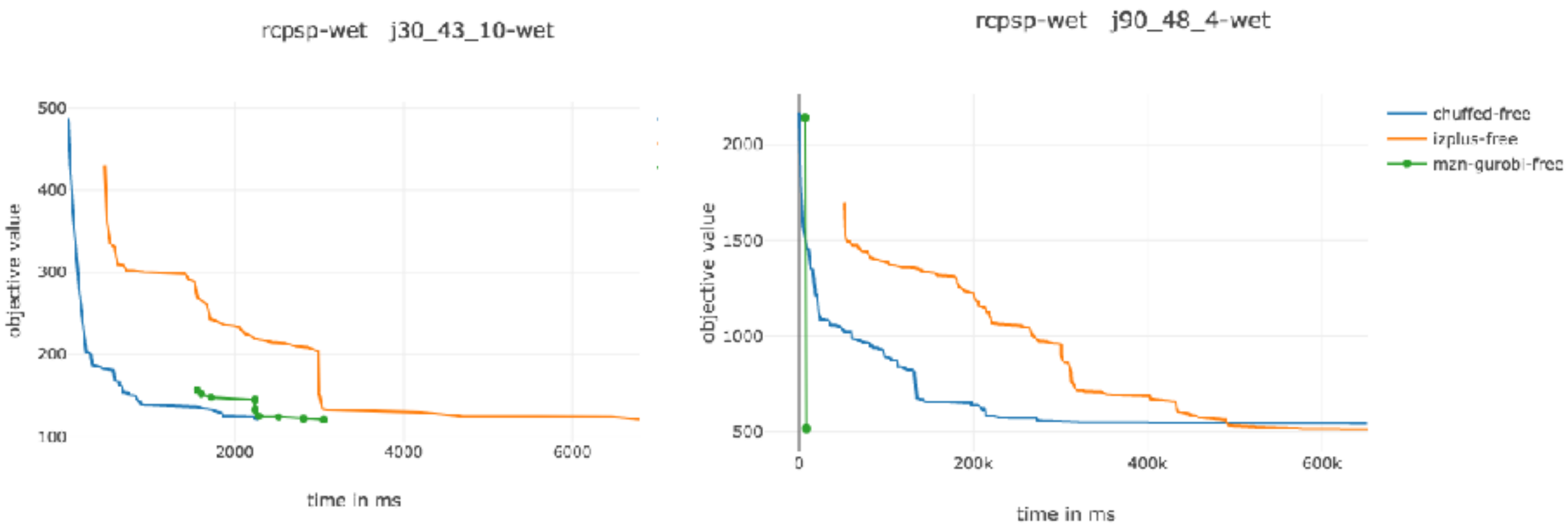
Free search category

oscar-free: 122.00
yuck-free: 234.04
cbc-free: 316.15
sisctus-fd: 322.72
concrete-free: 353.29
jacop-fd: 507.32
gecode-free: 529.41
cplex-free: 648.24
izplus-free: 662.28
choco-free: 683.06
haifa-CSP-free: 686.02
picat-SAT-free: 790.64
or_tools-free: 969.37
chuffed-free: 971.48

Positions on 20 problems	*1st*	*2nd*	*3rd*
cbc-free			*1*
oscar-free			*1*
gecode-free			*2*
concrete-free		*1*	
jacop-free		*1*	*2*
yuck-free	*1*		
choco-free	*1*	*1*	*1*
haifa-free	*1*	*4*	*2*
izplus-free	*2*		*1*
picat-SAT-free	*2*	*2*	*4*
cplex-free	*3*	*1*	*1*
chuffed-free	*5*	*4*	*2*
or_tools-free	*5*	*6*	*4*

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)

concrete-free: 81M -4

cbc-free: 80M -1

sisctus-fd: 78M -1

oscar-free: 76M +3

yuck-free: 69M +3

gecode-free: 66M -1

jacop-fd: 62M +1

cplex-free: 60M

izplus-free: 55M

haifa-CSP-free: 53M -1

choco-free: 50.5M +1

picat-SAT-free: 50.3M

or_tools-free: 36M

chuffed-free: 38M

Parallel search category

oscar-free: 123.50
yuck-free: 215.93
cbc-free: 302.07
sisctus-fd: 304.49
concrete-free: 327.73
jacop-fd: 475.64
gecode-par: 581.32 +0
haifa-CSP-free: 652.24 -3
izplus-par: 657.37 +0
cplex-par: 707.36 +2
picat-SAT-free: 754.51 -1
choco-par: 783.51 +2
chuffed-free: 929.50 -1
or_tools-par: 1107.83 +1

BRONZE Medal
SILVER Medal
GOLD Medal

Open search category

oscar-free: 116.00

yuck-free: 228.04

sisctus-fd: 318.55 -1

cbc-free: 326.64 +1

concrete-free: 351.21

jacop-fd: 501.85

gecode-par: 616.51

haifa-CSP-free: 691.04

izplus-par: 705.17

cplex-par: 772.59

picat-SAT-free: 807.16

choco-par: 830.66 BRONZE Medal

chuffed-free: 1007.12

sunny-cp-less: 1083.92 SILVER Medal

sunny-cp: 1098.05

or_tools-par: 1246.50 GOLD Medal

Summary

A year for one dominating solver

OR-tools

- includes learning/LCG
- includes LP (MIP?) propagation

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_tools	iZ_plus	OR_tools	OR_Tools	OR_Tools
SILVER	JacoP	yuck	picat-SAT	Choco	sunny-cp-
BRONZE	Choco	oscar	HaifaCSP	picat-SAT	Choco

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
- https://www.coursera.org/learn/advanced-modeling
- https://www.coursera.org/learn/solving-algorithms-discrete-optmization

Use MiniZinc

Make all your benchmarks available in MiniZinc

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

MiniZinc 2.2.0

- released on Friday 24th August

final final word

Monash University Discrete Optimization Group

- Three postdoctoral fellowships (3 years)
  - apply now
  - http://careers.pageuppeople.com/513/cw/en/job/580992/research-fellow-ai-optimisation-group
- Three continuing teaching and research academic positions
  - advertised within 2 weeks
- Come and join a very vibrant optimization group!