

ONLINE SUPPLEMENT
RADIUS OF ROBUST FEASIBILITY FOR MIXED-INTEGER
PROBLEMS

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DETAILED NUMERICAL RESULTS

In this online supplement, we provide the detailed numerical results of our computational study. We list all instances for which we could not compute the RRF in our time limit of 2 h in Table 1. For instances with positive RRF, the best computed RRF, the percentage of unsafe constraints, and its price of robustness are given in Table 2. The detailed runtimes and number of iterations for instances with positive RRF are given in Table 3 and for instances with RRF zero in Table 4.

TABLE 1. Summary of instances that hit the timelimit of 2 h or could not be solved due to numerical issues (rmatr100-p10)

Instances	Unsafe Constraints (%)	RRF
cryptanalysiskb128n5obj16	44.950	–
glass4	90.909	–
neos-1456979	96.750	–
neos-2746589-doon	48.436	–
neos-3004026-krka	66.321	–
neos-3024952-loue	97.166	–
neos-3046615-murg	51.807	–
neos-3381206-awhea	99.165	–
neos-5107597-kakapo	98.938	–
nursesched-sprint02	0.568	–
rmatr100-p10	99.986	–
rmatr200-p5	99.997	–
supportcase26	95.402	–
swath3	42.986	–

TABLE 2. Summary price of robustness for instances with positive RRF (All values are standard rounded except of the RRF values. The latter values are rounded down in order to prevent an overestimation which can lead to an infeasibility of the corresponding robust counterpart. The computation of the price of robustness is based on the exact values of the numerical results)

Instances	Unsafe Constraints (%)	RRF	Nominal Objective	Robust Objective	Price of Robustness (%)
30n20b8	84.375	0.0156	302.00	604.00	100.00
50v-10	78.541	119.6930	3311.18	–	–
assign1-5-8	80.745	0.3846	212.00	–	–
binkar10_1	0.975	0.9459	6742.20	8986.79	33.29
bppc4-08	81.982	0.9999	53.00	–	–
brazil3	1.202	0.9999	24.00	–	–
buildingenergy	90.533	0.3975	33 283.85	782 078.32	2249.72
CMS750_4	66.821	0.0021	252.00	1000.00	296.83
comp07-2idx	0.513	0.3333	6.00	1091.00	18 083.30
cost266-UUE	3.942	0.5857	25 148 940.56	29 503 525.47	17.32
csched007	14.245	0.0296	351.00	590.40	68.20
csched008	14.245	0.9999	173.00	94 999 859.99	5.49×10^7
drayage-100-23	91.253	0.8509	103 333.87	494 653.66	378.70
drayage-25-23	91.253	0.8509	101 282.65	490 365.10	384.16
fiball	12.895	0.2790	138.00	1729.00	1152.90
gen-ip002	100.000	241.2800	–4783.73	–41.79	99.13
gen-ip054	100.000	1.1641	6840.97	7 231 278 446.60	1.06×10^8
gmu-35-40	3.774	0.1122	–2 406 733.37	–2 239 650.68	6.94
gmu-35-50	3.678	0.1122	–2 607 958.33	–	–
graphdraw-domain	39.306	0.1136	19 686.00	64 795.72	229.15
ic97_potential	91.013	0.0204	3942.00	4255.31	7.95
leo1	14.840	0.9333	404 227 536.16	–	–

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TABLE 2. Summary price of robustness for instances with positive RRF (All values are standard rounded except of the RRF values. The latter values are rounded down in order to prevent an overestimation which can lead to an infeasibility of the corresponding robust counterpart. The computation of the price of robustness is based on the exact values of the numerical results)

Instances	Unsafe Constraints (%)	RRF	Nominal Objective	Robust Objective	Price of Robustness (%)
leo2	24.789	0.9333	404077441.12	–	–
mad	21.569	16.3333	0.03	2.02	7437.31
mas74	92.308	0.9999	11801.19	118171839.07	1.00×10^6
mas76	91.667	0.9999	40005.05	837260542319.45	2.09×10^9
mc11	79.167	0.9814	11689.00	128960.00	1003.26
mik-250-20-75-4	38.462	951.0000	–52301.00	0.00	100.00
mushroom-best	99.953	0.9090	0.06	3916.90	7.08×10^6
n3div36	1.293	2.9897	130800.00	–	–
n5-3	9.416	226.3543	8105.00	–	–
n9-3	7.107	218.5548	14409.00	–	–
neos-1122047	100.000	0.0001	161.00	162.00	0.62
neos-3083819-nubu	0.127	907.2763	6307996.00	7019780.00	11.28
neos-4763324-toguru	49.676	0.9999	1613.04	–	–
neos-662469	37.235	0.3333	184380.00	–	–
neos-787933	92.989	44.0000	30.00	1764.00	5780.00
neos-860300	60.000	6.6666	3201.00	3201.00	0.00
neos-911970	44.860	0.9999	54.76	232510087.68	4.25×10^8
neos-933966	26.920	0.9999	318.004	126665917461.59	1.30×10^{12}
neos17	99.794	416.9255	0.15	1.62	979.91
neos5	95.238	0.7272	15.00	60.00	300.00
nexp-150-20-8-5	50.455	0.9749	231.00	–	–
ns1760995	0.032	0.7225	–549.21	–69.06	87.43

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TABLE 2. Summary price of robustness for instances with positive RRF (All values are standard rounded except of the RRF values. The latter values are rounded down in order to prevent an overestimation which can lead to an infeasibility of the corresponding robust counterpart. The computation of the price of robustness is based on the exact values of the numerical results)

Instances	Unsafe Constraints (%)	RRF	Nominal Objective	Robust Objective	Price of Robustness (%)
nu25-pr12	5.015	0.9999	53 905.00	212 500 011 900.00	3.94×10^8
p200x1188c	85.591	1.9969	15 078.00	3 584 430.00	23 672.60
pg	20.000	1006.0000	-8674.34	7018.05	180.91
pk1	66.667	0.9999	11.00	7 641 184.01	6.95×10^7
rai102	0.003	1.0000	-200.45	-199.86	0.29
ran14x18-disj-8	81.655	0.8666	3712.00	42 404.10	1042.35
reblock115	0.422	219.5121	-36 800 603.23	0.00	100.00
rococoB10-011000	5.399	0.8959	19 449.00	108 960.00	460.23
rococoC11-011100	4.647	0.9029	20 889.00	146 524.00	601.44
s250r10	0.146	1.1111	-0.17	-	-
satellites2-40	13.731	0.0001	-19.00	-16.00	15.79
satellites2-60-fs	17.389	0.0001	-19.00	-16.00	15.79
savsched1	0.886	0.9999	3217.70	3 858 535 013.84	1.20×10^8
seymour1	86.064	0.3333	410.76	587.59	43.05
sp150x300d	66.667	5.1388	69.00	300.00	334.78
square41	0.090	0.9988	15.00	1681.00	11 106.70
square47	0.068	0.9990	16.00	2209.00	13 706.30
supportcase18	50.000	0.8666	48.00	120.00	150.00
supportcase42	100.000	0.9999	7.76	15 271 400 016.50	1.97×10^{11}
swath1	42.986	0.7576	379.07	-	-
trento1	1.265	0.8552	5 189 487.00	9 993 978 424.72	192 481
var-smallemercy-m6j6	1.118	6.8910	-149.38	226.79	251.83

TABLE 3. Runtimes and number of iterations for instances with positive RRF (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
30n20b8	13.62	15	14.11	15	42.58	13	60.24	6
50v-10	1.56	16	1.70	16	0.70	10	0.49	2
assign1-5-8	80.56	17	80.81	17	13.69	17	1.74	2
binkar10_1	1.98	18	2.76	16	3.02	17	0.92	3
bppc4-08	3.92	20	4.87	20	3.86	20	0.67	1
brazil3	227.63	15	227.89	15	6.85	1	6.89	1
buildingenergy	1903.99	15	1975.59	15	> 7200	-	> 7200	-
CMS750_4	9.10	15	10.10	15	8.84	13	3.93	2
comp07-2idx	7.01	15	6.57	12	4.03	14	4.01	2
cost266-UUE	6.01	32	6.32	32	13.88	32	1.62	1
csched007	346.43	16	346.56	16	> 7200	-	2593.44	4
csched008	1.25	15	1.26	15	0.39	1	0.38	1
drayage-100-23	7.07	30	9.24	29	7.76	29	3.16	3
drayage-25-23	7.03	30	9.16	29	8.12	29	3.24	3
fiball	23.28	15	26.82	14	40.24	11	51.70	10
gen-ip002	0.25	15	0.13	2	0.12	1	0.13	1
gen-ip054	0.37	15	0.36	15	0.22	11	0.67	29
gmu-35-40	2449.44	15	13.61	15	13.51	14	7.26	4
gmu-35-50	3893.63	15	1464.00	15	62.83	11	211.56	7
graphdraw-domain	2052.99	15	2049.67	15	4276.22	11	1695.64	5
ic97_potential	90.23	21	90.63	21	43.12	18	39.95	9
leo1	26.07	15	35.58	14	15.57	12	5.35	2
leo2	97.17	15	121.69	14	41.17	12	13.89	2

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TABLE 3. Runtimes and number of iterations for instances with positive RRF (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
mad	0.26	15	0.26	14	0.25	14	0.42	4
mas74	0.58	28	0.66	28	0.60	28	0.18	1
mas76	0.53	28	0.68	28	0.59	28	0.18	1
mc11	1.96	23	2.31	23	2.12	23	0.63	1
mik-250-20-75-4	1.24	16	1.20	15	1.40	16	0.64	3
mushroom-best	40.92	15	54.92	15	25.36	11	7.68	1
n3div36	463.74	15	432.79	15	55.37	8	42.86	3
n5-3	1.34	15	1.50	15	1.64	13	1.22	3
n9-3	4.18	15	4.90	15	2.79	13	3.54	2
neos-1122047	35.61	15	38.03	15	46.73	15	15.27	1
neos-3083819-nubu	1.59	15	0.58	2	0.42	1	0.44	1
neos-4763324-toguru	131.56	23	145.39	23	298.17	22	798.40	2
neos-662469	65.61	15	70.40	14	17.10	14	3.46	1
neos-787933	70.45	16	69.52	16	60.03	16	22.40	1
neos-860300	42.63	15	43.74	14	42.61	14	8.30	1
neos-911970	0.89	17	1.05	17	0.96	17	0.28	1
neos-933966	9.60	15	14.28	15	5.00	1	4.93	1
neos17	2.00	16	2.39	16	2.54	15	1.32	6
neos5	0.47	15	0.61	15	0.40	13	0.19	1
nexp-150-20-8-5	22.55	15	24.78	15	28.09	12	73.01	21
ns1760995	878.32	15	878.51	15	762.52	12	609.89	4
nu25-pr12	2.93	15	3.67	15	0.60	1	0.60	1
p200x1188c	1.55	26	1.67	26	1.72	26	0.41	1

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TABLE 3. Runtimes and number of iterations for instances with positive RRF (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
pg	1.04	15	0.22	1	0.24	1	0.27	1
pk1	0.23	15	0.16	15	0.11	1	0.11	1
rail02	> 7200	-	> 7200	-	> 7200	-	4280.51	1
ran14x18-disj-8	1.27	15	2.14	15	1.56	14	1.80	9
reblock115	0.96	15	0.36	2	0.37	1	0.35	1
rococoB10-011000	7.53	22	3.92	21	2.25	22	0.69	1
rococoC11-011100	3.25	22	3.18	22	3.32	22	1.03	1
s250r10	217.94	15	171.28	3	24.75	1	24.96	1
satellites2-40	6.26	15	6.58	15	6.83	15	2.95	1
satellites2-60-fs	4.53	15	4.77	15	4.39	15	1.64	1
savsched1	124.35	15	180.82	15	42.52	1	42.60	1
seymour1	6.81	15	9.01	15	5.86	14	1.45	1
sp150x300d	0.44	24	0.51	24	0.40	24	0.18	1
square41	5800.64	15	6857.40	8	266.05	5	74.89	1
square47	> 7200	-	> 7200	-	743.13	5	248.40	1
supportcase18	17.49	18	18.61	17	334.40	15	239.92	2
supportcase42	57.63	15	114.86	15	105.69	2	76.04	2
swath1	73.76	19	74.16	19	2671.01	19	4622.70	10
trento1	350.85	16	354.43	16	1724.57	16	> 7200	-
var-smallemergy-m6j6	461.69	21	526.71	21	457.99	20	203.29	7

TABLE 4. Runtimes and number of iterations for instances with RRF zero (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
academictimetablesmall	69.20	16	69.23	16	67.34	1	67.26	1
app1-2	25.48	15	25.78	15	20.14	1	20.37	1
atlanta-ip	59.33	15	61.03	15	8.07	1	8.13	1
beasleyC3	1.06	21	1.06	21	0.28	1	0.30	1
bnatt400	564.01	16	564.76	16	158.92	1	158.79	1
cbs-cta	5.67	15	5.95	15	1.15	1	1.16	1
cmflsp50-24-8-8	73.25	15	73.38	15	23.22	1	23.25	1
co-100	211.70	15	215.46	15	25.26	1	26.20	1
dano3_3	20.21	15	20.58	15	79.85	1	80.25	1
dano3_5	20.87	15	21.03	15	161.70	1	162.33	1
decomp2	5.33	16	5.37	16	1.93	1	1.91	1
exp-1-500-5-5	0.40	24	0.38	24	0.17	1	0.16	1
fastxgemm-n2r6s0t2	3.83	15	3.96	15	3.04	1	3.05	1
germanrr	220.16	16	220.30	16	5.58	1	5.49	1
h80x6320d	5.30	23	5.06	23	0.93	1	0.98	1
hypothyroid-k1	70.67	16	73.34	16	94.91	1	94.67	1
irish-electricity	87.55	15	88.96	15	36.56	1	36.32	1
istanbul-no-cutoff	13.25	15	13.62	15	4.68	1	4.74	1
k1mushroom	381.57	19	396.44	19	504.87	1	505.16	1
lectsched-5-obj	70.85	15	71.73	15	6.66	1	6.77	1
lotsize	11.90	29	11.72	29	0.35	1	0.37	1
map10	332.48	15	335.44	15	249.34	1	250.87	1
map16715-04	336.61	15	337.06	15	250.81	1	250.11	1

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TABLE 4. Runtimes and number of iterations for instances with RRF zero (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
mcsched	0.26	15	0.32	15	0.18	1	0.19	1
milo-v12-6-r2-40-1	9.62	20	9.64	20	2.65	1	2.66	1
momentum1	92.91	15	93.54	15	4.11	1	4.25	1
mzzv11	1.62	15	1.57	15	1.43	1	1.38	1
mzzv42z	3.95	15	3.80	15	1.55	1	1.53	1
n2seq36q	1063.70	16	1062.89	16	> 7200	-	> 7200	-
neos-1171448	16.10	16	16.94	16	2.08	1	2.12	1
neos-1171737	8.33	17	8.66	17	0.89	1	0.92	1
neos-1354092	4447.14	15	4490.15	15	504.62	1	504.71	1
neos-1582420	5.55	15	5.60	15	20.31	15	16.59	1
neos-2657525-crna	1.43	17	1.47	17	1.33	1	1.33	1
neos-2978193-inde	4.72	18	4.80	18	5.50	1	5.44	1
neos-3216931-puriri	96.38	16	96.38	16	17.27	1	17.33	1
neos-3627168-kasai	1.20	27	1.21	27	0.44	1	0.45	1
neos-4413714-turia	83.27	16	89.39	16	15.44	1	15.05	1
neos-4532248-waihi	817.56	16	819.32	16	2224.22	16	2090.09	1
neos-4722843-widden	21.60	15	21.71	15	15.54	1	14.99	1
neos-4738912-atrato	3.41	18	3.32	18	0.52	1	0.54	1
neos-5049753-cuanza	437.25	15	444.66	15	529.72	1	529.12	1
neos-5075914-elvire	2526.50	15	2526.25	15	> 7200	-	> 7200	-
neos-5188808-nattai	23.46	15	24.03	15	6.51	1	6.51	1
neos-5195221-niemur	17.78	15	18.32	15	11.96	1	12.09	1
neos-631710	46.16	17	47.00	17	> 7200	-	> 7200	-

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TABLE 4. Runtimes and number of iterations for instances with RRF zero (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
neos-827175	12.02	15	12.46	15	20.32	1	20.27	1
neos-848589	270.69	35	277.71	35	153.31	1	153.33	1
neos-873061	378.84	15	380.52	15	226.97	1	224.59	1
neos-950242	9.93	15	9.85	15	6.04	1	6.04	1
neos-957323	18.75	15	19.15	15	6.73	1	6.91	1
neos-960392	5.69	15	5.76	15	19.06	1	19.09	1
neos8	23.48	15	24.16	15	9.39	1	9.27	1
net12	14.07	15	14.41	15	2.30	1	2.22	1
ns1116954	1113.99	15	1122.95	15	2565.66	1	2567.18	1
ns1208400	16.32	15	16.48	15	16.11	1	16.11	1
ns1644855	247.80	15	262.14	15	23.03	1	22.90	1
ns1830653	14.35	16	14.58	16	1.89	1	1.92	1
peg-solitaire-a3	157.90	16	157.72	16	246.30	1	246.12	1
pg5_34	1.82	20	1.84	20	1.75	1	1.76	1
physiciansched3-3	353.65	15	359.83	15	177.99	1	175.61	1
physiciansched6-2	76.86	15	77.16	15	61.08	1	61.61	1
piperout-08	6.13	15	6.21	15	5.05	1	5.13	1
radiation18-12-05	15.95	15	16.29	15	4.48	1	4.31	1
rail01	461.10	16	461.55	16	679.00	1	678.23	1
rd-rplusc-21	461.78	15	483.85	15	134.18	1	132.79	1
rocI-4-11	4.18	15	4.18	15	1.40	1	1.39	1
rocII-5-11	82.81	15	83.64	15	6.58	1	6.60	1
roi2alpha3n4	113.86	17	118.77	17	10.26	1	10.41	1

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TABLE 4. Runtimes and number of iterations for instances with RRF zero (all values are standard rounded)

Instances	ClassicBin		ScalingBin		maxScalingBin		PureScaling	
	time/s	niter	time/s	niter	time/s	niter	time/s	niter
roll3000	3.28	15	3.26	15	0.70	1	0.68	1
sct2	2.48	15	2.54	15	0.50	1	0.50	1
snp-02-004-104	13.46	15	13.77	15	5.12	1	5.18	1
sp97ar	32.29	15	33.98	15	3.91	1	4.00	1
sp98ar	47.00	15	51.23	15	5.24	1	5.29	1
supportcase12	102.61	15	105.57	15	29.87	1	29.85	1
supportcase33	18.95	15	19.27	15	3.56	1	3.73	1
supportcase40	17.96	15	19.10	15	5.53	1	5.62	1
supportcase7	302.96	15	318.74	15	29.36	1	28.86	1
tr12-30	0.64	25	0.68	25	0.94	1	0.94	1
traininstance6	3.22	15	3.22	15	0.96	1	1.01	1
triptim1	41.73	15	41.52	15	19.92	1	19.92	1
uccase12	71.50	15	75.47	15	18.79	1	18.97	1
uccase9	45.94	15	46.08	15	10.10	1	10.07	1
uct-subprob	1.53	15	1.59	15	3.37	1	3.35	1
unitcal_7	29.77	15	30.48	15	5.11	1	5.13	1