



Computational Integer Programming

Lecture 2

Zuse Institute Berlin (ZIB)

DFG Research Center MATHEON
Mathematics for key technologies



20/Oct/2011



Toolbox for **generating** and **solving** constraint integer programs

ZIMPL

- ▷ a mixed integer programming modeling language
- ▷ easily generate LPs, MIPs, and ...

SCIP

- ▷ a MIP and CP solver, branch-cut-and-price framework
- ▷ ZIMPL models can directly be loaded into SCIP and solved

SoPlex

- ▷ a linear programming solver
- ▷ SCIP uses SoPlex as underlying LP solver



ZIMPL – Modeling Language

- ▷ distinguish between data and model
- ▷ easily generate LPs, MIPs, and ...
- ▷ fast prototyping
- ▷ <http://zimpl.zib.de>
- ▷ AIMMS, AMPL, GAMS, MOSEL, OPL, ...

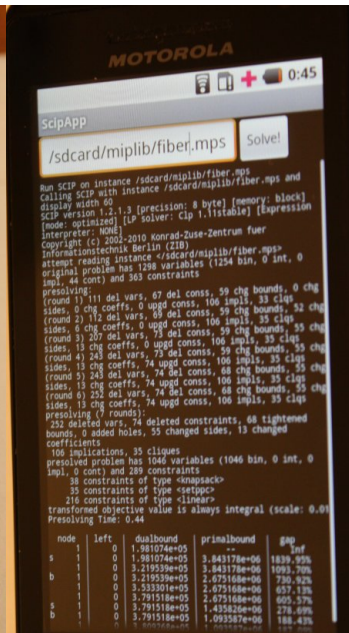
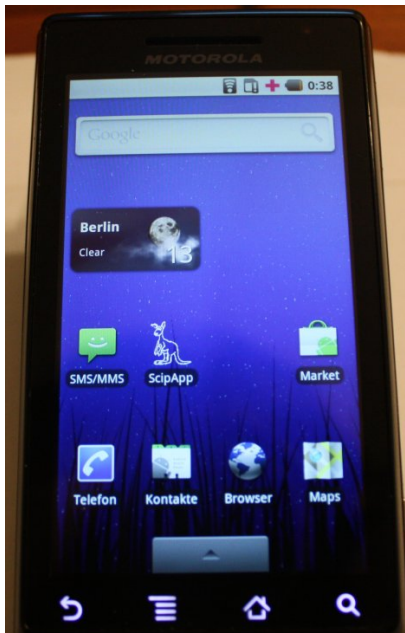
SoPlex – Linear Programming Solver

- ▷ dual and primal simplex
- ▷ has a warm start
- ▷ <http://soplex.zib.de>
- ▷ CLP, CPLEX, GUROBI, MOSEK, XPRESS, ...



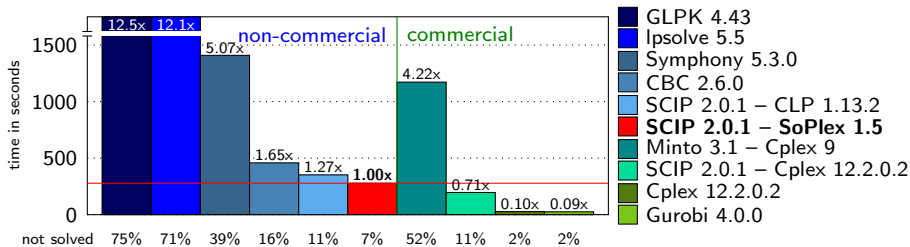
SCIP is a framework for Constraint Integer Programming oriented towards the needs of Mathematical Programming experts who want to have **total control of the solution process** and access **detailed information down to the guts of the solver**.

- ▷ framework to solve **constraint integer programs**
- ▷ **branch-and-bound** framework
- ▷ **branch-and-cut** framework
- ▷ **branch-and-propagate** framework
- ▷ **branch-and-price** framework
- ▷ **black box MIP solver**
- ▷ <http://scip.zib.de>
- ▷ CBC, CPLEX, GUROBI, MOSEK, XPRESS, ...

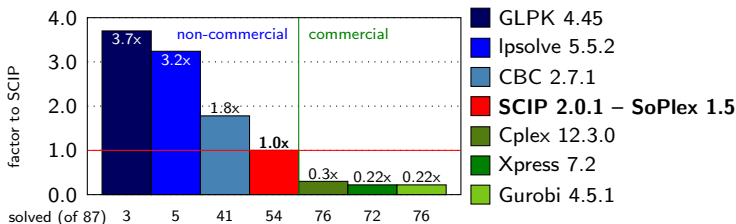




▷ fastest non-commercial MIP solver



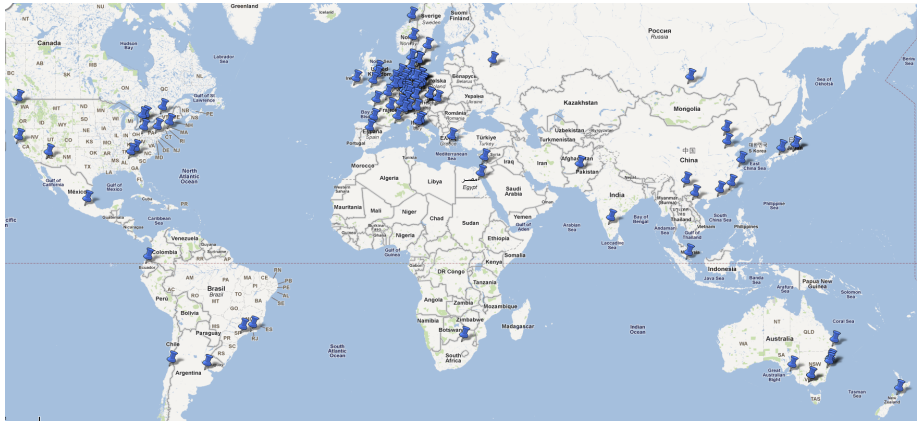
results by H. Mittelmann (16.1.2011)



MIPLIB 2010, results by H. Mittelmann (14.8.2011)



Some universities and institutes using the ZIB Optimization Suite:





Linux and Mac users

- ▷ download the ZIB Optimization Suite 2.0.1
<http://zibopt.zib.de>
- ▷ read the INSATLL
 - ▶ `tar xvf ziboptsuite-2.0.1.tgz`
 - ▶ `cd ziboptsuite-2.0.1`
 - ▶ `make`
 - ▶ `make test`
- ▷ requirements: `readline` and `zlib`
- ▷ you can also use the virtual machine (see next slide)



Windows user

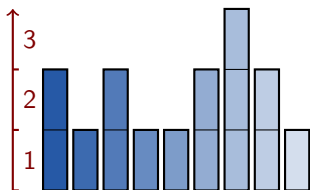
- ▷ download the virtual machine (VM) form the course web page
 - ▶ CIPvmware.zip (**Attention 2,7 GB**)
 - ▶ >1 GB main memory
 - ▶ 5–8 GB disk space
- ▷ follow the instruction stated in the README.txt
 - ▶ download the VMware Player (free software)
 - ▶ load the VM into the VMware Player
 - ▶ power on the VM
- ▷ ZIB Optimization Suite is already installed
- ▷ Eclipse, emacs, L^AT_EX, JAVA, Kate, Kile, ...

Questions



Definition

The **binpacking problem** consists of assigning sized items to bins of given capacities such that the total number of used bins is minimized.

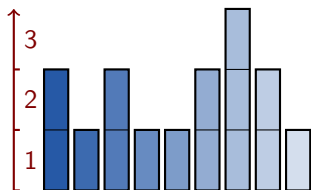


Items



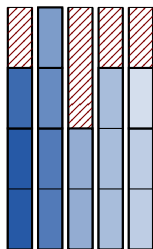
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Items

bin capacity 4



Assignment