

An Independent Evaluation of Continuous LP Codes

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NOTE: some of the results have been corrected/updated after the conference. Check the benchmark page for latest results.

Services we provide

- Guide to Software: "**Decision Tree**"
- <http://plato.asu.edu/guide.html>
- Software Archive
- Software Evaluation: "**Benchmarks**"
- Archive of Testproblems
- Web-based Solvers (**1/3 of NEOS**)

From the NEOS solvers webpage

- * Mixed Integer Linear Programming

- * GLPK [LP Input] [MPS Input] [CPLEX Input] [GMP Input]
[GLP Input] [PuLP Input] [Matlab Input] [AMPL Input]

- * Linear Programming

- * BPMPD [LP Input] [MPS Input] [CPLEX input] [AMPL Input]

- * Stochastic Linear Programming

- * BNBS [SMPS Input]

Overview of Talk

- Current Benchmarks
- LP Benchmarks
 - Benchmark of commercial LP codes
 - Benchmark of free LP codes
 - Robustness Issues
- Conclusion, Future Work

From my benchmark page

<http://plato.asu.edu/bench.html>

LINEAR PROGRAMMING

- * Benchmark of commercial LP solvers (10-22-2004)
- * Benchmark of free LP solvers (10-22-2004)

The only other ones updated: AMPL-NLP, SDP&SOCP

22 Oct 2004 =====
Benchmark of commercial LP solvers
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The URL of this page is <ftp://plato.asu.edu/pub/lpcom.txt>
Logfiles of these runs at: <ftp://plato.asu.edu/pub/lpcom/>

This benchmark was run on a Linux-PC (3.2 GHz P4, 4 GB RDRAM, Linux)
The MPS-datafiles for all testcases are in one of (see column "s")
<http://miplib.zib.de/> [1]
<ftp://plato.asu.edu/pub/lptestset/> [2]
http://www.sztaki.hu/~meszaros/public_ftp/lptestset/ (NETLIB[3],
MISC[4], PROBLEMATIC[5], STOCHLP[6], KENNINGTON[7], INFEAS[8])

NOTE: files in [2-8] need to be expanded with emps in same directory

The following codes were tested:

XP-B/D/P	http://www.dashoptimization.com/ (XPRESS-MP-15.20)
CPLEX-B/D/P	http://www.cplex.com/ (ILOG-CPLEX-9.0)
MOSEK-3.1.1	http://www.mosek.com (10/21/04, barrier)
LOQO-6.06	http://orfe.princeton.edu/~loqo/
LIPSOL	linprog in Matlab 7.0.1

B/D/P: barrier/dual/ primal simplex

Times are user times in secs including input and crossover to a feasible basis for all codes except LOQO and LIPSOL.

22 Oct 2004

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Benchmark of free LP solvers
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The URL of this page is <ftp://plato.asu.edu/pub/lpfree.txt>
Logfiles of these runs at: <ftp://plato.asu.edu/pub/lpfree/>

This benchmark was run on a Linux-PC (3.2 GHz P4, 4 GB RDRAM, Linux)

The MPS-datafiles for all testcases are in one of (see column "s")

<http://miplib.zib.de/> [1]

<ftp://plato.asu.edu/pub/lptestset/> [2]

http://www.sztaki.hu/~meszaros/public_ftp/lptestset/ (NETLIB[3],
MISC[4], PROBLEMATIC[5], STOCHLP[6], KENNINGTON[7], INFEAS[8])

NOTE: files in [2-8] need to be expanded with emps in same directory

The following codes were tested:

BPMPD-2.14	installed at NEOS
CLP-1.00.01	http://www.coin-or.org/
LPABO-6.0	http://www.orlab.org/software/lpabo/
LPAKO-7.0	http://www.orlab.org/software/lpako/
QSOPT-1.0	http://www.isye.gatech.edu/~wcook/qsopt/
SOPLEX-1.2.1	http://www.zib.de/Optimization/Software/Soplex/
GLPK-4.7	http://www.gnu.org/software/glpk/

see also the LIPSOL results on <ftp://plato.asu.edu/pub/lpcom.txt>

LIPSOL-0.60	http://www.caam.rice.edu/~zhang/lipsol/
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LOQO has no presolve as all other solvers have.

Times are user times in secs including input.

problem	rows	columns	nonzeros
dano3mip_lp	3203	13873	79656
dbic1	43200	183235	1038761
df1001	6072	12230	41873
fome12	24285	48920	167492
fome13	48569	97840	334984
gen4	1538	4297	110174
ken-18	105128	154699	512719
l30	2702	15380	64790
lp22	2959	13434	78994
mod2	35665	31728	220116
neos	479120	36786	1084461
neos1	131582	1892	468094
neos2	132569	1560	552596
nsct2	23004	14981	686396

problem	rows	columns	nonzeros
nug15	6331	22275	110700
nug20	15240	72600	304800
pds-40	66845	212859	605678
pds-100	156244	505360	1390539
qap12	3193	8856	44244
qap15	6331	22275	110700
rail4284	4284	1092610	12372358
rlfprim	57422	8052	264483
self	960	7364	1148845
sgpf5y6	246078	308634	902275
stormG2-125	66186	157496	529317
stormG2_1000	528186	1259121	4228817
watson_2	352014	671861	1843716
world	35511	32734	220748

problem	CPLEX-B	XP-B	CPLEX-D/P	XP-D/P	MOSEK	LOQO	LIPSOL
dano3mip	12	13	35/40	38/46	11	72	14
dbic1	118	135	146/120	374/152	34	152	104
df1001	22	20	24/54	19/73	7	101	13
fome12	120	75	171/744	204/988	36	369	88
fome13	94	110	782/1996	520/2181	77	718	85
gen4	16	16	2/83	12/88	8	21	233
ken-18	12	15	13/68	15/65	18	252	25
l30	37	4	28/49	15/35	5	2	1691
lp22	6	8	43/180	51/131	7	48	9
mod2	13	15	95/395	87/321	19	49	25
neos	112	156	27/178	7475/2624	227	613	321
neos1	32	36	689/18	740/132	31	151	37
neos2	24	57	520/32	11936/199	19	91	29
nsct2	104	45	2/3	3/9	38	837	131

problem	CPLEX-B	XP-B	CPLEX-D/P	XP-D/P	MOSEK	LOQO	LIPSOL
nug15	87	87	2629/2436	4442/4443	83	1492	118
nug20	1421	1299	50040/60692	54449/66607	1149	17468	3092
pds-40	153	150	49/206	54/241	191	14965	252
pds-100	717	741	160/2113	245/3062	1574		1673
qap12	11	10	195/201	280/275	17	153	17
qap15	78	90	3063/2660	4669/4247	90	1554	145
rail4284	262	411	4036/9221	8928/2059	438	3544	534
rlfprim	5	7	1/11	2/16	4	55	7
self	52	44	98/86	308/434	23	77	3194
sgpf5y6	7	16	4/3	14/13	10	11773	23
storm-125	23	22	17/81	24/43	57	37	62
storm_1000	303	327	605/5279	869/5088	761	1299	802
watson_2	53	44	166/502	622/85	49	327	70
world	15	17	102/513	97/398	20	45	28

How do the best IPM codes compare?

Total time for the testsuite:

CPLEX-B	XP-B	MOSEK	LIPSOL
3909	3970	4993	12812

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Benchmark of free LP solvers

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The following codes were tested:

BPMPD-2.14	installed at NEOS
CLP-1.00.01	http://www.coin-or.org/
LPABO-6.0	http://www.orlab.org/software/lpabo/
LPAKO-7.0	http://www.orlab.org/software/lpako/
QSOPT-1.0	http://www.isye.gatech.edu/~wcook/qsopt/
SOPLEX-1.2.1	http://www.zib.de/Optimization/Software/Soplex/
GLPK-4.7	http://www.gnu.org/software/glpk/

problem	BPMPD	CLP	LPABO	LPAKO	QSOPT	SOPLEX	GLPK
dano3mip	83	79	65	61	138	105	66
dbic1	118	422	112	1226	1274	2855	1037
df1001	99	28	220	113	239	72	10885
fome12	561	193	274	5184	2036	621	6202
fome13	416	326	517	33763	4927	1723	31232
gen4	24	20	18	f	140	33	f
ken-18	77	18	28	21898	2165	5829	3901
l30	2	73	9	f	303	74	706
lp22	31	52	69	147	196	84	254
mod2	23	87	18	1861	1414	672	1350
neos	1199	1923	f	>36000	16032	3536	107627
neos1	90	103	f	40	987	687	208
neos2	59	208	f	f	1634	742	>190000
nsct2	58	4	420	40	4	9	8

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problem	BPMPD	CLP	LPABO	LPAKO	QSOPT	SOPLEX	GLPK
nug15	641	3218	1684	f	17858	61784	6722
nug20	10120	>40000	23679	f	16102		f
pds-40	3359	42	6035	>48000	4986	3473	7354
pds-100	>69000	214	>69000	>50000	40009	f	>67000
qap12	39	459	104	f	562	1938	212
qap15	371	3587	910	f	26829	58743	6006
rail4284	1526	5776	f	>72000	23169	9880	f
rlfprim	11	8	11	95	109	23	66
self	49	150	1266	f	585	93	319
sgpf5y6	30	7	720	331	1447	1917	1841
storm-125	6191	34	17712	4838	419	217	997
storm_1000	671	1652	f	>42000	34878	14139	>42000
watson_2	119	123	61	>90000	18904	29971	19894
world	26	119	21	f	1769	851	1304

Robustness Issues I

Detecting Infeasibility: solve 34 NETLIB/infeas problems

	CPLEX-B	XP-B	CPLEX-D/P	XP-D/P	MOSEK	LOQO	LIPSOL
solved	34	34	34/34	34/34	34	18	33
	BPMPD	CLP	LPABO	LPAKO	QSOPT	SOPLEX	GLPK
solved	33	31	32	31	32	33	34

Robustness Issues II

Solve 7 additional difficult problems from:

http://www.sztaki.hu/~meszaros/public_ftp/lptestset/problematic/

	CPLEX-B	XP-B	CPLEX-D/P	XP-D/P	MOSEK	LOQO	LIPSOL
solved	4	6	6/6	6/6	5	4	2

	BPMPD	CLP	LPABO	LPAKO	QSOPT	SOPLEX	GLPK
solved	6	6	5	4	6	4	4

Conclusions I

Best commercial IP codes tested:

CPLEX, XPRESS, MOSEK
LIPSOL
LOQO

Best commercial Simplex codes tested:

CPLEX P/D, XPRESS P/D

Conclusions II

Best free IP codes tested:

BPMPD
LPABO

Best free Simplex codes tested:

CLP
SOPLEX (new version?)

For not too large problems:

QSOPT, GLPK

FINAL SLIDE

Codes not tested:

lp_solve

COPL_LP, HOPDM, PCx

MINOS, other NLP solvers

Future work: ???