

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
alan	1	11	10	1	2.17E-019	9.93E+000
alan	2	11	11	0	6.14E-003	9.74E-018
alan	3	(IL)	130(INF)			
alan	4	10	13	2	1.04E-002	1.47E+001
alan	5	(IL)	55(INF)			
alan	6	10	15	0	1.64E-004	3.33E-001
alan	7	11	11	4	3.23E-002	5.79E-001
alan	8	(IL)	75(INF)			
alan	9	11	13	2	7.66E-003	2.58E+000
alan	10	13	18	2	7.61E-002	1.53E-001
alan	11	11	15	2	8.93E-002	3.14E+001
alan	12	12	9	2	1.05E-002	1.47E-001
alan	13	11	10	0	5.79E-025	6.86E+000
alan	14	(IL)	62(INF)			
alan	15	11	10	2	4.52E-002	5.11E+000
alan	16	12	13	0	1.91E-003	1.15E+001
alan	17	11	13	2	7.28E-002	6.10E+000
alan	18	12	10	3	8.51E-002	8.53E+000
alan	19	(IL)	(IL)			
alan	20	13	13	0	1.87E-004	2.27E-001
eg_disc.s	1	19	22	2	1.36E-003	3.29E-003
eg_disc.s	2	18	19	1	1.65E-003	1.69E-001
eg_disc.s	3	19	17	0	1.83E-004	2.47E-002
eg_disc.s	4	20	18	38	9.50E-002	9.09E-001
eg_disc.s	5	23	22	1	1.36E-004	1.52E-002
eg_disc.s	6	22	17	2	4.90E-004	5.16E-003
eg_disc.s	7	20	22	1	2.17E-004	4.06E-006
eg_disc.s	8	53	26	2	5.65E-003	4.13E-001
ex1223	1	14	22	1	1.64E-002	1.60E+001
ex1223	2	15	25	3	7.43E-003	1.71E+001
ex1223	3	18	28	2	8.30E-002	1.63E+001
ex1223	4	16	38	1	5.18E-002	1.30E+000
ex1223	5	17	33	27	9.15E+000	1.81E+000
ex1223	6	14	29	4	7.31E-002	1.39E+001
ex1223	7	13	29	7	1.32E-001	2.24E+001
ex1223	8	13	37	4	2.14E-003	1.74E+001
ex1223	9	15	32	4	5.22E-002	1.77E+001
ex1223	10	13	29	4	1.16E-001	1.71E+001
ex1223	11	13	32	5	8.17E-002	2.95E+005
ex1223	12	12	32	3	3.80E-002	1.59E+001
ex1223	13	17	34	2	4.81E-002	1.66E+001
ex1223	14	12	31	1	4.64E-002	1.61E+001
ex1223	15	13	33	2	3.45E-002	1.65E+001
ex1223	16	15	22	4	4.99E-002	1.66E+001
ex1223	17	19	27	1	4.96E-002	1.56E+001
ex1223	18	12	29	3	3.23E-002	1.61E+001
ex1223	19	13	36	1	5.05E-002	1.61E+001
ex1223	20	20	35	2	4.06E-002	1.65E+001
ex1223a	1	14	13	1	2.08E-002	9.66E-001
ex1223a	2	11	10	8	3.18E-002	1.70E+000
ex1223a	3	12	11	0	2.81E-002	6.73E-002
ex1223a	4	12	10	1	1.79E-002	1.39E-001
ex1223a	5	12	14	1	5.85E-003	5.10E-002
ex1223a	6	10	10	1	4.47E-018	8.16E-001
ex1223a	7	12	10	2	3.43E-004	1.07E-001
ex1223a	8	12	10	0	2.67E-002	2.38E-001
ex1223a	9	12	11	1	4.93E-015	2.53E-001
ex1223a	10	22	28	16	7.02E+000	5.07E-001

TABLE 1. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for cold-starts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
ex1223b	1	13	12	0	2.89E-002	2.37E-001
ex1223b	2	12	15	3	1.89E-002	5.51E+000
ex1223b	3	12	15	0	9.44E-004	2.24E-003
ex1223b	4	12	10	1	4.78E-003	2.00E-001
ex1223b	5	12	13	2	6.57E-003	4.34E-001
ex1223b	6	12	16	2	1.73E-002	4.95E-001
ex1223b	7	13	11	2	2.01E-002	1.26E+000
ex1223b	8	12	16	1	1.64E-002	1.97E-001
ex1223b	9	12	11	1	1.59E-002	1.14E-001
ex1223b	10	12	10	1	1.33E-002	6.84E-002
ex1223b	11	12	10	1	2.39E-003	6.30E-002
ex1223b	12	12	11	0	8.90E-003	4.01E-001
ex1223b	13	12	10	5	3.44E-002	7.65E-001
ex1223b	14	13	14	19	7.10E+000	5.82E-001
ex1224	1	19	13	2	2.83E-002	1.33E+002
ex1224	2	19	16	2	1.05E-001	5.93E-005
ex1224	3	18	17	1	2.67E-002	1.85E-004
ex1224	4	17	17	2	2.57E-005	1.37E+002
ex1224	5	17	21	2	3.10E-002	3.69E-004
ex1224	6	20	30	2	1.25E-001	8.02E-005
ex1224	7	35	13	1	1.05E-002	1.25E-003
ex1224	8	30	33	2	3.48E-004	9.29E+001
ex1224	9	51	36	0	1.70E-003	1.31E-004
ex1224	10	56	53	0	1.98E-004	1.95E-005
ex1224	11	47	28	3	1.01E-001	6.24E-005
ex1224	12	55	48	3	1.36E-002	1.51E-003
ex1224	13	25	18	1	3.04E-003	6.20E-005
ex1224	14	24	27	1	2.53E-002	1.32E-006
ex1224	15	31	41	2	1.27E-001	3.66E-004
ex1225	1	13	9	3	2.76E-001	5.95E+000
ex1225	2	13	9	2	3.90E-003	7.79E-001
ex1225	3	10	13	1	4.61E-002	3.66E+001
ex1225	4	10	12	5	7.45E-001	6.64E+001
ex1225	5	10	12	2	3.05E-003	1.82E+001
ex1225	6	(IL)	81(INF)			
ex1225	7	(IL)	63(INF)			
ex1225	8	14	12	4	2.62E-001	6.71E+001
ex1225	9	11	12	22	7.20E-001	1.56E+000
ex1225	10	(IL)	(IL)			
ex1225	11	13	13	1	7.65E-021	2.19E-001
ex1225	12	(IL)	70(INF)			
ex1225	13	12	13	2	3.73E-001	2.28E+000
ex1225	14	14	10	7	5.61E-002	5.64E+000
ex1225	15	14	11	3	4.98E-002	3.39E+001
ex1225	16	16	15	0	5.54E-004	2.75E+000
ex3	1	17	22	1	3.05E-005	9.77E+000
ex3	2	17	26	2	1.12E-002	6.99E+000
ex3	3	17	24	6	2.70E-001	1.36E+001
ex3	4	17	25	8	5.50E-002	1.45E+001
ex3	5	22	22	4	1.70E-002	2.56E+001
ex3	6	18	33	2	7.76E-003	6.93E-001
ex3	7	17	27	7	3.70E-002	1.60E+001
ex3	8	18	24	2	3.52E-003	1.63E+001
ex3	9	18	34	48	1.47E+000	1.69E+002
ex3	10	21	18	9	4.02E-001	1.31E+001
ex3	11	17	20	8	3.87E-002	1.88E+001
ex3	12	21	22	6	1.89E-001	5.73E+000
ex3	13	17	26	18	4.07E-001	7.45E+001
ex3	14	20	27	11	2.76E-001	4.68E-001
ex3	15	17	32	2	2.39E-003	8.53E+000
ex3	16	18	27	4	1.16E-002	8.59E+000
ex3	17	17	27	1	2.09E-005	1.94E+001
ex3	18	19	39	18	5.89E-001	2.28E+001

TABLE 2. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for coldstarts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
fuel	1	44	23	24	4.12E+000	1.22E+001
fuel	2	53	27	0	1.56E-004	1.97E-004
fuel	3	46	19	6	8.61E-002	1.96E+003
fuel	4	17	33	0	2.13E-004	1.95E-004
fuel	5	48	26	3	5.17E-002	4.27E+000
fuel	6	17	19	0	8.23E-005	3.14E+003
gbd	1	(IL)	(IL)			
gbd	2	9	11	0	7.50E-003	4.31E-015
gbd	3	10	14	10	1.34E+000	6.00E-001
gbd	4	9	10	4	2.20E-001	1.19E+021
gkocis	1	16	14	1	2.81E-003	2.04E-003
gkocis	2	14	18	1	5.70E-020	3.24E+000
gkocis	3	14	33	1	4.60E-003	5.61E-003
gkocis	4	14	20	2	4.01E-001	4.98E+000
gkocis	5	13	17	14	3.98E-001	9.66E+000
gkocis	6	14	16	1	1.54E-018	1.54E-002
gkocis	7	15	18	4	7.03E-001	1.62E+001
gkocis	8	13	23	2	2.05E-001	2.55E+000
nvs03	1	21	16	3	8.92E-003	9.84E-001
nvs03	2	11	15	0	8.33E-003	7.73E+000
nvs03	3	21	18	2	8.26E-003	9.98E-001
nvs03	4	(IL)	59(INF)			
nvs03	5	21	21	1	3.57E-002	1.44E+002
nvs03	6	(IL)	60(IMP)			
nvs03	7	23	21	2	3.42E-003	6.89E-001
nvs03	8	(IL)	56(INF)			
nvs04	1	17	15	2	1.53E-001	0.00E+000
nvs04	2	72	42	3	9.91E-001	0.00E+000
nvs04	3	43	25	1	1.98E+000	0.00E+000
nvs04	4	68	59	1	2.00E-001	0.00E+000
nvs06	1	9	11	1	8.99E-003	0.00E+000
nvs06	2	12	19	0	2.62E-002	0.00E+000
nvs06	3	13	12	1	3.73E-002	0.00E+000
nvs06	4	16	14	3	5.38E-001	0.00E+000
nvs06	5	13	12	1	2.34E-002	0.00E+000
nvs06	6	18	14	1	3.73E-004	0.00E+000
nvs06	7	13	12	1	4.11E-002	0.00E+000
nvs07	1	17	21	0	6.35E-010	3.19E-007
nvs07	2	36	38	5	9.46E-001	4.81E-001
nvs07	3	11	17	2	4.01E-003	3.99E-001
nvs07	4	14	15	1	9.76E-002	2.50E-003
nvs08	1	16	17	1	3.85E-002	4.70E-002
nvs08	2	12	23	7	2.23E+000	4.62E-001
nvs08	3	28	17	1	2.56E-004	2.35E-003
nvs08	4	15	13	2	4.43E-002	3.36E-001
nvs08	5	76	21	2	1.24E-002	2.38E+002
nvs08	6	17	14	3	3.80E-002	3.50E-001
nvs10	1	16	18	1	4.78E-003	9.07E-009
nvs10	2	15	14	1	9.82E-003	5.92E-017
nvs10	3	24	11	6	1.16E+001	6.67E-001
nvs10	4	23	18	1	8.42E-003	1.60E-003
nvs11	1	16	27	1	1.05E-002	1.13E-016
nvs11	2	15	14	1	6.24E-005	7.36E-016
nvs11	3	16	14	1	1.29E-002	3.34E-016
nvs11	4	21	14	9	9.89E+000	7.50E-001
nvs11	5	20	12	1	7.29E-003	1.63E-003
nvs11	6	20	25	1	4.75E-003	4.06E-013
nvs11	7	30	13	1	6.87E-004	5.08E-018
nvs11	8	18	18	1	9.55E-004	1.38E-016

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Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
nvs12	1	17	16	1	6.91E-004	2.17E-015
nvs12	2	16	17	3	1.32E-002	1.55E-016
nvs12	3	17	15	1	9.44E-005	3.09E-015
nvs12	4	17	14	3	9.46E-003	1.79E-003
nvs12	5	23	16	1	8.45E-004	1.28E-016
nvs12	6	24	20	1	1.25E-002	2.43E-016
nvs12	7	22	14	2	6.52E-003	1.99E-003
nvs12	8	22	19	1	9.87E-003	1.51E-016
nvs12	9	22	16	12	8.16E+000	8.00E-001
nvs12	10	24	20	1	4.77E-003	1.27E-014
nvs12	11	25	18	1	1.12E-002	2.64E-018
nvs12	12	20	17	1	8.55E-004	1.55E-018
nvs13	1	16	17	3	3.24E-003	3.88E-005
nvs13	2	19	18	2	9.63E-003	1.42E-003
nvs13	3	21	18	1	2.58E-003	1.18E-003
nvs13	4	20	18	0	2.91E-004	2.62E-004
nvs13	5	19	17	1	6.94E-003	4.21E-004
nvs13	6	23	15	2	5.21E-003	2.95E-003
nvs13	7	22	19	3	5.67E-003	4.41E-005
nvs13	8	23	22	2	3.58E-003	2.04E-004
nvs13	9	19	18	1	1.55E-002	1.55E-003
nvs13	10	22	15	15	1.31E+001	8.28E-001
nvs13	11	22	18	1	4.13E-004	6.14E-018
nvs13	12	23	15	2	1.34E-005	1.27E-006
nvs13	13	29	22	1	9.57E-004	2.47E-016
nvs13	14	25	15	1	3.90E-005	6.50E-017
nvs15	1	17	17	3	3.85E-001	2.81E+002
nvs15	2	21	19	3	4.76E-002	5.02E+001
nvs15	3	23	18	1	4.98E-003	2.58E-003
nvs15	4	30	25	2	2.01E-001	4.71E-002
nvs15	5	13	18	1	3.79E-002	4.71E-002
nvs15	6	26	27	6	9.83E-001	3.02E-001
nvs15	7	29	27	1	8.55E-002	1.65E-001
nvs15	8	13	16	2	1.03E-012	2.00E-001
nvs17	1	14	15	1	5.52E-004	1.18E-017
nvs17	2	15	16	1	3.29E-004	4.84E-018
nvs17	3	16	22	2	1.29E-003	1.73E-020
nvs17	4	16	17	0	6.07E-018	9.47E-021
nvs17	5	16	17	3	3.27E-003	3.83E-018
nvs17	6	16	17	1	2.32E-005	1.21E-015
nvs17	7	23	17	2	5.45E-004	3.50E-004
nvs17	8	22	17	0	7.69E-006	5.97E-007
nvs17	9	22	17	2	1.97E-003	1.06E-003
nvs17	10	20	17	3	4.21E-003	1.17E-003
nvs17	11	23	19	0	1.05E-003	8.25E-005
nvs17	12	23	16	1	3.39E-004	3.96E-019
nvs17	13	22	15	1	7.18E-004	1.27E-016
nvs17	14	26	20	2	6.22E-003	3.51E-003
nvs17	15	22	19	3	2.38E-003	4.61E-018
nvs17	16	24	18	2	2.36E-003	5.26E-019
nvs17	17	25	15	1	3.80E-004	5.16E-018
nvs17	18	22	16	1	5.55E-003	1.21E-003
nvs17	19	26	19	1	5.38E-004	6.41E-017
nvs17	20	24	17	2	4.52E-003	1.27E-019
nvs17	21	25	17	21	1.73E+001	8.72E-001
nvs17	22	22	18	2	5.25E-003	5.02E-004
nvs17	23	20	22	2	5.74E-003	6.23E-004
nvs17	24	23	18	1	3.50E-004	1.46E-016
nvs17	25	21	15	2	3.63E-003	8.34E-006

TABLE 4. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for coldstarts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
nvs17	26	21	14	3	5.05E-003	1.29E-005
nvs17	27	25	18	1	7.33E-004	4.44E-018
nvs17	28	26	16	2	2.40E-003	3.37E-022
nvs17	29	24	17	3	1.03E-002	9.14E-003
nvs17	30	22	16	1	4.47E-004	5.66E-019
nvs17	31	23	19	1	2.32E-003	3.72E-018
nvs17	32	22	17	2	3.77E-003	2.35E-003
nvs17	33	24	16	3	4.87E-003	1.05E-017
nvs17	34	24	16	1	1.27E-003	1.53E-014
nvs17	35	23	21	2	6.60E-004	6.49E-020
nvs17	36	21	20	1	2.71E-003	8.21E-017
nvs17	37	16	14	1	1.79E-002	1.49E-004
nvs17	38	17	17	1	1.54E-003	7.01E-004
nvs17	39	18	18	1	4.36E-003	4.00E-018
nvs17	40	18	15	1	3.36E-003	3.59E-016
nvs17	41	25	16	1	5.48E-004	4.20E-016
nvs17	42	25	19	1	1.36E-004	7.14E-018
nvs17	43	24	16	2	1.10E-005	2.13E-007
nvs17	44	27	17	2	7.21E-003	5.75E-004
nvs17	45	28	16	2	2.76E-003	4.96E-015
nvs17	46	23	17	0	5.78E-004	1.99E-004
nvs17	47	26	15	2	7.96E-004	1.21E-004
nvs17	48	25	18	2	2.75E-003	6.56E-004
nvs17	49	23	17	1	1.12E-003	3.61E-017
nvs17	50	21	16	3	2.50E-003	1.17E-018
nvs17	51	25	23	1	8.63E-006	9.93E-018
nvs17	52	22	13	1	6.48E-004	5.03E-019
nvs18	1	22	19	1	2.73E-002	3.44E-004
nvs18	2	19	19	1	7.99E-003	3.75E-003
nvs18	3	21	23	1	3.16E-003	1.18E-003
nvs18	4	20	21	2	2.69E-003	7.73E-004
nvs18	5	18	17	3	3.01E-003	2.26E-004
nvs18	6	22	16	2	8.77E-003	4.30E-003
nvs18	7	27	20	1	3.57E-003	6.21E-005
nvs18	8	23	16	1	6.89E-004	5.14E-017
nvs18	9	20	19	2	2.15E-004	8.48E-005
nvs18	10	22	17	1	3.25E-004	1.14E-017
nvs18	11	20	15	0	1.41E-004	6.39E-015
nvs18	12	19	15	3	1.50E-003	5.49E-004
nvs18	13	20	22	18	1.49E+001	8.54E-001
nvs18	14	21	18	3	1.25E-002	6.10E-003
nvs18	15	24	20	3	3.72E-003	3.65E-003
nvs18	16	23	22	1	1.81E-003	2.83E-004
nvs18	17	27	19	2	1.05E-002	2.20E-004
nvs18	18	21	20	3	2.05E-003	1.21E-020
nvs18	19	21	15	3	4.23E-003	7.64E-006
nvs18	20	17	27	2	4.93E-003	1.11E-005
nvs18	21	17	17	3	7.35E-003	6.86E-004
nvs18	22	22	18	1	2.41E-005	8.06E-018
nvs18	23	23	16	2	5.52E-003	5.86E-018
nvs18	24	22	15	1	1.16E-003	1.17E-005
nvs18	25	29	25	2	3.25E-003	1.45E-004
nvs18	26	24	18	1	3.63E-004	5.88E-005
nvs18	27	17	13	2	1.64E-005	1.63E-007
nvs18	28	16	14	2	7.46E-003	1.10E-003
nvs18	29	23	20	1	1.61E-007	1.64E-007
nvs18	30	21	19	1	1.36E-003	7.45E-018

TABLE 5. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for coldstarts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
nvs20	1	13	19	1	1.16E-003	1.82E-003
nvs20	2	13	20	4	2.61E-001	3.27E-001
nvs20	3	14	17	4	8.82E-002	4.93E-002
nvs20	4	15	21	2	1.77E-001	1.29E-001
nvs20	5	13	22	5	2.13E-001	6.52E-001
nvs20	6	14	20	4	7.81E-003	1.13E-002
nvs20	7	14	18	3	1.13E-001	8.17E-002
nvs20	8	14	22	0	2.64E-004	3.38E-004
nvs20	9	30	24	3	1.07E-001	1.65E-001
nvs20	10	23	32	4	2.02E-001	1.41E-001
nvs20	11	14	25	5	7.60E-002	8.14E-002
nvs20	12	15	21	28	4.64E-001	1.00E+003
nvs20	13	13	25	1	6.70E-004	3.25E-003
nvs20	14	14	25	2	9.07E-002	1.02E-001
nvs20	15	13	21	4	4.50E-002	2.16E-002
nvs20	16	13	21	1	5.54E-003	2.01E-003
nvs20	17	14	22	1	6.55E-005	2.80E-004
nvs20	18	13	25	2	4.49E-002	5.01E-002
nvs20	19	14	23	0	4.63E-002	3.95E-002
nvs20	20	15	22	0	3.73E-002	2.15E-002
nvs20	21	29	26	1	3.77E-002	2.17E-002
nvs20	22	11	32	6	1.10E-001	8.43E-002
oaer	1	17	14	3	4.47E-001	1.19E+000
oaer	2	17	16	10	4.47E-001	1.37E+001
prob03	1	9	8	1	6.01E-002	3.52E-002
prob03	2	(IL)	51(IMP)			
prob03	3	8	11	1	3.75E-001	2.00E+000
prob03	4	11	10	0	2.02E-001	1.76E-001
prob03	5	8	10	2	1.75E-002	8.00E-001
prob03	6	9	10	1	9.32E-020	1.57E+002
prob10	1	37	45	1	9.72E-003	1.74E-001
prob10	2	31	26	7	4.58E+001	1.42E+000
procsel	1	13	16	3	6.15E-001	8.18E+000
procsel	2	14	10	1	2.70E-019	7.65E-001
procsel	3	14	11	2	2.42E-001	2.67E+000
procsel	4	13	13	1	3.05E-003	3.65E-003
procsel	5	13	10	9	7.90E-001	3.17E+001
procsel	6	14	17	2	4.56E-001	6.56E+000
procsel	7	16	21	1	2.44E-003	1.94E-003
procsel	8	14	15	1	9.54E-018	6.37E-002
st_e14	1	14	22	1	4.96E-002	1.56E+001
st_e14	2	15	25	3	7.43E-003	1.71E+001
st_e14	3	18	28	1	4.64E-002	1.61E+001
st_e14	4	16	38	2	4.81E-002	1.66E+001
st_e14	5	17	33	3	3.80E-002	1.59E+001
st_e14	6	14	29	4	5.22E-002	1.77E+001
st_e14	7	13	29	7	1.32E-001	2.24E+001
st_e14	8	13	37	5	8.17E-002	2.95E+005
st_e14	9	15	32	2	3.45E-002	1.65E+001
st_e14	10	13	29	2	3.60E-003	2.23E+001
st_e14	11	13	32	4	2.14E-003	1.74E+001
st_e14	12	12	32	1	5.18E-002	1.30E+000
st_e14	13	17	34	3	3.23E-002	1.61E+001
st_e14	14	12	31	1	1.64E-002	1.60E+001
st_e14	15	13	33	4	7.31E-002	1.39E+001
st_e14	16	15	22	1	5.05E-002	1.61E+001
st_e14	17	19	27	4	4.99E-002	1.66E+001
st_e14	18	12	29	2	8.30E-002	1.63E+001
st_e14	19	13	36	4	1.16E-001	1.71E+001
st_e14	20	20	35	27	9.15E+000	1.81E+000

TABLE 6. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for cold-starts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
st_e29	1	19	13	0	1.98E-004	1.95E-005
st_e29	2	19	16	2	1.25E-001	8.02E-005
st_e29	3	18	17	20	7.67E+000	8.77E-001
st_e29	4	17	17	2	3.10E-002	3.69E-004
st_e29	5	17	21	2	1.05E-001	5.93E-005
st_e29	6	20	30	1	2.67E-002	1.85E-004
st_e29	7	35	13	3	1.01E-001	6.24E-005
st_e29	8	30	33	1	1.05E-002	1.25E-003
st_e29	9	51	36	0	1.70E-003	1.31E-004
st_e29	10	56	53	2	1.27E-001	3.66E-004
st_e29	11	47	28	1	2.53E-002	1.32E-006
st_e29	12	55	48	2	2.57E-005	1.37E+002
st_e29	13	25	18	3	1.36E-002	1.51E-003
st_e29	14	24	27	1	3.04E-003	6.20E-005
st_e29	15	31	41	2	3.48E-004	9.29E+001
st_test1	1	7	10	9	6.40E-001	5.00E-001
st_test1	2	7	10	0	2.93E-018	4.57E-019
st_test1	3	8	11	0	6.08E-021	1.71E-018
st_test1	4	8	10	0	2.83E-021	6.57E-023
st_test1	5	7	10	0	6.52E-021	5.56E-021
st_test1	6	8	10	0	4.06E-022	1.89E-019
st_test1	7	8	10	0	9.23E-019	6.10E-017
st_test1	8	7	10	0	5.27E-020	1.06E-017
st_test1	9	7	11	0	2.40E-021	1.71E-016
st_test1	10	8	10	0	2.12E-019	4.60E-019
st_test1	11	8	10	0	9.85E-019	5.96E-017
st_test1	12	8	11	0	1.95E-019	3.93E-023
st_test1	13	7	10	0	5.09E-022	4.47E-019
st_test1	14	7	10	0	8.10E-020	3.55E-023
st_test2	1	12	15	1	6.94E-003	9.26E-001
st_test2	2	11	14	1	6.28E-016	1.00E-001
st_test2	3	11	14	8	2.69E+000	4.81E-001
st_test2	4	13	13	1	6.25E-002	4.00E-001
st_test4	1	12	11	2	9.09E-002	3.64E-002
st_test4	2	11	11	2	2.71E-005	1.31E-001
st_test4	3	11	13	1	5.78E-006	2.04E-002
st_test4	4	17	12	2	2.32E-005	2.76E-001
st_test4	5	12	11	2	5.15E-003	2.30E+003
st_test4	6	11	10	0	1.30E-003	6.58E+001
st_test4	7	(IL)	71(IMP)			
st_test4	8	13	10	3	4.05E-002	4.22E-001
st_test4	9	11	11	2	3.90E-002	2.22E-002
st_test4	10	9	12	10	1.35E+001	6.88E-001
st_test4	11	8	11	2	2.83E-004	5.88E-002
st_test4	12	(IL)	65(IMP)			
st_test4	13	13	11	1	2.26E-003	5.70E-002
st_test4	14	12	14	2	3.79E-002	5.70E-002
st_test4	15	9	12	2	2.87E-002	5.00E-002
st_test4	16	(IL)	75(IMP)			
st_test4	17	15	17	4	4.74E-001	4.71E+001
st_test4	18	13	11	2	7.29E-004	5.88E-002
st_testph4	1	12	12	3	3.50E-002	5.37E-001
st_testph4	2	9	8	0	1.76E-003	1.39E-002
st_testph4	3	9	11	11	1.61E+001	7.51E-001
st_testph4	4	12	10	1	1.47E-002	6.24E+000
st_testph4	5	(IL)	47(INF)			
synthes1	1	12	17	5	2.40E-001	8.27E+001
synthes1	2	12	12	3	1.00E-002	1.24E-001
synthes1	3	12	13	3	6.75E-001	1.09E+001
synthes1	4	15	13	2	1.02E-001	3.32E+001

TABLE 7. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for coldstarts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.

Problem	Node	ColdIters	WarmIters	Δ	PrimalDist	DualDist
synthes2	1	18	16	5	4.78E-002	1.70E+001
synthes2	2	17	19	4	9.47E-002	3.33E+001
synthes2	3	15	18	2	4.10E-004	9.45E-001
synthes2	4	13	20	4	3.28E-001	9.06E+000
synthes2	5	14	24	4	3.07E-001	1.35E+000
synthes2	6	15	24	1	7.02E-005	1.19E+000
synthes2	7	16	13	4	3.07E-001	4.52E-001
synthes2	8	15	14	3	3.63E-001	8.97E+000
synthes2	9	15	15	21	5.50E+000	3.50E+001
synthes2	10	21	20	1	7.02E-005	1.61E+000
synthes2	11	19	20	6	3.24E-001	6.49E+002
synthes2	12	22	14	2	8.32E-021	2.16E+000
synthes3	1	17	20	7	1.23E-001	9.51E+000
synthes3	2	18	21	10	3.11E-001	5.45E+001
synthes3	3	19	26	14	4.19E-001	5.66E+000
synthes3	4	16	21	2	5.15E-002	2.74E+000
synthes3	5	22	26	2	5.85E-003	1.35E+001
synthes3	6	19	27	8	3.15E-001	4.53E-001
synthes3	7	17	55	4	6.00E-002	1.27E+001
synthes3	8	17	61	1	5.96E-005	5.94E+000
synthes3	9	17	23	5	2.88E-001	7.44E+000
synthes3	10	22	17	14	4.19E-001	2.81E+002
synthes3	11	20	20	2	5.15E-002	8.97E-001
synthes3	12	21	18	41	1.48E+001	8.18E+001
synthes3	13	17	17	5	2.88E-001	2.11E+001
synthes3	14	23	18	6	6.57E-002	3.24E+001

TABLE 8. Numerical performance of LOQO on the MINLPLib test suite. Each problem is solved using a branch-and-bound code, where the nodes start from a user-supplied initial solution for coldstarts and from the solution of the parent node for warmstarts. “Node” indicates the number of the node on the branch-and-bound tree, “ColdIters” is the coldstart iteration count, “WarmIters” is the warmstart iteration count, Δ is the number of changes to the active set, “PrimalDist” and “DualDist” are the relative distances between the parent and the child node for the primal and the dual variables, respectively. (IL) indicates that the algorithm reached the iteration limit, (INF) indicates that the algorithm determined that the problem is infeasible, and (IMP) indicates that further improvement could not be made on a problem.