MiniZinc Challenge 2010

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Australian Government

Department of Communications, Information Technology and the Arts

Australian Research Council

NICTA Members

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What is the MiniZinc Challenge

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- Comparing Constraint Programming Solvers
- ~10 problems + ~100 problem instances
- 3 categories
  - fixed search: must follow a given search strategy
  - free search: search anyway you want
  - parallel search: shared memory dual-core (free) search
    - non parallel solver use free results
- Purse based scoring: 100 points per instance
  - split by speed of finding solution/proving optimality
  - quality of best solutions found (minimization)

The problems

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- Satisfaction and Optimization problems
- All problems are new, not previously used in MiniZinc challenge and preferably the models not seen before.
  - Submitted by contestants
  - Suggested by judges
  - Developed by G12 group
- Problems and number of instances selected by judges
  - instances selected randomly

The problems

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- Balanced academic curriculum [15]
  - minimization, linear + reified linear
- Costas Array [5]
  - satisfaction, alldifferent
- Depot Placement [15]
  - minimization, alldifferent, element, linear+reified linear
- Filter Scheduling [10]
  - satisfaction, diffn
- Crossing Minimization [5]
  - minimization, Boolean

The problems

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- Ghoulomb (evil golomb rulers) [10]
  - minimization, cumulative
- Grid colouring [5]
  - minimization, disjunction + reified equality
- RCPSP_max (resource scheduling) [10]
  - minimization, cumulative
- Solitaire Battleships [15]
  - satisfaction, reified expressions
- Waste Water Treatment Plant Scheduling [10]
  - satisfaction, linear, disjunction + reified equality

The contestants

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- `Gecode` [Fixed, Free, Par]
  - winner of all categories of last 2 challenges
- `JaCoP` [Fixed]
  - java based CP solver
- `fzn2smt` [Free]
  - translator from FlatZinc to SMTlib + SMT solver Yices
- `SCIP` [Free]
  - MIP solver with propagation and learning
- `fzntini` [Free]
  - Translation to SAT increasing integer sizes

G12 solver entries

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- `Cplex` [Free, Par]
  - Cplex 12.1 applied to a linearization written in MiniZinc
- `G12FD` [Fixed, Free]
  - G12 finite domain solver
- `Chuffed` [Fixed, Free, Par]
  - New lazy clause generation solver

Unfairness?

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- Linearization failed for some models
  - affects `Cplex` + `SCIP`
- Decomposition blew out for some models
  - affects `Cplex`, `fzntini`, `fzn2smt`
- `fzn2smt` doesn't appear to return answers as found (so loses potential points)

Results: Fixed

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- `Chuffed`, `Gecode`, `G12FD`, `JaCoP`

- `G12FD`: 1207
- `JaCoP`: 1579
- `Gecode`: 2133
- `Chuffed`: 4680

Results: Free

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- `Chuffed, Cplex, fzn2smt, fzntini, G12FD, Gecode, JaCoP, SCIP`
- `SCIP`: 289
- `Cplex`: 387
- `G12FD`: 525
- `fzntini`: 905
- `JaCoP`: 961
- `fzn2smt`: 1719
- `Gecode`: 1771
- `Chuffed`: 3341

Results: Parallel

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- Chuffed, Cplex, fzn2smt, fzntini, G12FD, Gecode, JaCoP, SCIP
- SCIP: 326
- Cplex: 500 (+113)
- G12FD: 556
- fzntini: 901
- JaCoP: 997
- Gecode: 1871 (+100)
- fzn2smt: 1873
- Chuffed: 2872 (-469)

Parallel:

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- Cplex-free: 1209 vs Cplex-par: 1190
- Chuffed-free: 5252 vs Chuffed-par: 4347
- Gecode-free: 3105 vs Gecode-par: 3994

The winners:

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- Fixed: Gecode, JaCoP
- Free: Gecode, fzn2smt, JaCoP
- Parallel: fzn2smt, Gecode, JaCoP

- Many thanks to our judges
  - Jimmy Lee
  - Barry O'Sullivan
  - Roland Yap

Remarks

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- Immature (for CP) solvers
  - `SCIP` and `CPLEX` + linearization
  - `fzn2smt`

  Next year they will do better!
- More CP Solvers
  - `ECLiPSe` + `SICStus`
  - others promised me entries at last CP!
- Rethink scoring?

Future of Constraint Programming?

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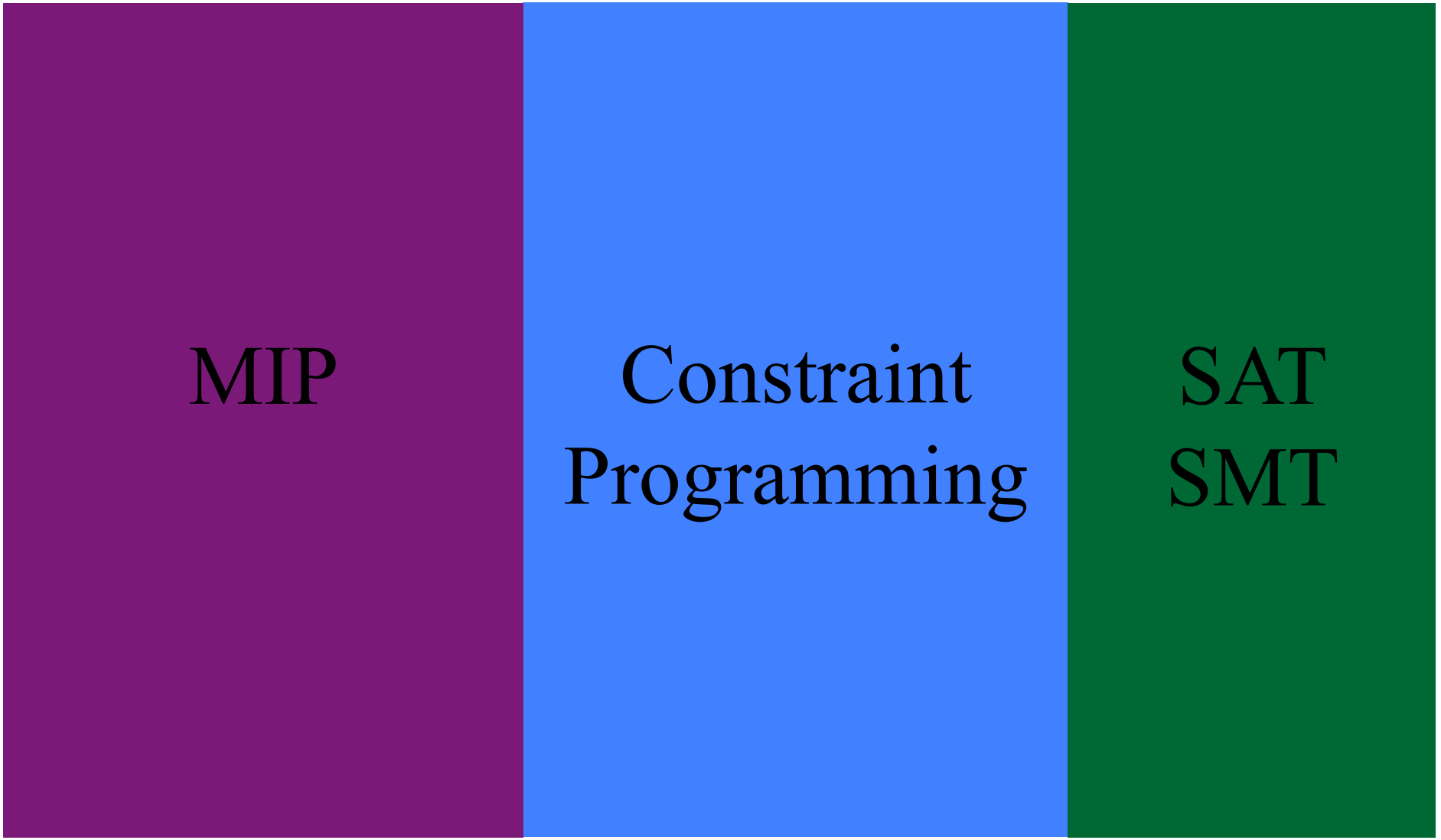
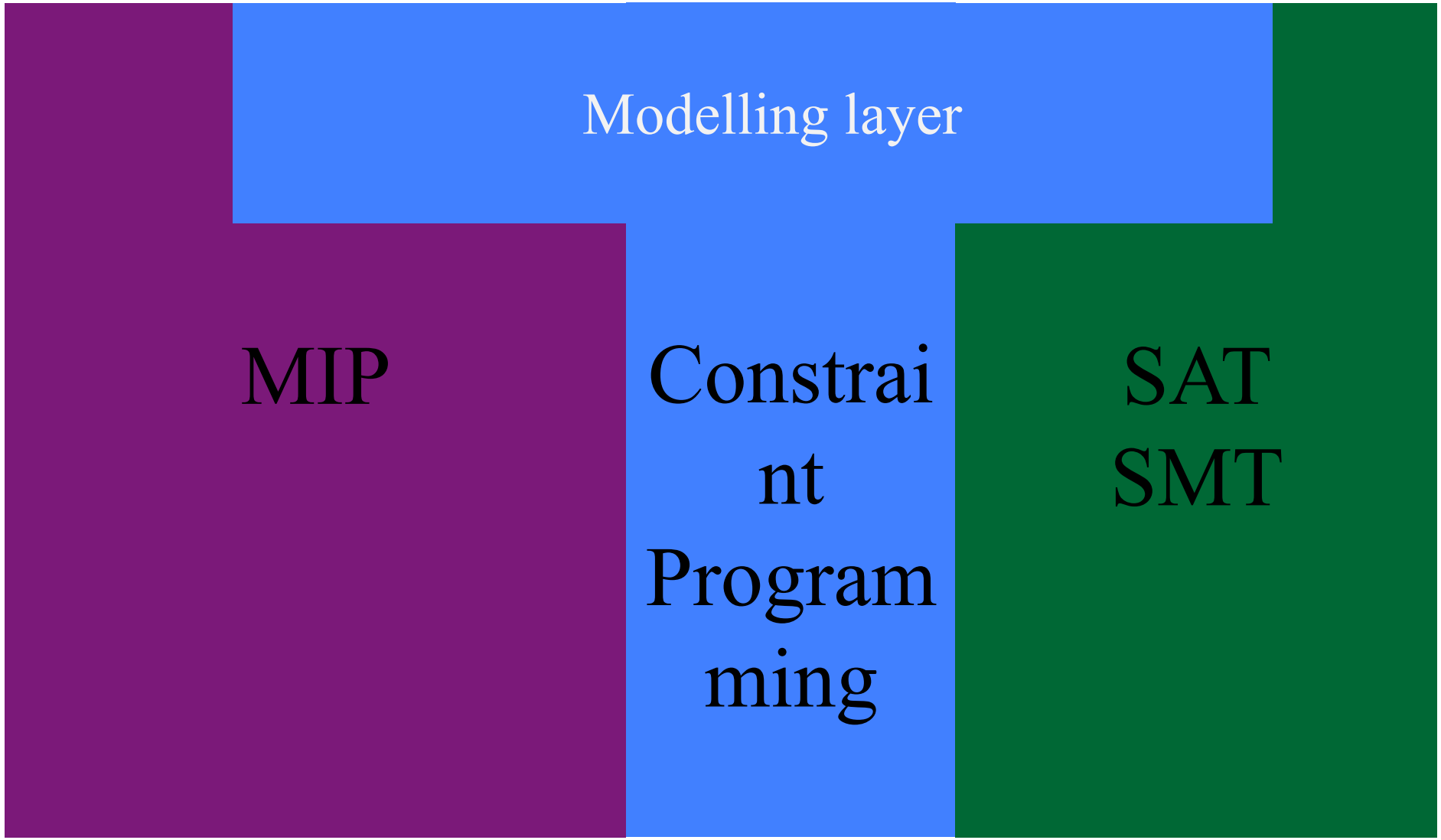


Pessimistic



Optimistic

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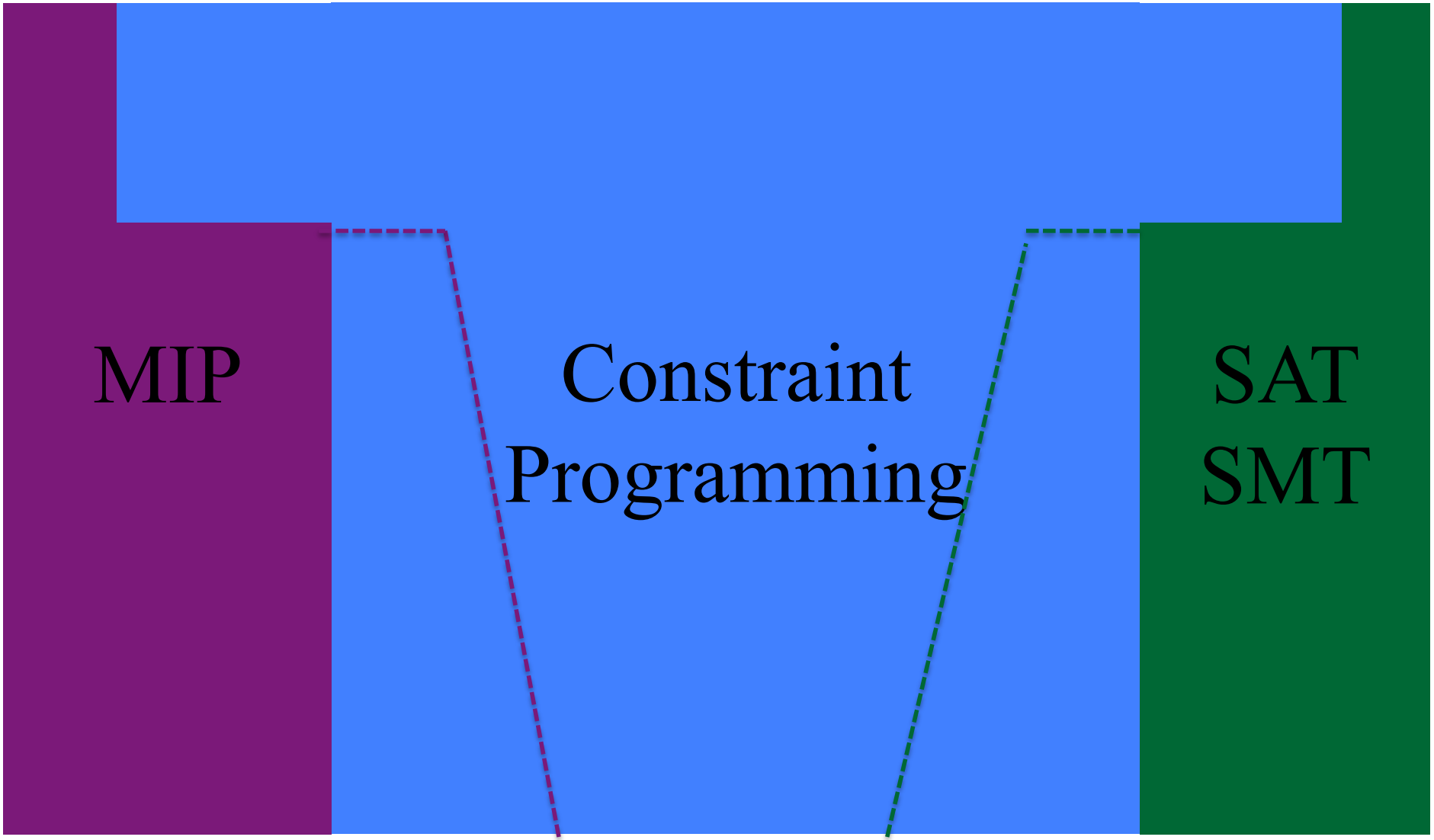

MiniZinc Resources

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- mzn2fzn translator
  - specializable to each FlatZinc backend
- MiniZinc IDE (Eclipse based)
- Flatzinc conformance test suite
- Large suite of benchmarks
- FlatZinc parser: yacc/lex
- XML version of FlatZinc (and converters)
- Courseware (some)

Blatant Advertising

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- Get MiniZinc 1.1.6
  - http://www.g12.csse.unimelb.edu.au/minizinc/
- Add some MiniZinc models to the Wiki
  - http://www.g12.csse.unimelb.edu.au/wiki/
- Positions available at G12 immediately: talk to
  - Peter Stuckey: peter.stuckey@nicta.com.au
  - Mark Wallace: mgw@infotech.monash.edu.au
- PhD scholarships available from NICTA!