QAPLIB - A Quadratic Assignment Problem Library

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Problem Instances and Solutions

Complete List

Compressed Data and Solutions

Data: qapdata.tar.gz (453187 KB). Solutions: qapsoln.tar.gz (9836 KB).
("gunzip qap*xxxx*.tar.gz" and "tar xf qap*xxxx*.tar". This should result in 136 instances and 111 solutions.)

Description

The instances are listed in alphabetical order by the names of their authors. We shortly characterize the examples by indicating their generation. All the instances in the current version are pure quadratic. If not stated otherwise the examples are symmetric.

The format of the problem data is

n
A
B

where n is the size of the instance, and A and B are either flow or distance matrix. This corresponds to a QAP of the form

$$\min_p \sum_i \sum_j a_{ij} \, b_{p(i),p(j)}$$

where p is a permutation.

We quote the filename under which it is stored in the library and report the size of the problem. Then the objective function value of the best known feasible solution is given. In parentheses we indicate whether this solution is optimal or derived by a heuristic. The heuristics that are used are

- ant systems: (ANT) [Stuetzle:97].
- genetic hybrids: (GEN) [FlFe:94], (GEN-2) [OsRu:96], (GEN-3) [TaGa:97], and (GEN-4) [Mise:04].
- a greedy randomized adaptive search procedure: (GRASP) [LiPaRe:94],
- scatter search: (ScS) [CuMaMiTa:97],
- simulated annealing: (SIM-1) [BuRe:84], (SIM-2) [ThBo:94] and (SIM-3) [Mise:03], and
- simulated jumping: (SIMJ) [Amin:98].
- tabu search: parallel adaptive tabu search (PA-TS) [TaHaGe:97], reactive tabu search (Re-TS) [BaTe:94], robust tabu search (Ro-TS) [Taillard:91,Taillard:94], strict tabu search (S-TS) [Skorin:90], (TS-1) [Iriyama:97] , (TS-2) [Mise:05] and (ITS) [Mise:08]

If available we give a link to a solution for the instances. The format of these files is

```
n    sol
p
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where n gives the size of the instance, sol is the objective function value and p a corresponding permutation, i.e.

$$sol = \sum_i \sum_j a_{ij} \, b_{p(i),p(j)} .$$

For optimal solutions we enclose the optimal permutation while for nonoptimal solutions lower bounds are given. We also give explicit reference who solved hard instances of size n>15 first. The lower bounds given in the tables are

- the Gilmore-Lawler bound: (GLB) [Gilmore:62,Lawler:63],
- the elimination bound: (ELI) [HaReWo:92],
- an interior point based linear programming bound: (IPLP) [ReRaDr:94]
- a triangle decomposition bound: (TDB) [KaRe:95a],
- a semidefinite programming bound: (SDP) [ZhKaReWo:96],
- a bound based on a dual procedure: (DP) [HaGr:95],
- a bound based on a cutting plane approach: (CUT) [Kaibel:97],
- a dual framework based bound: (DFB) [KaCeClEs:98],
- a lift-and-project relaxation bound: (L&P) [http://www.optimization-online.org/DB_HTML/2004/06/890.html],
- a level-2 RLT bound: (RLT2) [HHJGSR:01],
- a semidefinite programming bound: (SDP1) [DKSo:07], and
- a semidefinite relaxation-matrix splitting bound: (SDRMS) [http://www.optimization-online.org/DB_HTML/2009/02/2220.html],

When lower bounds are included we also give the relative gap between best feasible soltion and best known lower bound in percent, i.e. *gap = (solution - bound)/(solution)**100 %.

R.E. Burkard and J. Offermann [BuOf:77]

The data of the first matrix correspond to the typing-time of an average stenotypist, while the second matrix describes the frequency of pairs of letters in different languages taken over 100,000 pairs for examples a-f and over 187,778 pairs for examples g-h. (Note that the solutions are not scaled for a flow matrix of 100,000 pairs anymore.) One also distinguishes between two types of typewriter keyboards. The instances are asymmetric.

	name	n	feas. solution	bound	gap
*	Bur26a	26	5426670 (OPT)	(26 15 11 7 4 12 13 2 6 18 1 5 9 21 8 14 3 20 19 25 17 10 16 24 23 22)	
*	Bur26b	26	3817852 (OPT)	(17 11 26 7 4 14 6 22 23 18 5 9 1 21 8 12 3 19 20 15 10 25 24 16 13 2)	
*	Bur26c	26	5426795 (OPT)	(12 3 2 13 16 25 11 15 10 9 18 19 8 20 4 21 1 5 14 24 22 6 23 7 26 17)	
*	Bur26d	26	3821225 (OPT)	(3 22 11 2 16 26 8 15 21 9 19 12 18 20 23 25 14 5 1 6 13 24 4 7 17 10)	
*	Bur26e	26	5386879 (OPT)	(14 4 13 7 16 25 26 17 1 15 12 20 18 19 3 8 21 9 5 24 6 10 22 2 23 11)	
*	Bur26f	26	3782044 (OPT)	(7 2 13 17 16 26 23 1 10 15 19 20 18 12 14 25 21 5 9 3 6 24 22 4 11 8)	
*	Bur26g	26	10117172 (OPT)	(22 11 2 23 13 25 24 8 1 21 20 4 7 18 12 15 9 19 5 26 16 6 14 3 17 10)	
*	Bur26h	26	7098658 (OPT)	(22 16 3 12 6 24 17 1 8 21 20 4 7 18 14 15 9 5 19 2 11 13 23 26 25 10)	

N. Christofides and E. Benavent [ChBe:89]

One matrix is the adjacency matrix of a weighted tree the other that of a complete graph.

name	n	solution	permutation
Chr12a	12	9552 (OPT)	(7,5,12,2,1,3,9,11,10,6,8,4)
Chr12b	12	9742 (OPT)	(5,7,1,10,11,3,4,2,9,6,12,8)
Chr12c	12	11156 (OPT)	(7,5,1,3,10,4,8,6,9,11,2,12)
Chr15a	15	9896 (OPT)	(5,10,8,13,12,11,14,2,4,6,7,15,3,1,9)
Chr15b	15	7990 (OPT)	(4,13,15,1,9,2,5,12,6,14,7,3,10,11,8)
Chr15c	15	9504 (OPT)	(13,2,5,7,8,1,14,6,4,3,15,9,12,11,10)
Chr18a	18	11098 (OPT)	(3,13,6,4,18,12,10,5,1,11,8,7,17,14,9,16,15,2)
Chr18b	18	1534 (OPT)	(1,2,4,3,5,6,8,9,7,12,10,11,13,14,16,15,17,18)
Chr20a	20	2192 (OPT)	(3,20,7,18,9,12,19,4,10,11,1,6,15,8,2,5,14,16,13,17)
Chr20b	20	2298 (OPT)	(20,3,9,7,1,12,16,6,8,14,10,4,5,13,17,2,18,11,19,15)
Chr20c	20	14142 (OPT)	(12,6,9,2,10,11,3,4,15,18,7,13,16,5,14,17,19,1,8,20)
Chr22a	22	6156 (OPT)	(15,2,21,8,16,1,7,18,14,13,5,17,6,11,3,4,20,19,9,22,10,12)
Chr22b	22	6194 (OPT)	(10,19,3,1,20,2,6,4,7,8,17,12,11,15,21,13,9,5,22,14,18,16)
Chr25a	25	3796 (OPT)	(25,12,5,3,18,4,16,8,20,10,14,6,15,23,24,19,13,1,21,11,17,2,22,7,9)

A.N. Elshafei [Elshafei:77]

The data describe the distances of 19 different facilities of a hospital and the flow of patients between those locations. The optimal solution was first found by [Mautor:92].

name	n	solution	permutation
Els19	19	17212548 (OPT)	(9,10,7,18,14,19,13,17,6,11,4,5,12,8,15,16,1,2,3)

B. Eschermann and H.J. Wunderlich [EsWu:90]

These examples stem from an application in computer science, from the testing of self-testable sequential circuits. The amount of additional hardware for the testing should be minimized. The optimal solutions are due to [ClPe:94] (*n*=16) and [BrClMaPe:96] (*n*=32).

	name	n	feas.sol.	permutation/bound	gap
	Esc16a	16	68 (OPT)	(2,14,10,16,5,3,7,8,4,6,12,11,15,13,9,1)	
	Esc16b	16	292 (OPT)	(6,3,7,5,13,1,15,2,4,11,9,14,10,12,8,16)	
	Esc16c	16	160 (OPT)	(11,14,10,16,12,8,9,3,13,6,5,7,15,2,1,4)	
	Esc16d	16	16 (OPT)	(14,2,12,5,6,16,8,10,3,9,13,7,11,15,4,1)	
	Esc16e	16	28 (OPT)	(16,7,8,15,9,12,14,10,11,2,6,5,13,4,3,1)	
	Esc16f	16	0 (OPT)	(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)	
	Esc16g	16	26 (OPT)	(8,11,9,12,15,16,14,10,7,6,2,5,13,4,3,1)	
	Esc16h	16	996 (OPT)	(13,9,10,15,3,11,4,16,12,7,8,5,6,2,1,14)	
	Esc16i	16	14 (OPT)	(13,9,11,3,7,5,6,2,1,15,4,14,12,10,8,16)	
	Esc16j	16	8 (OPT)	(8,3,16,14,2,12,10,6,9,5,13,11,4,7,15,1)	
*	Esc32a	32	130 (OPT)	(11,3,7,23,19,27,15,14,20,17,28,9,12,4,8,2,26,24,32,13,22,25,6,18,29,10,30,21,1,5,16,31)	
*	Esc32b	32	168 (OPT)	(15,31,7,8,23,24,16,32,14,10,30,26,5,6,13,9,2,1,21,22,29,25,18,17,12,27,20,11,3,19,28,4)	
*	Esc32c	32	642 (OPT)	(15,12,27,13,22,8,24,23,20,19,4,2,1,7,6,3,5,18,17,21,14,29,16,32,26,11,31,30,28,10,25,9)	
*	Esc32d	32	200 (OPT)	(18,29,10,2,25,32,22,20,24,17,30,9,1,26,31,21,19,23,27,16,13,6,3,11,15,7,8,5,14,4,12,28)	
	Esc32e	32	2 (OPT)	(1,2,5,6,8,16,13,19,9,32,7,22,24,20,4,12,3, 17,29,21,11,25,27,18,30,31,23,28,14,15,26,10)	
	Esc32g	32	6 (OPT)	(14,15,16,12,11,26,30,10,25,8,29,22,31,28, 13,1,19,9,17,32,24,18,4,2,20,5,21,3,7,6,23,27)	
*	Esc32h	32	438 (OPT)	(1,19,29,22,12,4,30,25,9,7,27,11,21,6,5,13,14, 31,10,28,8,3,23,26,17,2,32,15,24,18,20,16)	
*	Esc64a	64	116 (OPT)	(1,2,9,50,3,61,4,62,5,54,64,6,7,52,56,8,55,10,63,18,11,51,12,13,14,15,20,43,16,41,17,47,23,19,24,21,53,22,28,25,26,27,29,60,30,59,31,32,33,34,35,36,37,38,39,40,42,44,45,46,48,49,57,58)	
*	Esc128	128	64 (OPT)	(1,2,3,4,117,5,6,7,8,9,10,11,12,73,13,89, 14,15,16,17,18,19,20,21,22,23,24,53,25,26,102, 27,104,28,118,120,29,30,31,80,32,111,112,34,35, 36,97,98,38,39,100,40,99,41,42,43,44,45,46,47, 48,33,49,37,51,121,52,54,122,55,123,56,124,57, 125,58,126,59,127,128,81,60,61,62,63,64,113, 105,66,67,68,69,70,65,71,72,74,75,76,77,78,79, 82,83,84,85,86,87,88,90,50,91,114,92,93,94,95, 96,101,103,106,107,108,109,110,115,116,119)	

S.W. Hadley, F. Rendl and H. Wolkowicz [HaReWo:92]

The first matrix represents Manhattan distances of a connected cellular complex in the plane while the entries in the flow matrix are drawn uniformly from the interval [1,*n*]. The proof of optimality of the solution for *n=16* is due to [HaGrHa:96], for *n=18* and *n=20* due to [BrClMaPe:96]

name	n	solution	permutation
Had12	12	1652 (OPT)	(3,10,11,2,12,5,6,7,8,1,4,9)
Had14	14	2724 (OPT)	(8,13,10,5,12,11,2,14,3,6,7,1,9,4)
Had16	16	3720 (OPT)	(9,4,16,1,7,8,6,14,15,11,12,10,5,3,2,13)
Had18	18	5358 (OPT)	(8,15,16,6,7,18,14,11,1,10,12,5,3,13,2,17,9,4)
Had20	20	6922 (OPT)	(8,15,16,14,19,6,7,17,1,12,10,11,5,20,2,3,4,9,18,13)

J. Krarup and P.M. Pruzan [KrPr:78]

The instances contain real world data and were used to plan the Klinikum Regensburg in Germany.

	name	n	feas. solution	permutation/bound	gap
*	Kra30a	30	88900 (OPT)	(23,10,28,29,21,7,13,24,20,8,9,19,25,27,15, 4,22,12,6,5,16,11,3,2,17,1,30,26,18,14)	
*	Kra30b	30	91420 (OPT)	(23,26,19,25,20,22,11,8,9,14,27,30,12,6,28, 24,21,18,1,7,10,29,13,5,2,17,3,15,4,16)	
*	Kra32	32	88700 (OPT)	(31,23,18,21,22,19,10,11,15,9,30,29,14,12,17,26, 27,28,1,7,6,25,5,3,8,24,32,13,2,20,4,16)	

Y. Li and P.M. Pardalos [LiPa:92]

These instances come from problem generators described in [LiPa:92]. The generators provide asymmetric instances with known optimal solutions.

name	n	solution
Lipa20a	20	3683 (OPT)
Lipa20b	20	27076 (OPT)
Lipa30a	30	13178 (OPT)
Lipa30b	30	151426 (OPT)
Lipa40a	40	31538 (OPT)
Lipa40b	40	476581 (OPT)
Lipa50a	50	62093 (OPT)
Lipa50b	50	1210244 (OPT)
Lipa60a	60	107218 (OPT)
Lipa60b	60	2520135 (OPT)
Lipa70a	70	169755 (OPT)
Lipa70b	70	4603200 (OPT)
Lipa80a	80	253195 (OPT)
Lipa80b	80	7763962 (OPT)
Lipa90a	90	360630 (OPT)
Lipa90b	90	12490441 (OPT)

C.E. Nugent, T.E. Vollmann and J. Ruml [NuVoRu:68]

The following problem instances are probably the most used. The distance matrix contains Manhattan distances of rectangular grids. The instances of size *n* = {14,16,17,18,21,22,24,25} were constructed out of the larger instances by deleting certain rows and columns, see Clausen and Perregaard [ClPe:94]. The optimal solutions are also due to [ClPe:94]. For Nug21 and Nug22 optimality was proved by [BrClMaPe:96], for Nug24 by [CEKPT:96]. The instances of size *n* =27 and *n* =28 were constructed out of the instance of size *n* =30 by deleting the three or two last facilities, respectively, and were solved by Anstreicher, Brixius, Goux, and Linderoth. Aslo Nug 30 was solved by these authors. The solution was found by applying a branch and bound algorithm, see Anstreicher and Brixius [AnBr2:00]. The involved bound was based on convex quadratic programming, see Anstreicher and Brixius [AnBr1:00].

	name	n	feas.sol.	permutation/bound	gap
	Nug12	12	578 (OPT)	(12,7,9,3,4,8,11,1,5,6,10,2)	
	Nug14	14	1014 (OPT)	(9,8,13,2,1,11,7,14,3,4,12,5,6,10)	
	Nug15	15	1150 (OPT)	(1,2,13,8,9,4,3,14,7,11,10,15,6,5,12)	
	Nug16a	16	1610 (OPT)	(9,14,2,15,16,3,10,12,8,11,6,5,7,1,4,13)	
	Nug16b	16	1240 (OPT)	(16,12,13,8,4,2,9,11,15,10,7,3,14,6,1,5)	
	Nug17	17	1732 (OPT)	(16,15,2,14,9,11,8,12,10,3,4,1,7,6,13,17,5)	
	Nug18	18	1930 (OPT)	(10,3,14,2,18,6,7,12,15,4,5,1,11,8,17,13,9,16)	
	Nug20	20	2570 (OPT)	(18,14,10,3,9,4,2,12,11,16,19,15,20,8,13,17,5,7,1,6)	
	Nug21	21	2438 (OPT)	(4,21,3,9,13,2,5,14,18,11,16,10,6,15,20,19,8,7,1,12,17)	
	Nug22	22	3596 (OPT)	(2,21,9,10,7,3,1,19,8,20,17,5,13,6,12,16,11,22,18,14,15)	
	Nug24	24	3488 (OPT)	(17,8,11,23,4,20,15,19,22,18,3,14,1,10,7,9,16,21,24,12,6,13,5,2)	
	Nug25	25	3744 (OPT)	(5,11,20,15,22,2,25,8,9,1,18,16,3,6,19,24,21,14,7,10,17,12,4,23,13)	
*	Nug27	27	5234 (OPT)	(23,18,3,1,27,17,5,12,7,15,4,26,8,19,20,2,24,21,14,10,9,13,22,25,6,16,11)	
*	Nug28	28	5166 (OPT)	(18,21,9,1,28,20,11,3,13,12,10,19,14,22,15,2,25,16,4,23,7,17,24,26,5,27,8,6)	
*	Nug30	30	6124 (OPT)	(5 12 6 13 2 21 26 24 10 9 29 28 17 1 8 7 19 25 23 22 11 16 30 4 15 18 27 3 14 20)	

C. Roucairol [Roucairol:87]

The entries of the matrices are chosen from the interval [1,100].

name	n	feas.sol.	permutation
Rou12	12	235528 (OPT)	(6,5,11,9,2,8,3,1,12,7,4,10)
Rou15	15	354210 (OPT)	(12,6,8,13,5,3,15,2,7,1,9,10,4,14,11)
Rou20	20	725522 (OPT)	(1,19,2,14,10,16,11,20,9,5,7,4,8,18,15,3,12,17,13,6)

M. Scriabin and R.C. Vergin [ScVe:75]

The distances of these problems are rectangular. The optimal solution for the instanze of size *n*=20 was found by [Mautor:92].

name	n	solution	permutation
Scr12	12	31410 (OPT)	(8,6,3,2,10,1,5,9,4,7,12,11)
Scr15	15	51140 (OPT)	(15,7,11,8,1,4,3,2,12,6,13,5,14,10,9)
Scr20	20	110030 (OPT)	(20,7,12,6,4,8,3,2,14,11,18,9,19,15,16,17,13,5,10,1)

J. Skorin-Kapov [Skorin:90]

The distances of these problems are rectangular and the entries in flow matrices are pseudorandom numbers.

	name	n	feas.sol.	bound	gap
	Sko42	42	15812 (Ro-TS)	14934 (TDB)	5.56 %
	Sko49	49	23386 (Ro-TS)	22004 (TDB)	5.91 %
	Sko56	56	34458 (Ro-TS)	32610 (TDB)	5.37 %
	Sko64	64	48498 (Ro-TS)	45736 (TDB)	5.70 %
	Sko72	72	66256 (Ro-TS)	62691 (TDB)	5.38 %
	Sko81	81	90998 (GEN)	86072 (TDB)	5.41 %
*	Sko90	90	115534 (Ro-TS)	109030 (SDRMS-SUM)	5.63 %
*	Sko100a	100	152002 (GEN)	143846 (SDRMS-SUM)	5.37 %
*	Sko100b	100	153890 (GEN)	145522 (SDRMS-SUM)	5.44 %
*	Sko100c	100	147862 (GEN)	139881 (SDRMS-SUM)	5.54 %
*	Sko100d	100	149576 (GEN)	141289 (SDRMS-SUM)	5.54 %
*	Sko100e	100	149150 (GEN)	140893 (SDRMS-SUM)	5.54 %
*	Sko100f	100	149036 (GEN)	140691 (SDRMS-SUM)	5.60 %

L. Steinberg [Steinberg:61]

The three instances model the backboard wiring problem. The distances in the first one are Manhattan, in the second squared Euclidean, and in the third one Euclidean distances (multiplied by 1000).

	name	n	feas.sol.	permutation/bound	gap
*	Ste36a	36	9526 (OPT)	(35,5,6,12,11,27,26,25,24,9,4,1,13,20,14,23,21,22,2,8,10,7,28,19,32,34,33,17,18,3,15,16,29,30,31,36)	

*	Ste36b	36	15852 (OPT)	(35,31,30,29,28,1,15,9,16,33,34,32,19,20,7,10,18,17,26,25,23,14,12,13,4,8,2,24,22,21,27,11,6,5,3,36)
*	Ste36c	36	8239110 (OPT)	(3,19,29,21,30,31,13,20,2,12,32,23,22,24,4,1,10,11,15,14,26,27,25,36,35,34,33,5,6,7,8,16,18,17,28,9)

E.D. Taillard [Taillard:91,Taillard:94]

The instances Tai*xx*a are uniformly generated and were proposed in [Taillard:91]. The other problems were introduced in [Taillard:94]. Problems Tai*xx*b are asymmetric and randomly generated. Instances Tai*xx*c occur in the generation of grey patterns. The optimality of the solutions for Tai17a and Tai20a was proved by [BrClMaPe:96], while the method of [HaGrHa:96] proved optimality of Tai20b and the Tai25a. Giovannetti [Giovannetti:97] showed the optimality of Tai25b. Drezner [Drez:06] proved the optimality of the Tai64c. Drezner's method is branch and bound. His bound exploits the special structure of the problem.

	name	n	feas.sol.	permutation/bound	gap
	Tai12a	12	224416 (OPT)	(8,1,6,2,11,10,3,5,9,7,12,4)	
	Tai12b	12	39464925 (OPT)	(9,4,6,3,11,7,12,2,8,10,1,5)	
	Tai15a	15	388214 (OPT)	(5,10,4,13,2,9,1,11,12,14,7,15,3,8,6)	
	Tai15b	15	51765268 (OPT)	(1,9,4,6,8,15,7,11,3,5,2,14,13,12,10)	
	Tai17a	17	491812 (OPT)	(12,2,6,7,4,8,14,5,11,3,16,13,17,9,1,10,15)	
	Tai20a	20	703482 (OPT)	(10,9,12,20,19,3,14,6,17,11,5,7,15,16,18,2,4,8,13,1)	
*	Tai20b	20	122455319 (OPT)	(8,16,14,17,4,11,3,19,7,9,1,15,6,13,10,2,5,20,18,12)	
*	Tai25a	25	1167256 (OPT)	(9,4,6,11,5,1,15,10,14,3,17,12,19,18,23,8,21,2,22,7,16,20,24,25,13)	
*	Tai25b	25	344355646 (OPT)	(4,15,10,9,13,5,25,19,7,3,17,6,18,20,16,2,22,23,8,11,21,24,14,12,1)	
	Tai30a	30	1818146 (Ro-TS)	1706855 (L&P)	6.12 %
*	Tai30b	30	637117113 (OPT)	(4 8 11 15 17 20 21 5 14 30 2 13 6 29 10 26 27 24 28 22 12 9 7 23 19 18 25 16 1 3)	
	Tai35a	35	2422002 (Ro-TS)	2216627 (L&P)	8,48 %
*	Tai35b	35	283315445 (Ro-TS)	242172800 (SDRMS-SUM)	14.52 %
	Tai40a	40	3139370 (Ro-TS)	2843274 (L&P)	9.43 %
*	Tai40b	40	637250948 (Ro-TS)	564428353 (SDRMS-SUM)	11.43 %
*	Tai50a	50	4938796 (ITS)	4390920 (L&P)	11.09 %
*	Tai50b	50	458821517 (Ro-TS)	395543467 (SDRMS-SUM)	13.79 %
*	Tai60a	60	7205962 (TS-2)	5578356 (SDRMS)	22.59 %
*	Tai60b	60	608215054 (Ro-TS)	542376603 (SDRMS-SUM)	10.82 %
	Tai64c	64	1855928 (BandB)	(1,3,5,15,17,20,30,35,40,45,49,51,55,2,4,6,7,8,9,10,11,12,13,14,16,18,19,21,22,23,24,25,26,27,28,29,31,32,33,34,36,37,38,39,41,42,43,44,46,47,48,50,52,53,54,56,57,58,59,60,61,62,63,64)	
*	Tai80a	80	13499184 (ITS)	10501941 (DP)	22.20 %
*	Tai80b	80	818415043 (Ro-TS)	717907288 (SDRMS-SUM)	12.28 %
*	Tai100a	100	21052466 (ITS)	15844731 (SDRMS)	24.86 %
*	Tai100b	100	1185996137 (Ro-TS)	1058131796 (SDRMS-SUM)	10.78 %
*	Tai150b	150	498896643 (GEN-3)	441786736 (SDRMS-SUM)	11.45 %
*	Tai256c	256	44759294 (ANT)	43849646 (SDRMS)	2.03 %

U.W. Thonemann and A. Bölte [ThBo:94]

The distances of these instances are rectangular.

	name	n	feas.sol.	bound	gap
*	Tho30	30	149936 (OPT)	(8,6,20,17,19,12,29,15,1,2,30,11,13,28,23, 27,16,22,10,21,25,24,26,18,3,14,7,5,9,4)	
	Tho40	40	240516 (SIM-2)	224414 (L&P)	6.69 %
*	Tho150	150	8133398 (SIM-3)	7620628 (TDB)	6.30 %

M.R. Wilhelm and T.L. Ward [WiWa:87]

The distances of these problems are rectangular.

	name	n	feas.sol.	bound	gap
	Wil50	50	48816 (SIM-2)	47098 (TDB)	3.52 %
*	Wil100	100	273038 (GEN)	264442 (SDRMS-SUM)	3.15 %

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