

Comparison tables: BBOB 2010 noisy testbed

The BBOBies

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Abstract

This document provides tabular results of the workshop for Black-Box Optimization Benchmarking at GECCO 2010, see <http://coco.gforge.inria.fr/doku.php?id=bbob-2010>. More than 30 algorithms have been tested on 24 benchmark functions in dimensions between 2 and 40. A description of the used objective functions can be found in [10, 6]. The experimental set-up is described in [9].

The performance measure provided in the following tables is the expected number of objective function evaluations to reach a given target function value (ERT, expected running time), divided by the respective value for the best algorithm. Consequently, the best (smallest) value is 1 and the value 1 appears in each column at least once. See [9] for details on how ERT is obtained. Bold entries in the table correspond to values below 3 or the top-three best values.

Table 1: 02-D, running time excess ERT/ERT_{best} on f_{101} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	2.1	5.6	10	13	14	16	17	18	
(1,2)-CMA-ES	1	1	1.7	1.8	2.0	2.8	4.1	5.0	5.7	7.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.6	1.7	2.3	3.2	4.2	4.6	6.1	7.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.0	1	2.1	3.0	3.6	4.2	5.2	6.8	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.0	2.3	3.1	3.6	6.8	7.2	8.3	9.4	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.2	1.8	2.4	3.0	3.5	4.1	4.6	5.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.4	1.2	1.6	2.3	3.1	3.5	4.2	5.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.4	1.2	1.4	1.8	2.4	2.8	3.0	3.8	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	2.0	1.8	1.6	2.3	2.8	3.4	3.5	4.5	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1.4	1.2	1.0	1.0	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	10	13	6.1	6.6	6.0	8.0	20	26	53	1541	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.3	1.8	1.8	3.3	4.1	4.7	5.7	7.1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.5	2.3	2.8	3.2	4.2	4.9	6.3	7.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.0	2.2	5.0	10	15	19	22	28	CMA+DE-MOS [12]
NEWUOA	1	1	1.1	1.3	1	1	1.2	1.2	1.2	1.2	NEWUOA [15]
Basic RCGA	1	1	1	2.3	16	27	33	46	64	118	Basic RCGA [16]
SPSA	24	41	75	113	135	391	381	365	365	395	SPSA [8]

Table 2: 02-D, running time excess ERT/ERT_{best} on f_{102} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	102 Sphere moderate unif										
$\Delta\text{ftarget}$ ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 1.8	1e+00 7.4	1e-01 14	1e-02 25	1e-03 35	1e-04 41	1e-05 42	1e-07 44	$\Delta\text{ftarget}$ ERT_{best}/D
(1,2)-CMA-ES	1	1	2.8	1.5	2.0	1.9	1.8	2.3	2.7	3.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.7	1.3	1.2	1.6	1.8	1.9	2.2	3.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.6	1.0	1.6	1.7	1.7	1.9	2.3	3.1	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.6	1.3	1.6	1.7	2.0	2.1	2.8	4.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.0	1.3	1.5	1.4	1.4	1.5	1.6	2.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	2.0	1.1	1.2	1.4	1.3	1.5	1.8	2.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.6	1.2	1	1	1.0	1.3	1.6	1.6	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.7	1.1	1.2	1.0	1.1	1.1	1.3	1.8	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.2	2.0	1	1.0	1.5	1.1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	13	16	8.2	3.4	15	12	13	12	207	1347	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.1	1.6	2.3	1.9	1.9	2.2	2.4	3.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.4	1.6	2.2	1.7	1.6	2.0	2.3	3.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.2	2.0	4.1	5.6	6.7	7.2	9.5	12	CMA+DE-MOS [12]
NEWUOA	1	1	3.6	5.2	3.6	2.3	1.8	1.6	1.5	1.5	NEWUOA [15]
Basic RCGA	1	1	1	1.6	9.2	15	15	20	30	51	Basic RCGA [16]
SPSA	9.1	16	14	113	103	85	69	238	256	1437	SPSA [8]

Table 3: 02-D, running time excess ERT/ERT_{best} on f_{103} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy											
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 1.4	1e+00 6.0	1e-01 10	1e-02 14	1e-03 19	1e-04 22	1e-05 31	1e-07 47	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	2.2	2.2	2.5	3.1	3.3	3.9	3.5	3.3	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	2.0	1.2	1.9	2.7	3.1	3.6	3.1	3.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.6	1.3	2.0	2.7	2.9	3.3	3.0	2.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.0	2.1	3.5	3.3	3.3	3.6	3.3	3.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.6	1.4	2.1	2.2	2.3	2.7	2.4	2.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.8	1	1.7	2.1	2.2	2.6	2.2	2.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.5	1.1	1.3	1.6	1.7	1.9	1.7	1.6	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	2.8	1.5	1.7	1.8	2.0	2.2	2.0	1.8	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.0	1.2	1.0	1	1	1	1.1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	12	19	12	4.5	5.6	6.5	8.5	17	13	27	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.1	1.6	2.1	2.8	2.9	3.6	3.2	3.0	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.5	2.2	2.7	2.9	3.3	3.8	3.5	3.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.6	1.7	6.4	10	13	14	13	14	CMA+DE-MOS [12]
NEWUOA	1	1	2.1	1.0	1	1.0	1.0	1.1	1	1.1	NEWUOA [15]
Basic RCGA	1	1	1	2.5	10	17	27	38	42	62	Basic RCGA [16]
SPSA	22	38	237	128	124	126	361	918	1785	1794	SPSA [8]

Table 4: 02-D, running time excess ERT/ERT_{best} on f_{104} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	1.5	2.5	7.9	42	113	212	242	260	271	297	ERT_{best}/D
(1,2)-CMA-ES	1.7	3.3	2.6	4.9	7.9	8.9	10	9.5	9.5	13	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	3.2	2.0	3.7	4.2	4.9	5.1	5.0	4.9	4.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.3	1.5	1.7	2.4	3.8	4.8	5.6	5.7	5.9	5.8	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.4	3.8	3.1	6.4	10	13	15	28	28	33	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.7	2.8	2.3	2.2	2.4	1.6	1.6	1.6	1.6	1.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.8	2.5	1.9	3.1	2.0	1.4	1.3	1.3	1.3	1.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.0	1	1	1.3	1.5	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.1	1.3	1.2	2.0	2.5	2.1	2.0	1.9	1.9	1.8	(1,4s)-CMA-ES [3]
avg NEWUOA	2.1	2.2	1.5	1.3	1.1	2.0	2.7	3.1	3.2	3.8	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	18	14	6.9	3.3	22	41	102	95	144	174	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.1	1.7	1.2	1	1	1.0	1.1	1.1	1.1	1.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.1	2.6	1.7	2.5	2.3	1.8	2.0	2.0	2.1	2.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.8	2.2	1.9	2.6	2.4	2.6	2.8	3.1	3.3	CMA+DE-MOS [12]
NEWUOA	2.9	2.3	2.2	2.3	2.9	3.7	5.2	6.1	5.9	5.6	NEWUOA [15]
Basic RCGA	1.3	1.6	2.6	3.2	29	50	125	249	806	<i>10e-5/5e4</i>	Basic RCGA [16]
SPSA	244	232	287	294	3694	<i>39e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 5: 02-D, running time excess ERT/ERT_{best} on f_{105} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	105 Rosenbrock moderate unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	2.4	2.6	1.8	4.8	8.8	12	17	28	33	30	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	2.0	1.9	2.9	2.3	2.2	5.6	9.3	18	18	17	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.1	1.1	3.2	8.7	12	16	20	18	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2.0	1.8	2.9	4.8	4.2	11	23	60	60	71	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.8	2.2	1.4	4.7	2.8	3.2	3.4	3.2	3.1	2.9	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.1	1.3	1	3.0	1.8	2.4	2.1	2.2	2.1	2.0	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.3	1.5	1.4	2.3	2.5	3.0	2.9	3.0	3.3	3.0	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.4	3.3	1.3	3.3	3.0	4.1	3.9	3.9	3.8	3.5	(1,4s)-CMA-ES [3]
avg NEWUOA	2.7	2.1	1.7	1.8	2.2	5.8	16	28	96	177	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	21	12	4.5	2.3	39	159	515	1122	1659	3153	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	3.5	1.8	1.6	1.1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.7	2.1	1.4	2.2	2.2	3.6	3.1	2.9	2.9	2.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.3	1.5	1	1.6	1.9	1.8	1.9	2.0	2.2	CMA+DE-MOS [12]
NEWUOA	2.6	1.5	1.9	2.2	3.0	4.2	12	21	20	52	NEWUOA [15]
Basic RCGA	1.4	2.2	2.0	1.5	13	33	89	236	569	<i>18e-5/5e4</i>	Basic RCGA [16]
SPSA	217	170	78	204	1418	5355	<i>34e-2/1e5</i>	.	.	.	SPSA [8]

Table 6: 02-D, running time excess ERT/ERT_{best} on f_{106} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	106 Rosenbrock moderate Cauchy										
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	1.4	3.4	7.0	22	93	155	184	208	222	246	ERT_{best}/D
(1,2)-CMA-ES	3.3	4.3	11	19	10	8.5	8.0	7.5	7.2	6.7	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	2.1	2.8	2.6	4.4	3.6	3.5	3.7	3.5	3.6	3.5	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.6	1.9	2.1	1.4	3.6	2.8	3.0	3.0	2.9	2.8	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2.0	2.0	1.5	30	23	19	18	20	19	21	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2.3	1.9	2.4	3.9	2.0	1.5	1.5	1.4	1.4	1.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.2	1	1.6	2.2	1.5	1.2	1.3	1.2	1.3	1.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.0	1.8	1.2	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.2	1.0	1	3.4	2.2	1.7	1.6	1.5	1.5	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1.9	1.3	1.4	1.6	1.6	1.9	3.1	3.3	4.7	7.8	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	23	21	37	32	11	8.8	8.3	7.6	39	39	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.4	2.1	3.2	2.7	1.6	1.6	1.5	1.5	1.5	1.6	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.3	1.3	1.5	3.2	2.5	2.4	2.5	2.5	2.5	2.6	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.3	2.4	4.4	2.9	3.2	3.6	3.5	3.9	4.4	CMA+DE-MOS [12]
NEWUOA	1.3	1.2	1.0	2.2	1.5	2.1	3.2	3.1	5.3	7.6	NEWUOA [15]
Basic RCGA	1	1.9	2.6	4.2	14	94	295	381	726	2913	Basic RCGA [16]
SPSA	426	532	1013	2191	2546	9115	<i>40e-2/1e5</i>	.	.	.	SPSA [8]

Table 7: 02-D, running time excess ERT/ERT_{best} on f_{107} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss											
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 1.6	1e+00 12	1e-01 22	1e-02 37	1e-03 59	1e-04 75	1e-05 141	1e-07 206	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	17	8.1	6.3	6.0	6.8	10	10	13	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	2.5	2.9	2.6	2.8	2.2	2.1	1.3	1.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.3	1.2	1.2	2.2	2.1	2.5	1.5	2.0	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	3.1	1.4	3.3	9.2	10	12	6.9	9.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	5.9	2.0	4.9	3.9	2.9	2.8	1.9	1.9	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	4.1	1.2	2.8	2.3	1.8	1.7	1.5	1.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.2	1	1	1	1	1.3	1.2	1.2	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	3.4	6.3	5.0	3.6	3.3	2.8	1.8	2.0	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	7.7	18	15	20	21	41	40	82	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	9.2	14	11	3.9	7.1	5.5	34	112	138	311	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.9	1.5	1.7	2.0	1.5	1.6	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	3.1	1.1	1.7	1.9	1.5	1.6	1.0	1.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.4	1.1	3.9	6.9	8.0	7.8	5.1	4.6	CMA+DE-MOS [12]
NEWUOA	1	1	15	12	20	27	27	50	74	85	NEWUOA [15]
Basic RCGA	1	1	1	1.1	5.8	13	13	12	12	20	Basic RCGA [16]
SPSA	16	21	272	814	2429	6194	5209	18783	<i>27e-3/1e5</i>	.	SPSA [8]

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Table 8: 02-D, running time excess ERT/ERT_{best} on f_{108} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.50	0.50	2.1	15	164	586	1170	2574	3799	6046	ERT_{best}/D
(1,2)-CMA-ES	1	1.2	7.4	13	3.4	4.5	21	<i>26e-4/1e4</i>	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	13	17	5.5	7.9	60	<i>29e-4/1e4</i>	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	13	7.8	3.4	13	56	<i>60e-4/1e4</i>	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	7.3	12	6.1	11	<i>56e-4/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	21	12	2.5	2.6	11	55	37	<i>61e-5/1e4</i>	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	37	13	3.6	2.9	6.9	18	<i>50e-5/1e4</i>	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	5.9	14	3.7	7.0	8.3	17	<i>48e-5/1e4</i>	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	62	26	5.4	4.6	7.0	18	39	<i>51e-5/1e4</i>	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	37	42	13	22	24	<i>14e-3/6e3</i>	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	1612	6028	1734	309	88	82	78	61	183	243	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.2	2.4	5.9	2.2	1	1	1	1	1.0	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.6	3.8	1	1.2	1.4	1.0	1.1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.0	1	1.4	2.1	2.4	4.2	4.3	4.9	CMA+DE-MOS [12]
NEWUOA	1	1	52	56	15	27	36	<i>13e-3/6e3</i>	.	.	NEWUOA [15]
Basic RCGA	1	1	1	1.3	7.2	24	31	28	45	<i>21e-5/5e4</i>	Basic RCGA [16]
SPSA	27	126	88	100	62	107	<i>28e-4/1e5</i>	.	.	.	SPSA [8]

Table 9: 02-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	1.5	6.5	18	32	46	65	85	114	
(1,2)-CMA-ES	1	1.5	1.5	2.5	1.6	1.6	3.1	2.8	2.9	3.9	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.6	1.4	1.0	1.5	1.7	1.7	1.8	2.3	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1.0	1	1.2	1.4	1.3	1.3	1.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	3.9	2.7	1.8	6.7	6.9	5.5	4.6	6.5	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.6	1.6	1.1	1.0	1.3	1.3	1.4	1.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	3.1	1.9	1.4	1.1	1.4	1.4	1.3	1.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.5	1.4	1.1	1.0	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.3	1	1.0	1	1.2	1.1	1.1	1.1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.0	1.9	5.5	7.3	6.6	8.3	8.3	13	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	21	13	5.1	3.9	7.4	85	71	503	12353	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.9	1.5	1.2	1.2	1.5	1.8	1.7	2.0	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.2	1.1	1.4	1.2	1.5	1.6	1.9	2.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.4	1.7	3.1	6.2	6.5	8.0	8.1	10	CMA+DE-MOS [12]
NEWUOA	1	1	2.0	2.7	4.3	5.9	7.6	10	12	15	NEWUOA [15]
Basic RCGA	1	1	1.1	1.9	5.4	10	14	18	20	28	Basic RCGA [16]
SPSA	19	32	169	97	98	365	1216	1808	5210	<i>72e-6/1e5</i>	SPSA [8]

Table 10: 02-D, running time excess ERT/ERT_{best} on f_{110} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1.4	1	7.5	5.9	2.3	3.7	3.6	9.2	36	<i>22e-5/1e4</i>	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.2	4.3	2.5	3.2	1.4	2.0	2.3	3.4	4.9	17	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.3	2.0	1.7	3.1	1	1.9	4.3	5.0	18	36	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2.2	9.2	5.3	10	2.8	2.9	3.3	5.5	8.0	34	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.3	1.3	1.2	3.4	2.7	3.6	2.9	2.9	3.7	5.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.0	1.8	1.0	1	1.1	1	1	1	1.2	1.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.1	1.4	2.3	2.9	1.4	2.6	2.1	2.5	2.8	3.7	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.7	1.6	1.2	4.5	1.9	2.0	1.5	1.7	3.0	3.0	(1,4s)-CMA-ES [3]
avg NEWUOA	1.6	6.1	3.4	2.8	1.6	1.8	3.6	7.1	6.2	<i>12e-4/5e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	88	71	29	13	8.6	121	650	<i>99e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.4	1.4	1.2	2.0	4.0	3.2	1.7	1.1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	3.1	2.1	1.5	4.5	2.7	3.1	1.7	1.2	1.1	1.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.3	2.1	159	11	9.0	4.8	3.2	2.8	2.9	CMA+DE-MOS [12]
NEWUOA	9.4	8.7	5.3	8.1	1.9	2.7	4.8	22	<i>19e-4/5e3</i>	.	NEWUOA [15]
Basic RCGA	1	1.2	1	2.3	3.4	13	17	24	58	174	Basic RCGA [16]
SPSA	222	118	109	464	908	<i>38e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 11: 02-D, running time excess ERT/ERT_{best} on f_{111} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	111 Rosenbrock unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	7.1	6.4	5.5	5.5	3.1	3.1	<i>21e-3/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.4	7.3	8.3	2.3	2.9	13	<i>30e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	7.9	15	10	5.8	1.9	5.9	<i>17e-3/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	14	6.9	8.2	6.8	1.7	5.9	<i>15e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	25	19	11	3.1	1.4	1.8	1.3	2.0	3.8	<i>61e-4/1e4</i>	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	23	13	10	4.3	1.5	1.4	2.8	<i>47e-4/1e4</i>	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	7.9	4.8	3.4	2.9	1.6	3.5	2.8	<i>12e-3/1e4</i>	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.5	14	10	5.0	2.3	1.7	1.9	<i>17e-4/1e4</i>	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	29	43	42	19	13	17	<i>26e-2/6e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	228	538	181	42	5.6	7.3	8.5	42	37	<i>22e-4/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.8	2.4	6.9	2.2	1	1.6	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.3	3.8	4.6	2.2	1.2	1	1.1	1.1	1.1	1.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.2	1.9	1.4	11	12	3.2	2.5	2.6	2.6	CMA+DE-MOS [12]
NEWUOA	55	29	19	16	4.8	5.3	<i>68e-3/6e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1	1	2.3	2.0	1.5	6.6	19	<i>32e-5/5e4</i>	Basic RCGA [16]
SPSA	29	20	48	99	44	273	<i>51e-3/1e5</i>	.	.	.	SPSA [8]

Table 12: 02-D, running time excess ERT/ERT_{best} on f_{112} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	2.4	2.4	2.3	5.8	10	6.8	7.2	7.9	10	8.9	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.2	1.4	8.4	19	6.2	4.8	5.9	5.8	5.6	5.2	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.8	2.1	1.9	10	3.3	2.9	3.1	3.1	3.0	2.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.7	3.9	2.0	24	14	21	34	50	47	80	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2.5	2.2	1.2	2.5	1.3	1.3	1.4	1.5	1.5	1.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.8	2.2	1.1	1	1	1.0	1.1	1.2	1.2	1.2	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.6	1.4	1.6	3.4	1.4	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.2	1.3	1.1	2.9	1.8	1.3	1.4	1.4	1.4	1.3	(1,4s)-CMA-ES [3]
avg NEWUOA	1.8	1.5	1.3	2.5	1.8	6.5	30	164	<i>19e-4/5e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	16	6.8	10	8.0	113	428	<i>12e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.2	1	1.2	3.7	1.6	1.3	1.3	1.3	1.3	1.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.0	1.3	1	1.2	1.0	1.3	1.6	1.6	1.6	1.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.3	1.7	2.6	1.7	2.5	2.9	3.1	3.4	3.8	CMA+DE-MOS [12]
NEWUOA	2.0	1.5	1.2	3.0	1.9	2.5	14	156	146	<i>70e-5/5e3</i>	NEWUOA [15]
Basic RCGA	1.8	1.7	2.2	2.1	6.7	61	118	158	348	645	Basic RCGA [16]
SPSA	4746	2169	744	766	1076	3836	3379	<i>21e-2/1e5</i>	.	.	SPSA [8]

Table 13: 02-D, running time excess ERT/ERT_{best} on f_{113} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.63	1.7	5.3	59	277	482	643	643	643	841	ERT_{best}/D
(1,2)-CMA-ES	1.5	5.3	3.6	2.0	2.0	3.3	4.7	4.7	4.7	6.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.8	2.9	2.0	1.1	1.2	1.1	1.4	1.4	1.4	2.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	2.2	3.1	2.0	1.8	1.8	2.7	3.0	3.0	3.0	2.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	11	5.3	4.4	2.5	2.1	2.6	5.3	5.3	5.3	5.8	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.6	1.2	1.3	3.9	2.1	1.9	2.2	2.2	2.2	2.2	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.4	10	3.9	1.7	1.9	1.7	2.2	2.2	2.2	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.7	2.4	1.6	1.9	2.4	1.7	1.4	1.4	1.4	1.1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	2.3	3.5	5.7	2.2	2.6	2.5	1.9	1.9	1.9	2.1	(1,4s)-CMA-ES [3]
avg NEWUOA	1.6	7.9	4.3	1.6	1.5	2.7	4.5	4.5	4.5	6.9	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	28	18	7.6	11	55	142	160	160	160	289	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.9	1.9	1	2.7	2.7	1.7	1.9	1.9	1.9	1.5	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.6	1.7	5.0	2.3	1.5	1.3	1.3	1.3	1.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.3	1.4	1.0	1	1	1	1	1	1	CMA+DE-MOS [12]
NEWUOA	1.9	5.4	5.4	1.5	2.6	4.2	5.7	5.7	5.7	7.2	NEWUOA [15]
Basic RCGA	1.2	1	2.1	1	13	26	29	29	29	27	Basic RCGA [16]
SPSA	14	12	8.3	278	142	512	393	393	393	396	SPSA [8]

Table 14: 02-D, running time excess ERT/ERT_{best} on f_{114} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.70	1.5	5.0	81	572	904	2236	2236	2236	3587	
(1,2)-CMA-ES	1.1	15	6.2	4.1	3.9	13	30	30	30	40	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	12	23	13	3.2	2.8	8.5	8.3	8.3	8.3	<i>32e-4/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	6.3	22	23	5.0	3.5	9.0	20	20	20	<i>63e-4/1e4</i>	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	12	18	11	3.4	5.1	10	9.3	9.3	9.3	19	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.4	24	15	3.1	2.3	5.6	5.7	5.7	5.7	20	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.1	10	6.8	4.0	3.5	8.7	6.1	6.1	6.1	10	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	3.2	38	28	5.3	2.7	4.6	8.3	8.3	8.3	12	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	24	12	5.1	4.3	17	9.1	9.1	9.1	5.7	(1,4s)-CMA-ES [3]
avg NEWUOA	1.0	36	26	4.3	16	29	40	40	40	25	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	441	329	187	52	37	45	25	25	25	54	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.3	7.5	7.6	2.7	1.7	2.3	2.0	2.0	2.0	1.6	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.4	2.3	2.3	1.5	1	1	1	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.5	1.2	1	5.5	5.8	2.7	2.7	2.7	6.1	CMA+DE-MOS [12]
NEWUOA	1.4	22	61	14	23	97	39	39	39	<i>21e-2/6e3</i>	NEWUOA [15]
Basic RCGA	1.3	1	1	1.7	11	30	24	24	24	21	Basic RCGA [16]
SPSA	71	147	95	49	50	120	141	141	141	<i>63e-4/1e5</i>	SPSA [8]

Table 15: 02-D, running time excess ERT/ERT_{best} on f_{115} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1.7	2.0	1.6	1.8	2.1	4.2	6.7	6.7	6.7	19	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.3	2.0	1.3	1.8	2.3	5.3	5.3	5.3	16	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.6	1.1	1.7	1.3	1.6	2.9	5.8	5.8	5.8	13	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1.4	1	1.7	1.9	1.8	7.3	8.8	8.8	8.8	18	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.2	1.2	1.5	1.3	1.2	2.2	2.4	2.4	2.4	3.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.9	1.3	1	1.3	1.5	2.2	2.2	2.2	2.2	2.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.6	1.2	1.1	1.5	1.0	1.2	1.9	1.9	1.9	1.8	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	2.1	2.3	1.9	1	1	1.9	2.1	2.1	2.1	2.6	(1,4s)-CMA-ES [3]
avg NEWUOA	1.2	1.5	2.1	1.9	3.2	6.0	6.9	6.9	6.9	12	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	11	6.4	4.5	4.5	111	319	535	535	535	1214	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.1	1.7	1.2	1.4	1.5	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.3	2.4	1.7	3.7	2.5	2.4	2.4	2.4	2.4	2.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1.2	1.1	1.3	1.5	2.1	2.0	6.2	6.2	6.2	5.2	CMA+DE-MOS [12]
NEWUOA	1.7	1.4	1.4	3.0	3.2	4.4	11	11	11	11	NEWUOA [15]
Basic RCGA	1.3	1.0	1.7	15	27	99	110	110	110	134	Basic RCGA [16]
SPSA	39	26	35	113	169	263	756	756	756	2395	SPSA [8]

Table 16: 02-D, running time excess ERT/ERT_{best} on f_{116} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	8.3	5.6	2.8	2.2	1.6	4.6	7.4	16	33	66	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.4	4.3	4.8	2.6	2.5	8.4	8.3	13	16	21	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	2.0	2.4	1	1.8	4.5	6.4	16	34	69	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	9.2	18	3.4	2.5	2.0	11	<i>12e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.3	1	3.3	1.9	1.8	2.9	3.0	3.0	4.1	3.9	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.3	1.1	2.1	2.4	1.8	3.2	3.5	3.8	4.5	5.0	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.0	3.7	3.1	1.9	1.1	2.2	2.5	3.1	3.5	3.9	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.8	1.1	1.4	2.3	1.6	3.2	3.6	4.2	4.9	5.9	(1,4s)-CMA-ES [3]
avg NEWUOA	5.5	2.9	2.7	1.4	1.7	6.4	9.0	40	<i>14e-3/5e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	46	61	110	103	187	416	733	<i>34e-2/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	2.2	1.3	5.3	2.1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.2	1.8	6.0	4.0	1.9	2.3	2.2	2.2	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1.5	1.7	7.2	7.9	3.6	3.6	3.1	3.2	3.2	3.3	CMA+DE-MOS [12]
NEWUOA	3.8	2.1	1.4	1.7	2.0	7.0	41	<i>50e-3/5e3</i>	.	.	NEWUOA [15]
Basic RCGA	1.3	2.1	1	10	25	56	116	176	170	337	Basic RCGA [16]
SPSA	14	8.8	13	29	60	297	780	<i>43e-3/1e5</i>	.	.	SPSA [8]

Table 17: 02-D, running time excess ERT/ERT_{best} on f_{117} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	117 Ellipsoid unif										
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	5.3	21	137	2224	5898	6907	9411	10034	11058	13526	ERT_{best}/D
(1,2)-CMA-ES	8.3	7.1	5.4	1.8	3.0	<i>12e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	5.9	6.2	4.9	1.6	3.1	22	16	<i>11e-2/1e4</i>	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	8.0	6.4	6.0	1.1	3.8	<i>14e-2/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	9.2	7.0	5.8	2.6	7.3	<i>31e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	10	7.7	6.0	1.2	1.1	10	<i>36e-3/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	13	5.1	4.4	1	3.3	10	<i>12e-2/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	13	11	5.8	1.4	1.8	6.1	15	<i>59e-3/1e4</i>	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	7.1	7.2	2.9	1.4	1.5	3.9	16	<i>33e-3/1e4</i>	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	14	27	15	3.1	4.6	<i>78e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	45	93	70	10	34	104	154	<i>17e-2/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	4.9	4.6	3.1	1.1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.9	3.9	6.2	1.4	1.1	1.5	1.4	1.4	1.6	1.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1	1.1	2.3	4.3	3.6	3.9	3.9	4.6	CMA+DE-MOS [12]
NEWUOA	39	21	18	3.7	14	<i>97e-2/6e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1.6	1.3	3.6	6.7	8.5	13	17	<i>73e-3/5e4</i>	.	.	Basic RCGA [16]
SPSA	52	34	48	39	72	216	158	<i>35e-2/1e5</i>	.	.	SPSA [8]

Table 18: 02-D, running time excess ERT/ERT_{best} on f_{118} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	118 Ellipsoid Cauchy										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	3.6	5.3	20	9.3	8.5	7.9	7.9	8.5	8.5	8.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.3	2.4	16	8.8	7.8	6.9	6.6	6.1	6.1	5.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	2.1	4.8	7.3	4.1	3.6	4.1	4.2	4.2	4.0	3.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1.5	5.9	47	26	30	35	38	35	33	29	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.7	2.8	4.4	2.3	1.9	2.0	2.0	1.8	1.9	1.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.7	2.8	3.2	1.7	1.8	1.7	1.7	1.8	1.7	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.7	3.1	2.1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.1	1.7	1.7	1.4	1.5	1.4	1.4	1.4	1.4	1.3	(1,4s)-CMA-ES [3]
avg NEWUOA	1.1	1	1	1.9	5.7	13	32	338	<i>90e-5/5e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	20	61	22	22	247	897	2123	1886	6047	5147	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.4	3.5	2.8	1.6	1.7	1.6	1.8	1.8	1.8	1.9	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.8	2.8	4.4	2.4	2.6	3.5	3.8	3.6	3.6	3.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1.2	4.4	3.1	2.3	2.8	2.9	3.4	3.8	4.2	5.1	CMA+DE-MOS [12]
NEWUOA	1	1.1	2.0	2.0	5.1	15	54	109	312	<i>11e-4/5e3</i>	NEWUOA [15]
Basic RCGA	1.9	2.3	27	49	214	370	432	1652	1517	<i>16e-3/5e4</i>	Basic RCGA [16]
SPSA	29	171	434	369	2051	8144	<i>20e-2/1e5</i>	.	.	.	SPSA [8]

Table 19: 02-D, running time excess ERT/ERT_{best} on f_{119} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	119 Sum of diff powers Gauss										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.53	0.97	12	50	117	366	1153	1602	2770	
(1,2)-CMA-ES	1	1.1	1.8	1.8	4.5	5.0	5.5	6.1	11	52	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.9	2.3	3.8	2.9	2.1	1.7	1.8	4.9	25	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.1	1.4	2.4	2.0	1.8	2.9	2.5	4.3	16	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.5	1.6	2.2	3.1	5.2	6.8	12	91	<i>90e-6/1e4</i>	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	2.0	2.4	1.8	2.8	1.4	1.6	1.2	2.8	16	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.5	3.1	1.6	1.1	2.1	1.7	2.4	11	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.8	2.1	2.5	1	1.2	1	1.1	1.9	25	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.3	2.1	5.8	2.6	2.3	1.4	1.8	3.2	16	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.3	2.1	8.1	5.7	11	8.4	5.4	10	<i>67e-6/5e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	12	19	12	1.7	1.3	10	115	68	273	<i>34e-6/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.2	3.0	1.2	1	1.1	1.4	1.5	1.4	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.6	2.8	3.6	1.6	1.1	1.6	2.1	2.4	3.4	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.4	1.3	3.6	4.3	2.2	1	1	1	CMA+DE-MOS [12]
NEWUOA	1	2.4	2.2	6.9	6.1	17	10	16	48	28	NEWUOA [15]
Basic RCGA	1	1.1	1	1	2.3	6.6	6.5	8.8	15	35	Basic RCGA [16]
SPSA	15	30	25	418	820	1984	1191	<i>21e-3/1e5</i>	.	.	SPSA [8]

Table 20: 02-D, running time excess ERT/ERT_{best} on f_{120} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	120 Sum of diff powers unif										
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 1.1	1e+00 9.1	1e-01 445	1e-02 1182	1e-03 3214	1e-04 8792	1e-05 16925	1e-07 53115	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1.7	12	21	2.5	8.0	<i>76e-4/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.1	12	12	2.0	15	<i>12e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	2.9	13	12	2.1	8.7	<i>52e-4/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.1	7.4	20	3.9	14	46	<i>15e-3/1e4</i>	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.3	1.6	26	1.9	7.8	13	<i>56e-4/1e4</i>	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.5	22	16	2.1	4.6	44	<i>25e-4/1e4</i>	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.5	10	16	2.1	4.6	<i>54e-4/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	5.9	1.6	8.4	<i>79e-4/1e4</i>	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	9.5	23	46	17	16	<i>94e-3/6e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	423	709	383	139	15	70	220	<i>53e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.2	1.2	5.4	1	1	1	1	1.2	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.5	2.2	15	1.5	1.6	1.3	1.1	1	1.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.3	1.2	2.8	1.3	4.7	15	16	9.2	10	CMA+DE-MOS [12]
NEWUOA	1	3.1	30	38	17	36	<i>98e-3/6e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1.3	1.3	1	2.9	14	17	24	42	<i>31e-5/5e4</i>	Basic RCGA [16]
SPSA	57	173	94	94	45	270	<i>13e-3/1e5</i>	.	.	.	SPSA [8]

Table 21: 02-D, running time excess ERT/ERT_{best} on f_{121} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	121 Sum of diff powers Cauchy										
$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$
	0.50	0.60	1.2	7.0	20	49	113	270	398	601	
(1,2)-CMA-ES	1	1.3	1.4	1.9	2.6	6.0	9.5	8.2	11	14	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.1	1.3	1.3	2.1	1.6	2.2	4.1	5.0	7.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.1	1.5	1.7	1.0	1.6	1.9	2.4	3.1	3.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.1	2.5	2.5	1.8	5.0	23	25	42	119	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.9	1.6	1.5	1.5	1.3	1.2	1.5	2.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	1.7	1.6	1.6	1.9	1.9	2.0	1.8	2.0	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.3	1	1	1	1.0	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.4	1.6	1.4	1.1	1.1	1	1.0	1.0	1.1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.3	1.6	2.9	4.5	9.3	31	49	<i>31e-5/5e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	15	21	13	16	10	15	88	472	3535	<i>13e-5/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.1	1.6	1.6	1.5	1.7	1.9	1.6	1.7	1.9	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.7	2.5	1.9	1.6	1.5	2.3	2.8	3.1	3.7	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.3	2.1	5.9	5.5	5.6	4.1	4.1	4.6	CMA+DE-MOS [12]
NEWUOA	1	1.3	1.6	2.2	3.1	11	20	80	170	<i>40e-5/5e3</i>	NEWUOA [15]
Basic RCGA	1	1.1	1	1.0	8.3	9.1	20	21	51	147	Basic RCGA [16]
SPSA	33	50	76	407	2835	2575	2803	<i>13e-3/1e5</i>	.	.	SPSA [8]

Table 22: 02-D, running time excess ERT/ERT_{best} on f_{122} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	3.1	56	212	548	840	1164	1950	2867	
(1,2)-CMA-ES	1	2.9	6.8	4.3	6.0	15	81	<i>53e-4/1e4</i>	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.3	1.1	2.8	2.0	6.2	13	27	36	<i>98e-5/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.7	5.8	3.2	3.9	5.3	50	<i>32e-4/1e4</i>	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.6	11	3.6	8.7	28	<i>16e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.3	2.7	5.1	4.1	4.0	6.3	20	36	<i>23e-5/1e4</i>	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.1	2.2	3.2	3.1	3.6	4.4	8.6	8.5	52	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.4	15	1.9	2.6	3.1	7.8	20	22	<i>38e-5/1e4</i>	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.9	17	3.8	7.0	9.4	26	39	75	<i>32e-4/1e4</i>	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.3	6.7	8.3	40	70	<i>11e-2/5e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	12	16	7.6	18	46	117	261	<i>53e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.3	1.7	1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.3	14	3.3	3.0	1.5	1.4	1.4	1.1	1.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.4	1	26	25	13	10	8.4	5.7	4.8	CMA+DE-MOS [12]
NEWUOA	1	1.7	4.7	14	37	70	<i>99e-3/5e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	8.6	27	18	28	36	50	<i>25e-6/5e4</i>	Basic RCGA [16]
SPSA	21	38	29	688	<i>44e-2/1e5</i>	.	.	.	.	.	SPSA [8]

Table 23: 02-D, running time excess ERT/ERT_{best} on f_{123} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	3.0	386	2371	6690	13816	22782	33525	78413	
(1,2)-CMA-ES	1	1.8	13	1.9	62	<i>24e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.2	2.8	9.3	1.3	10	<i>13e-2/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.1	6.1	16	2.0	61	<i>23e-2/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.2	25	2.7	30	<i>18e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.8	11	2.3	4.7	<i>83e-3/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	3.8	1.3	14	<i>13e-2/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	2.0	15	1.7	6.0	22	<i>98e-3/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.8	40	1.9	15	<i>11e-2/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	10	34	6.6	38	<i>46e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	261	1354	288	34	27	46	<i>48e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.0	10	1.5	1.2	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.6	9.0	1	1	1.3	1.4	1.1	1.1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.5	1	11	52	33	21	13	12	7.2	CMA+DE-MOS [12]
NEWUOA	1	1	29	8.8	38	<i>44e-2/6e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.5	1.5	5.8	31	<i>11e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	32	64	71	21	296	<i>22e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 24: 02-D, running time excess ERT/ERT_{best} on f_{124} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy											
$\Delta\text{ftarget}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$
ERT_{best}/D	0.50	0.53	2.1	33	108	274	1110	1849	4139	9115	ERT_{best}/D
(1,2)-CMA-ES	1	2.0	3.3	13	20	32	62	<i>60e-4/1e4</i>	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.7	2.5	3.3	2.8	5.6	11	<i>98e-5/1e4</i>	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.8	2.6	2.7	6.6	6.8	7.6	77	<i>89e-5/1e4</i>	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.6	13	11	19	55	<i>16e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	3.6	2.8	7.5	6.5	7.9	7.2	24	<i>23e-5/1e4</i>	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	2.7	4.4	2.1	3.4	2.9	10	34	<i>23e-5/1e4</i>	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.7	22	4.9	2.6	2.0	1.5	11	35	<i>23e-5/1e4</i>	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.1	1.4	1.6	10	6.7	6.2	7.2	79	<i>42e-5/1e4</i>	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.6	10	9.0	32	76	<i>98e-3/5e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	19	30	11	55	176	203	764	<i>19e-4/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.7	1.9	1	1.3	1.9	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.3	3.0	1.2	1	1	1.1	1.3	1.3	1.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.4	1.6	3.0	21	25	9.1	5.8	5.3	3.6	CMA+DE-MOS [12]
NEWUOA	1	2.1	4.7	6.3	20	57	<i>33e-3/5e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1	2.9	33	31	29	52	88	<i>19e-5/5e4</i>	Basic RCGA [16]
SPSA	48	84	3825	818	683	2545	<i>37e-3/1e5</i>	.	.	.	SPSA [8]

Table 25: 02-D, running time excess ERT/ERT_{best} on f_{125} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	125 Griewank-Rosenbrock Gauss										
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 0.50	1e+00 1.9	1e-01 12	1e-02 86	1e-03 269	1e-04 1246	1e-05 2703	1e-07 3541	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	5.6	3.7	4.2	3.8	8.7	4.0	4.3	<i>63e-7/1e4</i>	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	1.5	2.1	1.4	6.0	3.0	3.9	13	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1	1.4	2.3	7.3	4.4	5.0	20	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.1	2.8	5.5	2.7	12	4.4	5.4	41	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1.2	1	1.6	12	5.1	5.7	13	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.1	1.5	2.0	2.2	8.5	3.5	2.7	4.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1.4	2.4	2.7	7.3	2.1	2.2	6.9	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.2	1.3	1.3	1.6	13	5.9	4.4	19	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.3	1.8	1.9	1.6	5.7	2.4	1.6	6.6	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	20	25	8.9	3.5	4.3	12	6.7	10	43	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.1	1.2	2.1	1.2	3.3	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.2	1.5	1.4	1.8	4.2	1.3	1.3	1.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	1.5	1.8	1	1	3.3	1.5	1.2	CMA+DE-MOS [12]
NEWUOA	1	1	2.0	1.6	3.1	1.2	5.7	2.1	1.8	11	NEWUOA [15]
Basic RCGA	1	1	1.2	1.7	2.3	1.6	5.8	4.6	3.6	14	Basic RCGA [16]
SPSA	22	32	37	16	6.8	1.9	209	227	246	<i>45e-5/1e5</i>	SPSA [8]

Table 26: 02-D, running time excess ERT/ERT_{best} on f_{126} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	126 Griewank-Rosenbrock unif										
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 0.50	1e+00 1.7	1e-01 23	1e-02 88	1e-03 1671	1e-04 3483	1e-05 5350	1e-07 27651	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	2.3	15	6.4	12	7.0	19	27	<i>75e-5/1e4</i>	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.1	1.2	3.0	11	4.9	5.9	8.2	<i>23e-5/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1	5.0	6.8	9.1	7.7	28	<i>81e-5/1e4</i>	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.1	11	5.3	16	8.6	12	26	<i>12e-4/1e4</i>	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1.8	7.2	7.6	3.7	8.8	12	5.1	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	2.1	2.4	5.7	4.0	3.7	5.8	<i>64e-6/1e4</i>	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.1	12	2.4	3.9	3.1	3.5	5.7	5.2	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	3.5	5.5	5.9	4.9	4.6	<i>18e-5/1e4</i>	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	26	27	14	26	12	7.6	<i>18e-4/6e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	284	472	608	203	34	99	23	40	38	<i>32e-6/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1.3	4.9	3.3	1.4	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.2	1.6	3.2	1.1	1.9	2.2	1.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	1.1	1.0	1	12	17	21	13	CMA+DE-MOS [12]
NEWUOA	1	1	2.1	58	13	26	54	<i>32e-4/6e3</i>	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1.3	1	1.2	1	1.3	1.5	1.3	Basic RCGA [16]
SPSA	16	50	86	56	40	151	113	93	83	<i>18e-4/1e5</i>	SPSA [8]

Table 27: 02-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	127 Griewank-Rosenbrock Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 0.50	1e+00 1.6	1e-01 8.3	1e-02 83	1e-03 520	1e-04 1883	1e-05 2428	1e-07 2506	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	3.0	3.2	2.8	5.9	3.0	3.8	7.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.1	2.0	2.4	1.3	2.3	1.0	1.2	2.3	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1.5	2.0	1.3	3.1	1.7	1.9	2.3	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.2	3.3	5.1	2.8	9.3	3.8	5.2	28	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1.1	1	3.0	4.0	2.3	1.8	2.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.3	1.2	2.9	3.5	1.8	1.9	2.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.1	1.3	1.2	3.1	3.0	1.3	1.1	1.4	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	1	4.9	2.4	2.8	1	1.0	1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1.3	2.2	4.3	1.8	4.0	1.9	3.4	<i>16e-6/5e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	12	17	19	8.6	4.2	1.7	2.5	5.0	16	96	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.4	1.9	2.3	2.7	3.0	1.2	1.1	1.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.3	4.7	1.3	1.9	1.1	1	2.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	1.2	1.9	1	1	1.6	3.6	5.1	CMA+DE-MOS [12]
NEWUOA	1	1	2.1	1.9	5.7	2.0	5.6	4.1	3.9	13	NEWUOA [15]
Basic RCGA	1	1	1.2	1.1	2.5	1.6	4.6	2.8	3.5	42	Basic RCGA [16]
SPSA	26	39	94	195	296	140	206	176	<i>40e-5/1e5</i>	.	SPSA [8]

Table 28: 02-D, running time excess ERT/ERT_{best} on f_{128} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	0.70	37	247	618	706	759	771	783	
(1,2)-CMA-ES	1	1	5.3	5.4	2.6	1.6	1.9	2.0	2.1	2.7	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.2	3.1	1.7	1.4	1.7	1.6	1.8	2.2	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	2.1	1.5	1	1.0	1.3	1.5	1.7	1.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	9.4	4.9	1.5	1	1.9	2.7	4.0	4.2	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.1	12	3.9	1.6	1.9	1.8	1.8	1.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	2.7	6.8	3.2	1.8	1.7	1.6	1.5	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	2.3	8.0	2.7	1.1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.6	3.7	2.7	1.5	1.4	2.0	2.2	2.1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	3.8	12	2.5	2.0	2.0	2.4	3.7	13	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	13	19	20	9.1	12	5.0	13	21	94	223	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.6	14	4.3	2.0	3.1	5.1	5.1	5.4	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	5.2	2.9	2.3	2.0	2.0	2.0	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.8	20	23	13	11	11	11	11	CMA+DE-MOS [12]
NEWUOA	1	1	2.4	9.5	2.6	2.5	2.7	4.4	5.3	8.0	NEWUOA [15]
Basic RCGA	1	1	1.4	1	4.9	4.0	8.1	18	22	59	Basic RCGA [16]
SPSA	10	22	45	173	179	206	609	567	<i>83e-4/1e5</i>	.	SPSA [8]

Table 29: 02-D, running time excess ERT/ERT_{best} on f_{129} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	129 Gallagher unif										
Δf_{target} ERT_{best}/D	1e+03 0.50	1e+02 0.50	1e+01 0.73	1e+00 21	1e-01 621	1e-02 1124	1e-03 2090	1e-04 3863	1e-05 9428	1e-07 17273	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	11	13	2.4	3.0	4.5	7.0	4.9	8.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	2.2	17	1.7	1.8	2.1	6.2	15	<i>12e-5/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.6	17	1.9	2.5	1.8	5.1	2.6	8.5	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	22	13	1.1	2.5	3.9	2.6	3.3	<i>60e-6/1e4</i>	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.5	13	1.6	1.9	1.8	1.9	1.0	2.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	2.0	11	1.0	1	1.3	2.0	1.2	2.6	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	2.0	17	1.6	1.2	1.9	2.2	1.8	4.1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	12	1	1.7	1.7	2.1	3.5	<i>31e-6/1e4</i>	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	63	40	5.6	6.3	4.3	11	9.3	5.1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	288	439	335	144	9.4	22	18	29	18	85	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.9	21	2.3	1.5	1	1	1	1.7	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.1	12	2.2	2.2	2.5	3.4	1.5	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.8	2.2	2.3	11	13	8.5	3.6	2.1	CMA+DE-MOS [12]
NEWUOA	1	1	30	36	3.7	6.0	8.7	11	10	<i>37e-4/6e3</i>	NEWUOA [15]
Basic RCGA	1	1	1.0	1	2.4	3.6	5.8	4.5	7.4	42	Basic RCGA [16]
SPSA	5.1	48	118	156	12	25	25	34	47	<i>86e-6/1e5</i>	SPSA [8]

Table 30: 02-D, running time excess ERT/ERT_{best} on f_{130} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.50	0.50	0.93	24	97	637	1328	1341	1365	1392	
(1,2)-CMA-ES	1	1	1.6	38	34	7.1	3.8	3.8	5.0	5.1	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.2	29	16	3.4	1.7	1.7	1.8	1.8	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.2	13	15	4.2	2.2	2.8	2.7	2.8	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.1	39	55	12	5.9	6.0	6.2	6.9	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.6	20	13	2.4	1.3	1.3	1.3	1.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	2.0	15	10	2.7	1.4	1.4	1.4	1.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.2	6.1	9.1	2.0	1	1	1.2	1.2	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.1	8.6	13	2.1	1.0	1.0	1	1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.6	7.8	3.8	1	1.1	2.4	4.9	11	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	8.8	12	9.0	7.4	23	7.1	9.0	44	84	202	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.2	6.3	6.7	15	7.8	7.7	7.8	53	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	7.9	18	3.4	1.7	1.9	1.9	1.9	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.4	1	1	3.9	7.1	12	12	25	CMA+DE-MOS [12]
NEWUOA	1	1	2.3	9.3	5.5	1.4	1.1	2.2	3.0	10	NEWUOA [15]
Basic RCGA	1	1	1.7	1.1	8.7	8.0	11	27	41	121	Basic RCGA [16]
SPSA	22	34	69	630	523	116	73	175	315	496	SPSA [8]

Table 31: 03-D, running time excess ERT/ERT_{best} on f_{101} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.33	0.33	1.9	6.9	11	13	14	15	16	18	
(1,2)-CMA-ES	1	1	3.6	3.2	4.2	6.2	6.9	7.2	8.4	9.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	1.8	3.5	4.1	5.0	5.8	6.5	7.8	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.2	3.0	2.0	3.2	3.7	4.2	5.1	5.9	6.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	4.5	3.4	4.2	5.3	6.4	7.3	8.6	10	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.3	1.9	2.4	3.1	3.6	4.4	5.2	5.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.7	1.9	2.0	2.7	3.4	4.0	4.5	5.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	2.1	1.6	1.8	2.2	2.6	2.9	3.4	3.9	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	2.3	2.1	2.1	2.6	3.0	3.3	3.9	4.6	(1,4s)-CMA-ES [3]
avg NEWUOA	1	2.1	2.2	1	1	1	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	21	10	8.0	64	204	320	485	985	888	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.6	2.4	2.9	4.0	4.7	5.5	6.4	7.6	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.4	1.9	2.9	4.0	4.8	5.7	6.5	8.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.6	6.5	12	15	19	21	25	30	CMA+DE-MOS [12]
NEWUOA	1	1.5	1.8	1.3	1.5	1.5	1.6	1.6	1.6	1.5	NEWUOA [15]
Basic RCGA	1	1.1	1.5	6.2	21	39	58	92	127	223	Basic RCGA [16]
SPSA	30	46	128	189	484	1054	1008	976	958	2591	SPSA [8]

Table 32: 03-D, running time excess ERT/ERT_{best} on f_{102} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	102 Sphere moderate unif										
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 2.1	1e+00 9.1	1e-01 17	1e-02 24	1e-03 30	1e-04 32	1e-05 33	1e-07 35	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	3.3	2.5	2.7	2.8	2.9	3.5	4.2	5.0	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.9	1.7	2.1	2.0	2.2	2.6	3.0	3.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.8	1.4	1.9	1.9	1.9	2.4	2.8	3.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.5	2.6	2.4	2.8	2.9	3.3	3.4	6.2	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.8	1.2	1.3	1.4	1.5	1.9	2.2	2.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	2.5	1.5	1.5	1.5	1.7	1.9	2.2	2.7	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1.5	1	1	1.2	1.2	1.4	1.6	2.0	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.7	1.2	1.1	1.3	1.4	1.6	1.8	2.3	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.9	2.1	1.3	1.3	1	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	28	45	12	6.3	7.0	7.3	7.4	55	770	1945	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	2.4	1.7	1.9	2.0	2.3	2.6	3.1	3.8	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.6	1.9	2.0	2.1	2.4	2.9	3.3	4.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.5	5.1	7.7	8.0	8.9	11	12	15	CMA+DE-MOS [12]
NEWUOA	1	1.5	3.4	2.6	2.5	2.8	2.4	3.0	3.6	4.6	NEWUOA [15]
Basic RCGA	1	1.1	1	7.4	13	16	27	42	66	110	Basic RCGA [16]
SPSA	24	38	273	177	318	793	763	844	2129	39796	SPSA [8]

Table 33: 03-D, running time excess ERT/ERT_{best} on f_{103} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy											
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 2.3	1e+00 7.5	1e-01 10	1e-02 13	1e-03 30	1e-04 39	1e-05 44	1e-07 75	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	3.2	2.9	4.2	4.9	3.0	3.0	3.3	2.6	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.3	1.6	2.9	3.8	2.1	2.1	2.2	1.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.4	1.7	2.8	3.7	1.8	1.9	2.1	1.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.0	2.5	3.3	3.9	2.5	2.5	2.9	2.5	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	2.1	2.0	2.5	3.1	1.6	1.8	1.9	1.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.3	1.2	2.5	3.0	1.6	1.6	1.7	1.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1.1	1.6	2.1	1.1	1.2	1.2	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	2.0	1.3	2.1	2.6	1.4	1.4	1.4	1.2	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.9	1.7	1	1	1	1.2	1.6	1.7	1.7	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	17	30	10	9.1	14	14	7.2	220	383	495	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.2	1.7	2.9	4.0	2.1	2.2	2.3	1.9	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.1	2.0	3.1	4.0	2.3	2.4	2.5	2.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.3	6.4	13	15	8.7	8.9	11	10	CMA+DE-MOS [12]
NEWUOA	1	1	1.8	1.2	1.6	1.7	1	1	1	1.8	NEWUOA [15]
Basic RCGA	1	1.1	1.2	7.6	25	35	29	38	49	55	Basic RCGA [16]
SPSA	40	142	187	124	145	203	118	206	796	2188	SPSA [8]

Table 36: 03-D, running time excess ERT/ERT_{best} on f_{106} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	106 Rosenbrock moderate Cauchy										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	2.0	3.7	3.8	4.4	6.7	5.6	3.9	4.0	4.0	3.9	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.2	2.1	3.7	5.3	5.2	4.2	2.7	2.7	2.8	2.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.1	2.4	4.0	3.5	3.5	2.8	1.9	1.9	1.9	1.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.4	10	9.4	17	16	13	8.3	8.5	8.3	7.9	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2.0	2.8	3.0	4.0	3.5	2.7	1.8	1.7	1.7	1.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.1	1.7	3.2	3.7	3.3	2.5	1.6	1.6	1.6	1.6	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.2	2.1	2.1	2.0	1.6	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.3	1.4	2.2	3.1	2.9	2.3	1.4	1.4	1.4	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1.2	1.1	1.1	1	1	1	2.0	3.2	7.2	11	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	15	18	16	17	13	10	6.8	6.8	7.0	8.0	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.1	1.6	2.6	1.5	2.3	2.0	1.3	1.3	1.3	1.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.2	2.4	3.2	2.2	3.5	3.0	2.0	2.0	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1.3	4.1	10	3.6	5.2	4.6	2.9	3.1	3.2	3.5	CMA+DE-MOS [12]
NEWUOA	1.1	1	1	1.4	3.0	4.3	7.0	14	19	49	NEWUOA [15]
Basic RCGA	1.2	4.8	14	60	488	1071	2698	<i>43e-3/5e4</i>	.	.	Basic RCGA [16]
SPSA	448	624	792	3788	<i>19e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 37: 03-D, running time excess ERT/ERT_{best} on f_{107} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss											
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 2.2	1e+00 19	1e-01 36	1e-02 63	1e-03 104	1e-04 131	1e-05 164	1e-07 231	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	19	10	15	27	28	47	208	<i>28e-6/1e4</i>	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	6.4	1.6	2.7	2.5	2.2	2.9	3.2	4.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	6.1	1.9	3.1	4.2	4.9	4.9	7.5	8.1	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	5.1	7.0	18	21	51	122	97	635	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	7.8	2.8	4.0	4.0	3.7	4.7	6.4	5.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	3.2	1.0	1	1	1.0	1.3	1.1	1.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.1	12	2.1	1.6	2.0	1.7	2.1	3.2	4.1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	1.8	2.1	4.6	3.5	4.2	4.5	10	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	14	17	64	141	377	624	<i>16e-3/6e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	24	37	11	4.1	8.6	17	51	239	568	6078	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.0	4.7	1.1	1.4	1.2	1	1.1	1.0	1.0	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.5	1	1.1	1.2	1.0	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.4	2.8	7.5	8.7	7.5	7.6	7.3	6.9	CMA+DE-MOS [12]
NEWUOA	1	1.1	11	24	86	79	157	561	<i>57e-4/5e3</i>	.	NEWUOA [15]
Basic RCGA	1	1	1.4	6.5	13	13	14	21	26	30	Basic RCGA [16]
SPSA	36	53	173	7105	19257	22083	13722	<i>11e-1/1e5</i>	.	.	SPSA [8]

Table 38: 03-D, running time excess ERT/ERT_{best} on f_{108} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif											
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 3.0	1e+00 276	1e-01 835	1e-02 1871	1e-03 3202	1e-04 4057	1e-05 6265	1e-07 8649	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	22	3.4	42	<i>15e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	23	15	3.0	10	37	<i>84e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	34	3.0	18	80	<i>10e-2/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	19	4.9	15	78	<i>88e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.1	19	1.2	4.7	38	<i>42e-3/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	19	2.2	4.6	14	<i>18e-3/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.1	6.3	1.7	7.3	37	<i>38e-3/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	22	2.4	6.8	76	<i>39e-3/1e4</i>	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.5	77	10	99	<i>39e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	1294	1758	1698	32	35	25	19	31	40	84	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	8.7	1	1.4	1.1	1.1	1	1.0	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.1	62	1.3	1	1	1	1.1	1	1.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1	7.9	108	89	68	61	42	35	CMA+DE-MOS [12]
NEWUOA	1	1	68	6.7	28	<i>41e-2/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.3	1.2	19	20	25	41	118	<i>18e-4/5e4</i>	Basic RCGA [16]
SPSA	111	264	175	20	45	384	<i>28e-3/1e5</i>	.	.	.	SPSA [8]

Table 39: 03-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	109 Sphere Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 2.5	1e+00 8.6	1e-01 21	1e-02 35	1e-03 47	1e-04 64	1e-05 79	1e-07 107	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	2.6	2.8	3.0	2.6	3.9	3.7	4.2	5.3	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.9	2.3	1.9	2.2	2.3	2.3	2.6	2.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.7	1.4	1.3	1.3	1.5	1.5	1.6	1.9	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	4.2	6.1	3.7	4.3	4.8	4.5	6.5	6.5	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.2	1.5	1.4	1.5	1.6	1.8	1.8	2.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.9	1.6	1.6	1.7	1.8	1.8	1.9	2.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.1	1.3	1.1	1.2	1.2	1.2	1.3	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.5	1.6	6.0	8.9	12	24	59	118	206	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	15	30	10	7.6	6.7	45	557	3410	<i>20e-5/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.3	2.1	2.0	2.0	2.2	2.1	2.2	2.5	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.2	1.9	1.8	1.9	2.4	2.3	2.5	2.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1.2	4.9	6.3	7.7	8.9	10	13	13	CMA+DE-MOS [12]
NEWUOA	1	1.3	2.5	5.0	10	17	46	148	192	<i>17e-5/5e3</i>	NEWUOA [15]
Basic RCGA	1	1.1	1.6	8.4	16	20	27	28	35	40	Basic RCGA [16]
SPSA	37	157	214	184	2213	2243	5203	6984	<i>43e-4/1e5</i>	.	SPSA [8]

Table 42: 03-D, running time excess ERT/ERT_{best} on f_{112} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	2.8	6.4	12	151	397	482	530	559	578	610	ERT_{best}/D
(1,2)-CMA-ES	3.8	8.6	13	21	14	15	14	14	15	15	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.5	3.0	2.6	4.3	3.3	3.5	3.4	3.5	3.5	3.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	2.5	2.4	2.7	3.8	2.3	2.4	2.5	2.5	2.5	2.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2.2	5.0	6.8	20	16	28	31	37	56	54	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.4	1.5	1.7	1	1.3	1.5	1.6	1.7	1.7	1.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.5	1.5	1.8	2.3	1.5	1.5	1.6	1.6	1.5	1.6	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.4	1.3	1.5	1.6	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.5	1.8	2.1	3.4	2.0	2.0	2.0	2.0	2.0	1.9	(1,4s)-CMA-ES [3]
avg NEWUOA	1.4	1.1	1.6	1.6	2.3	16	151	<i>20e-3/6e3</i>	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	28	27	18	229	752	2915	<i>26e-2/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.5	2.0	3.0	1.2	1.0	1.2	1.3	1.3	1.4	1.5	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.1	2.6	2.9	3.5	2.4	2.6	2.7	2.7	2.7	2.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1.7	4.5	7.7	1.8	2.4	2.7	2.9	3.2	3.4	3.9	CMA+DE-MOS [12]
NEWUOA	1	1	1	1.2	1.8	15	66	130	<i>44e-4/5e3</i>	.	NEWUOA [15]
Basic RCGA	1.3	4.1	8.6	14	95	159	654	1267	<i>23e-3/5e4</i>	.	Basic RCGA [16]
SPSA	647	2011	2223	9313	<i>29e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 43: 03-D, running time excess ERT/ERT_{best} on f_{113} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	2.4	8.4	5.9	2.6	3.1	10	14	14	14	19	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.3	1	2.3	1.0	1	4.9	5.3	5.3	5.3	8.4	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.1	1.8	7.7	1.8	1.6	3.0	9.5	9.5	9.5	18	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2.5	18	10	2.1	4.3	30	54	54	54	166	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.5	2.3	3.7	1.2	2.4	3.9	4.6	4.6	4.6	5.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.9	1.9	1	1.4	2.3	4.4	4.4	4.4	4.4	4.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.2	3.3	5.7	1.2	1.9	4.6	3.6	3.6	3.6	4.2	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.2	2.1	2.1	1.1	2.0	3.7	4.3	4.3	4.3	7.6	(1,4s)-CMA-ES [3]
avg NEWUOA	1.5	4.2	7.3	3.8	10	43	97	97	97	<i>57e-3/6e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	26	11	19	4.7	98	491	508	508	508	1700	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	19	6.4	1.8	1.9	1.0	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.6	2.1	1.7	1.6	2.3	3.1	2.3	2.3	2.3	2.4	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.3	1.2	1	4.1	5.7	4.6	4.6	4.6	4.6	CMA+DE-MOS [12]
NEWUOA	1.4	11	6.9	3.5	6.1	20	91	91	91	<i>74e-3/5e3</i>	NEWUOA [15]
Basic RCGA	1	1.2	1.9	2.8	23	65	50	50	50	51	Basic RCGA [16]
SPSA	37	18	16	408	1203	2309	<i>71e-2/1e5</i>	.	.	.	SPSA [8]

Table 44: 03-D, running time excess ERT/ERT_{best} on f_{114} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.33	1.7	13	475	1847	3819	3949	3949	3949	4189	ERT_{best}/D
(1,2)-CMA-ES	1.1	2.9	21	8.1	23	<i>31e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.1	4.7	11	4.9	24	<i>30e-2/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.1	36	20	16	26	<i>22e-2/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1.1	20	19	8.5	<i>52e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.3	38	13	2.6	8.7	38	<i>11e-2/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.8	1.3	4.2	1.8	6.5	17	35	35	35	<i>83e-3/1e4</i>	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.8	15	16	2.8	13	<i>16e-2/1e4</i>	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	17	8.3	12	4.5	12	<i>22e-2/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	82	66	19	<i>11e-1/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	877	1311	351	90	167	<i>14e-2/1e5</i>	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.4	19	16	1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.1	7.1	4.5	1.7	1.8	1.3	1.4	1.4	1.4	1.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1.1	1.1	1.2	6.6	35	33	32	32	32	37	CMA+DE-MOS [12]
NEWUOA	1	29	45	22	<i>11e-1/5e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1.5	1	1	5.7	14	23	28	28	28	51	Basic RCGA [16]
SPSA	271	117	142	45	776	<i>29e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 45: 03-D, running time excess ERT/ERT_{best} on f_{115} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	115 Step-ellipsoid Cauchy										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1.6	3.4	5.1	3.0	9.1	52	71	71	71	<i>54e-4/1e4</i>	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.4	2.2	1.8	2.4	3.3	7.3	13	13	13	27	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.1	1.6	3.0	1.7	1.8	6.3	15	15	15	51	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1.4	4.0	4.5	3.8	3.9	29	55	55	55	218	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.4	3.8	3.0	1.7	1.9	3.5	4.8	4.8	4.8	8.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.3	3.0	2.8	1	1.5	1.7	3.8	3.8	3.8	5.3	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.1	1.5	2.2	1.4	1	1.7	1.8	1.8	1.8	2.7	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.0	4.7	2.2	1.8	3.2	3.4	3.4	3.4	6.8	(1,4s)-CMA-ES [3]
avg NEWUOA	1.4	3.2	1.1	3.0	5.7	24	50	50	50	75	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	23	18	21	139	450	2056	5308	5308	5308	4382	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.1	2.9	2.1	1.0	1.0	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.6	3.4	6.7	2.7	2.1	3.0	2.6	2.6	2.6	2.4	IPOP-CMA-ES [14]
CMA+DE-MOS	1	2.1	2.4	2.4	5.8	9.3	8.5	8.5	8.5	7.3	CMA+DE-MOS [12]
NEWUOA	2.2	3.0	1	4.6	10	83	240	240	240	198	NEWUOA [15]
Basic RCGA	1	1	6.3	64	110	182	154	154	154	166	Basic RCGA [16]
SPSA	49	46	50	658	643	1925	<i>43e-3/1e5</i>	.	.	.	SPSA [8]

Table 46: 03-D, running time excess ERT/ERT_{best} on f_{116} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	116 Ellipsoid Gauss										
$\Delta\text{ftarget}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$
ERT_{best}/D	14	58	333	1187	1812	2090	2154	2224	2285	2404	ERT_{best}/D
(1,2)-CMA-ES	6.3	6.1	2.9	7.0	78	<i>68e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	2.9	4.8	2.4	3.0	6.8	10	15	15	64	<i>54e-3/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.8	5.3	4.5	4.2	5.6	33	<i>45e-3/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	6.4	15	6.8	9.3	38	34	70	<i>61e-2/1e4</i>	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.1	1	2.1	2.8	9.1	14	20	21	20	29	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.1	2.5	1.7	2.3	3.5	4.8	6.0	11	20	19	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	4.9	3.9	1.9	1.3	3.2	4.4	6.1	11	14	<i>96e-5/1e4</i>	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	7.8	3.1	1.4	1.7	3.2	6.9	14	20	<i>18e-3/1e4</i>	.	(1,4s)-CMA-ES [3]
avg NEWUOA	8.9	11	11	21	<i>30e-1/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	659	573	334	1262	<i>97e-1/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	3.1	2.7	1	1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.1	3.2	1.8	2.1	2.1	2.1	2.1	2.1	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.2	1.2	3.3	2.4	2.4	2.5	2.7	2.7	3.0	CMA+DE-MOS [12]
NEWUOA	5.4	7.8	7.5	31	41	<i>49e-1/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1.2	8.0	10	20	42	63	<i>67e-3/5e4</i>	.	.	.	Basic RCGA [16]
SPSA	45	375	687	1203	<i>20e+0/1e5</i>	.	.	.	.	.	SPSA [8]

Table 48: 03-D, running time excess ERT/ERT_{best} on f_{118} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	12	13	9.1	6.3	7.8	7.9	7.9	8.2	7.9	10	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.2	6.4	4.0	3.2	3.7	4.2	4.2	4.2	4.3	4.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.1	5.4	5.3	2.4	2.2	2.2	2.6	2.6	2.6	2.5	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	7.1	10	29	19	25	29	34	32	30	31	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.2	4.7	2.5	1.4	1.4	1.5	1.6	1.6	1.6	1.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.6	5.0	3.1	1.5	1.3	1.4	1.5	1.5	1.5	1.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	2.4	2.4	1.9	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.7	4.3	3.2	1.3	1.2	1.2	1.2	1.2	1.2	1.1	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1	2.1	5.8	31	99	<i>43e-4/6e3</i>	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	38	59	688	1269	2993	5962	<i>21e-1/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	3.4	3.6	3.2	1.3	1.1	1.2	1.2	1.2	1.3	1.4	IPOP-aCMA-ES [11]
IPOP-CMA-ES	4.4	5.8	5.9	2.9	2.8	2.9	2.8	2.8	2.9	2.9	IPOP-CMA-ES [14]
CMA+DE-MOS	3.4	7.3	5.8	2.2	2.1	2.5	3.0	3.6	3.9	4.7	CMA+DE-MOS [12]
NEWUOA	1.3	1.0	1.6	1.6	7.0	53	140	<i>19e-3/5e3</i>	.	.	NEWUOA [15]
Basic RCGA	2.4	57	136	231	732	1533	2870	<i>75e-2/5e4</i>	.	.	Basic RCGA [16]
SPSA	128	184	1352	2830	<i>41e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 49: 03-D, running time excess ERT/ERT_{best} on f_{119} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	119 Sum of diff powers Gauss										
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 0.84	1e+00 21	1e-01 54	1e-02 141	1e-03 514	1e-04 1648	1e-05 2711	1e-07 4116	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1.3	5.8	4.6	14	24	62	<i>24e-4/1e4</i>	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	4.1	3.5	4.3	6.0	4.1	9.4	25	<i>14e-5/1e4</i>	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.1	1.9	1.6	3.8	4.2	5.9	40	<i>18e-5/1e4</i>	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.1	24	7.4	10	56	143	<i>50e-4/1e4</i>	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	2.1	8.0	4.6	3.9	4.3	3.1	4.7	26	<i>63e-6/1e4</i>	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	4.1	3.4	2.4	2.2	3.0	3.5	5.8	36	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.8	11	1.8	2.5	2.6	3.4	3.3	9.0	<i>48e-6/1e4</i>	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	3.7	37	3.9	5.3	4.6	6.3	11	52	<i>18e-5/1e4</i>	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	20	8.7	41	73	<i>13e-3/6e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	24	36	22	26	64	197	251	422	<i>11e-4/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.1	4.8	1.1	1.4	1.3	1	1	1.1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.9	7.3	1	1	1	1.2	1.4	1.5	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	1	1.3	6.8	6.6	2.8	1.2	1	1.3	CMA+DE-MOS [12]
NEWUOA	1	2.2	11	19	71	167	149	<i>31e-3/5e3</i>	.	.	NEWUOA [15]
Basic RCGA	1	1.3	2.1	7.1	16	11	12	10	36	<i>17e-6/5e4</i>	Basic RCGA [16]
SPSA	35	55	163	6303	27530	10543	<i>10e-1/1e5</i>	.	.	.	SPSA [8]

Table 50: 03-D, running time excess ERT/ERT_{best} on f_{120} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	120 Sum of diff powers unif											
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 0.84	1e+00 95	1e-01 1133	1e-02 2242	1e-03 6359	1e-04 12487	1e-05 21134	1e-07 44226	Δf_{target} ERT_{best}/D	
(1,2)-CMA-ES	1	41	37	8.7	16	<i>11e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	4.0	50	2.2	8.1	<i>54e-3/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.1	57	8.9	15	65	<i>14e-2/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	1.3	19	10	15	29	<i>13e-2/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	3.1	7.8	3.1	6.9	64	<i>71e-3/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1.4	23	3.5	3.8	<i>44e-3/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.7	4.6	4.8	5.3	63	<i>31e-3/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1	47	5.1	7.6	<i>51e-3/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	24	104	19	21	<i>36e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	779	1826	1833	241	80	76	73	118	<i>11e-3/1e5</i>	.	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	2.2	12	2.3	1	1.7	1.1	1	1.1	1	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1.3	7.4	3.0	1.0	1	1	1.1	1	1.5	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.1	1	1	42	40	25	19	18	8.8	CMA+DE-MOS [12]	
NEWUOA	1	1.7	104	18	33	<i>42e-2/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.5	2.6	1.6	10	27	54	<i>85e-4/5e4</i>	.	.	Basic RCGA [16]	
SPSA	99	281	477	70	179	<i>12e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 51: 03-D, running time excess ERT/ERT_{best} on f_{121} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy												
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D	
	0.33	0.33	0.84	11	25	55	154	272	397	621		
(1,2)-CMA-ES	1	1.3	2.3	2.0	2.5	3.7	4.7	5.3	7.5	9.4	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	1	2.6	1.4	1.7	2.2	2.6	3.7	4.2	5.3	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	1	1.6	1.4	1.7	1.3	1.7	2.6	2.7	3.2	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	1.6	2.2	3.5	4.3	11	11	13	23	42	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	1.3	1.3	1	1.2	1.8	1.7	2.0	1.8	2.0	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1.3	3.4	1.6	1.4	1.6	1.6	1.8	1.6	1.9	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	1.4	2.0	1.3	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1.5	4.0	1.5	1.3	1.4	1.4	1.5	1.5	1.4	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	2.3	2.5	4.5	8.3	41	482	<i>47e-4/5e3</i>	.	.	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	18	34	25	10	7.2	404	1338	5180	<i>11e-4/1e5</i>	.	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	2.5	1.5	1.4	1.6	1.4	1.5	1.7	1.6	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1.1	3.7	1.6	1.9	2.3	2.5	3.1	3.7	4.6	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.1	1	1.9	7.1	7.2	4.9	4.4	4.4	4.6	CMA+DE-MOS [12]	
NEWUOA	1	1.2	2.8	4.6	12	65	<i>62e-4/5e3</i>	.	.	.	NEWUOA [15]	
Basic RCGA	1	1.4	1.3	3.3	20	16	55	78	310	<i>19e-6/5e4</i>	Basic RCGA [16]	
SPSA	36	101	241	3498	5677	3438	9408	<i>24e-2/1e5</i>	.	.	SPSA [8]	

Table 52: 03-D, running time excess ERT/ERT_{best} on f_{122} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss											
$\Delta\text{ftarget}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$
ERT_{best}/D	0.33	0.33	2.7	88	481	990	1707	2112	3299	5708	ERT_{best}/D
(1,2)-CMA-ES	1	5.3	5.1	9.2	66	<i>15e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.8	3.7	2.1	6.3	34	<i>21e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.3	4.6	4.2	12	68	<i>35e-3/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.7	6.9	7.0	70	<i>16e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.3	4.4	4.8	7.6	69	<i>20e-3/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	3.3	2.6	4.5	14	<i>85e-4/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.3	2.2	1	6.6	16	86	<i>18e-3/1e4</i>	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.3	7.9	6.9	13	149	<i>61e-3/1e4</i>	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	2.1	10	30	<i>37e-2/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	29	35	8.0	5.5	62	214	245	664	<i>52e-3/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.3	2.1	1.9	1	1.0	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.1	1.4	1.4	1.3	1	1.1	1.4	1.2	1.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.3	1.1	3.7	12	22	23	27	28	19	CMA+DE-MOS [12]
NEWUOA	1	1.1	6.2	29	153	<i>65e-2/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1.1	1.1	1	11	16	12	20	27	107	<i>67e-6/5e4</i>	Basic RCGA [16]
SPSA	69	158	75	3555	<i>20e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 53: 03-D, running time excess ERT/ERT_{best} on f_{123} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	123 Schaffer F7 unif											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D	
	0.33	0.36	2.9	898	4071	11932	23354	32415	53261	1.35e5		
(1,2)-CMA-ES	1	5.6	16	6.4	<i>73e-2/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	2.2	20	4.2	<i>62e-2/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	19	27	2.9	<i>65e-2/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.1	28	8.8	<i>90e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.4	16	4.1	35	<i>34e-2/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	2.6	1.8	<i>32e-2/1e4</i>	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.3	17	3.0	<i>45e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	35	47	6.0	<i>59e-2/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	12	67	19	<i>16e-1/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	374	514	397	27	31	125	<i>75e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	14	1.7	1	1	1	1	1	1	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1.3	4.8	1	1.6	1.4	1.2	1.1	1.0	1.3	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.2	1	98	91	32	22	21	13	5.2	CMA+DE-MOS [12]	
NEWUOA	1	12	75	11	<i>12e-1/5e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.1	1.2	7.7	83	<i>36e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	64	43456	13041	740	<i>14e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 54: 03-D, running time excess ERT/ERT_{best} on f_{124} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy											
$\Delta\text{ftarget}$ ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$ ERT_{best}/D
(1,2)-CMA-ES	1	1.3	24	16	41	<i>82e-3/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.4	1.3	1	3.2	8.2	109	<i>70e-4/1e4</i>	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.5	2.2	4.8	4.5	15	<i>73e-4/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.2	3.5	22	95	<i>13e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.8	19	36	10	22	109	<i>79e-4/1e4</i>	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.5	1.9	2.6	5.7	12	53	<i>10e-4/1e4</i>	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.3	2.0	5.2	1.5	2.9	10	<i>91e-5/1e4</i>	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.9	12	5.6	5.1	11	114	<i>45e-4/1e4</i>	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.4	6.2	17	72	<i>18e-2/5e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	15	22	8.6	13	37	206	<i>11e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.9	2.3	1.2	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.4	1.8	1.3	2.4	2.1	1.4	1.1	1.3	1.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.2	1.3	5.5	33	20	11	5.7	4.3	3.7	CMA+DE-MOS [12]
NEWUOA	1	1.4	3.1	27	44	<i>14e-2/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.1	1	10	27	21	32	57	145	<i>80e-5/5e4</i>	Basic RCGA [16]
SPSA	27	48	3392	4731	5907	<i>11e-1/1e5</i>	.	.	.	.	SPSA [8]

Table 55: 03-D, running time excess ERT/ERT_{best} on f_{125} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss											
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 0.33	1e+00 2.7	1e-01 69	1e-02 1010	1e-03 5516	1e-04 8125	1e-05 9253	1e-07 9555	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	2.4	2.8	9.4	<i>69e-4/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	1.1	1	5.7	27	18	<i>38e-4/1e4</i>	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1.3	1.4	4.0	27	18	<i>53e-4/1e4</i>	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.3	1.3	3.8	8.5	<i>68e-4/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1	3.3	7.0	13	<i>55e-4/1e4</i>	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.3	2.5	4.5	13	18	16	<i>31e-4/1e4</i>	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1.1	1.4	3.6	6.0	18	<i>31e-4/1e4</i>	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	1.8	2.7	7.8	27	<i>69e-4/1e4</i>	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1.4	1.2	1.6	2.3	4.5	10	8.7	<i>40e-4/6e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	30	38	49	10	2.8	2.7	31	55	74	152	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.3	1.2	1.4	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.2	1.3	1.2	2.1	1.7	1.4	1.3	1.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	1.6	1.1	2.6	5.9	9.1	8.0	7.9	CMA+DE-MOS [12]
NEWUOA	1	1	2.8	1.3	1.6	1.3	4.2	2.8	2.5	<i>19e-4/5e3</i>	NEWUOA [15]
Basic RCGA	1	1	1.3	1.2	1.4	1.5	7.7	12	77	<i>54e-5/5e4</i>	Basic RCGA [16]
SPSA	25	38	41	8.2	105	20	<i>36e-4/1e5</i>	.	.	.	SPSA [8]

Table 56: 03-D, running time excess ERT/ERT_{best} on f_{126} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	126 Griewank-Rosenbrock unif										
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.33	0.33	0.33	2.2	79	494	24438	73344	1.01e5	1.56e5	ERT_{best}/D
(1,2)-CMA-ES	1	1	1.1	21	15	139	<i>26e-3/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	14	13	144	<i>22e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	23	6.1	64	<i>20e-3/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	32	23	<i>38e-3/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.2	2.4	5.2	87	<i>18e-3/1e4</i>	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.7	6.8	31	<i>10e-3/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1	4.7	67	<i>12e-3/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	32	15	6.7	49	<i>12e-3/1e4</i>	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1.7	40	26	<i>49e-3/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	630	728	1797	401	34	78	6.3	9.2	<i>22e-4/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	12	3.9	6.2	1.4	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	2.4	2.7	7.7	1.4	1.2	2.0	1.9	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	2.5	1	1	24	<i>27e-4/1e5</i>	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	13	41	36	158	<i>48e-3/5e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1.1	1.5	2.8	1	1.7	7.3	<i>15e-5/5e4</i>	Basic RCGA [16]
SPSA	18	46208	75111	31067	1298	1452	<i>54e-3/1e5</i>	.	.	.	SPSA [8]

Table 57: 03-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy												
Δf_{target} ERT_{best}/D	1e+03 0.33	1e+02 0.33	1e+01 0.33	1e+00 1.6	1e-01 60	1e-02 225	1e-03 10765	1e-04 16315	1e-05 16562	1e-07 17133	Δf_{target} ERT_{best}/D	
(1,2)-CMA-ES	1	1	1.3	2.3	2.1	32	<i>76e-4/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	1	1.1	1.5	1.0	11	2.2	4.3	4.2	4.1	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	1	1	2.1	3.6	18	6.6	<i>54e-4/1e4</i>	.	.	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	1	1	2.7	3.6	38	13	<i>73e-4/1e4</i>	.	.	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	1	1	1.0	2.4	31	6.6	8.8	8.7	8.4	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1	1.1	2.0	2.3	19	6.5	9.0	8.9	8.6	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	1	1	1	1.2	7.6	2.7	1.8	1.8	1.7	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1	1	2.8	1.1	24	2.8	4.1	4.1	4.0	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	1	2.1	2.4	1.6	23	<i>61e-4/5e3</i>	.	.	.	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	14	24	30	12	1.3	53	29	86	<i>17e-4/1e5</i>	.	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	1	1.4	1	19	1.5	1	1	1	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1	1	3.0	1.1	22	1	1.3	1.3	1.3	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1	1.1	2.5	1.1	1	2.3	2.5	2.5	2.5	CMA+DE-MOS [12]	
NEWUOA	1	1	2.1	3.9	1.6	8.1	2.8	3.9	3.9	<i>61e-4/4e3</i>	NEWUOA [15]	
Basic RCGA	1	1	1.1	2.5	1.6	5.9	2.8	7.6	14	41	Basic RCGA [16]	
SPSA	31	47	82	328	256	3030	<i>22e-3/1e5</i>	.	.	.	SPSA [8]	

Table 58: 03-D, running time excess ERT/ERT_{best} on f_{128} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss												
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D	
	0.33	0.33	2.3	231	845	1107	1130	1188	1199	1309		
(1,2)-CMA-ES	1	1	3.9	2.2	1	1.9	2.6	5.2	5.3	8.5	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	1	1.6	1	1.0	1	1.0	1.0	1.3	1.2	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	1	1.9	1.8	1.8	1.5	1.7	1.7	2.0	2.1	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	1	2.8	1.9	1.5	2.3	2.8	2.9	2.9	4.8	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	1	2.1	1.7	1.1	1.0	1	1	1	1	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1	1.6	2.0	1.8	1.6	1.6	1.8	1.8	2.1	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	1	2.9	1.9	1.4	1.5	1.4	1.4	1.4	1.3	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1	2.2	1.9	2.1	2.0	2.1	2.1	2.1	2.6	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	1	3.5	6.1	8.3	10	10	13	34	<i>45e-3/6e3</i>	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	30	40	10	8.5	21	34	83	200	355	<i>90e-5/1e5</i>	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	1	4.5	7.0	15	15	58	58	53	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1	1.8	4.5	5.4	4.3	8.6	8.3	8.5	8.0	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1	1.9	20	23	18	18	18	18	17	CMA+DE-MOS [12]	
NEWUOA	1	1	1.4	4.3	4.0	5.6	20	64	<i>89e-4/5e3</i>	.	NEWUOA [15]	
Basic RCGA	1	1	1.0	11	15	23	28	27	33	46	Basic RCGA [16]	
SPSA	20	31	122	863	857	1317	1291	<i>13e-1/1e5</i>	.	.	SPSA [8]	

Table 59: 03-D, running time excess ERT/ERT_{best} on f_{129} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.33	0.33	2.3	713	3563	7429	23646	70382	86332	88752	
(1,2)-CMA-ES	1	1	37	2.6	1.7	19	<i>23e-3/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	15	2.1	1.5	5.9	6.0	<i>61e-3/1e4</i>	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	22	3.0	2.5	6.4	6.2	<i>27e-3/1e4</i>	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	20	4.3	3.6	10	<i>90e-3/1e4</i>	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	10	2.3	1.3	2.0	1.8	2.1	1.7	<i>11e-3/1e4</i>	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	3.6	1.2	1	1.9	1.9	1	<i>47e-4/1e4</i>	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	6.7	1.9	1.4	2.2	6.0	<i>30e-3/1e4</i>	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	16	1.8	1.7	2.7	6.3	2.1	<i>14e-3/1e4</i>	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	36	5.7	3.8	5.3	3.5	1.2	<i>23e-2/6e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	181	2286	4398	38	24	16	14	6.6	17	17	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1	1.6	1	1.9	1.2	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	5.3	2.0	1.5	1.1	1	1.5	1.2	3.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.7	40	26	25	13	6.0	5.0	7.0	CMA+DE-MOS [12]
NEWUOA	1	1	39	11	6.7	11	3.4	<i>79e-2/5e3</i>	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1.9	3.7	3.9	3.8	1.7	1.4	3.8	Basic RCGA [16]
SPSA	54	279	711	29	98	96	<i>14e-2/1e5</i>	.	.	.	SPSA [8]

Table 60: 03-D, running time excess ERT/ERT_{best} on f_{130} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.33	0.33	2.2	242	1310	1574	1587	1594	1605	1621	
(1,2)-CMA-ES	1	1	2.4	13	5.7	4.8	4.8	4.8	5.8	5.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	2.3	5.7	1.8	1.5	1.7	1.7	1.8	1.8	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	2.7	1.3	1.9	1.9	2.4	2.4	2.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	3.4	11	6.9	6.1	6.1	7.1	7.1	7.1	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	18	3.2	1.8	1.9	1.9	1.9	1.9	1.9	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.8	3.6	2.0	1.7	1.7	1.7	1.7	1.7	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	12	2.9	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	2.0	2.6	1.9	1.6	1.6	1.6	1.6	1.6	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.2	1.3	1.6	1.7	3.6	7.9	14	<i>90e-5/5e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	22	37	10	18	20	42	64	186	258	<i>99e-5/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.9	6.3	6.1	10	18	49	49	49	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	2.6	18	7.5	6.3	48	48	48	47	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.5	30	44	77	123	123	216	214	CMA+DE-MOS [12]
NEWUOA	1	1	1.7	1	1.2	3.5	6.6	9.3	42	<i>86e-4/5e3</i>	NEWUOA [15]
Basic RCGA	1	1	1.1	4.9	11	26	44	44	56	76	Basic RCGA [16]
SPSA	15	30	87	176	64	111	431	921	914	<i>51e-3/1e5</i>	SPSA [8]

Table 61: 05-D, running time excess ERT/ERT_{best} on f_{101} , in *italics* is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	0.20	5.2	11	14	17	19	20	21	23	
(1,2)-CMA-ES	1	1.2	3.5	3.0	4.1	4.8	5.6	6.6	7.2	8.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	3.1	1.8	2.3	3.2	3.5	3.9	4.3	4.8	5.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.6	2.0	2.6	3.0	3.3	3.8	4.3	5.0	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	2.9	3.2	4.3	4.7	5.0	5.8	6.3	7.8	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1.2	1.9	2.3	2.7	3.0	3.6	4.0	4.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.3	1	1.4	1.8	2.3	2.7	2.9	3.3	4.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.2	1.0	1.1	1.5	1.7	2.0	2.3	2.5	3.0	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	3.3	1.1	1.4	1.7	2.0	2.3	2.6	2.9	3.5	(1,4s)-CMA-ES [3]
avg NEWUOA	1	2.6	1.2	1	1	1	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	41	61	9.5	8.6	9.1	10	11	12	13	16	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.2	1.2	2.0	2.7	3.4	3.8	4.4	4.9	6.0	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.2	1.4	2.3	3.0	3.5	4.0	4.5	5.1	6.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	3.1	7.9	12	13	16	18	20	24	CMA+DE-MOS [12]
NEWUOA	1	3.6	1.1	1.1	1.3	1.5	1.7	1.9	1.9	2.0	NEWUOA [15]
Basic RCGA	1	1.1	3.3	17	31	52	75	102	133	189	Basic RCGA [16]
SPSA	40	64	35	117	246	255	301	325	368	6241	SPSA [8]

Table 62: 05-D, running time excess ERT/ERT_{best} on f_{102} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif												
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D	
	0.20	0.20	5.1	10	15	19	22	24	27	30		
(1,2)-CMA-ES	1	1.4	4.0	4.0	4.3	4.6	5.1	5.9	6.2	7.1	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	1.4	1.7	2.3	2.4	3.0	3.2	3.5	3.9	4.5	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	2.4	1.8	2.3	2.7	2.8	3.1	3.3	3.5	4.1	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	2.3	1.8	3.6	4.4	4.6	5.3	5.6	6.0	6.9	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	1	1.4	1.7	2.0	2.1	2.4	2.7	3.0	3.5	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1.7	1.0	1.6	1.9	1.9	2.3	2.5	2.6	3.0	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	1	1	1.2	1.4	1.7	1.8	2.0	2.0	2.4	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1.6	1.2	1.4	1.6	1.9	2.1	2.2	2.3	2.9	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	1.3	1.2	1	1	1	1	1	1	1	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	45	79	9.1	10	10	10	10	11	12	13	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1.4	1.5	2.3	2.6	3.1	3.3	3.8	3.9	4.6	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1.5	1.5	2.2	2.8	3.0	3.3	3.9	4.2	4.8	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.1	2.5	8.7	11	12	14	15	16	18	CMA+DE-MOS [12]	
NEWUOA	1	3.9	2.7	4.1	4.8	11	13	18	21	27	NEWUOA [15]	
Basic RCGA	1	1.2	4.5	20	27	40	58	80	99	138	Basic RCGA [16]	
SPSA	41	60	863	3390	6811	6831	6080	7162	15738	<i>31e-3/1e5</i>	SPSA [8]	

Table 63: 05-D, running time excess ERT/ERT_{best} on f_{103} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy												
$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	
	0.20	0.20	4.7	8.7	21	29	38	48	57	79		
(1,2)-CMA-ES	1	1.5	2.9	4.2	2.6	2.8	3.0	2.9	3.1	3.0	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	2.5	1.6	2.4	1.6	1.7	1.7	1.8	1.8	1.8	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	1	1.8	2.3	1.6	1.5	1.5	1.6	1.6	1.6	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	2.1	3.8	4.4	2.8	2.6	2.6	2.7	2.7	2.7	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	1.6	1	1.9	1.3	1.3	1.4	1.4	1.5	1.5	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	1.3	1.2	1.8	1.3	1.3	1.3	1.3	1.3	1.3	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	1.2	1.1	1.3	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	1.6	1.4	1.8	1.4	1.4	1.3	1.3	1.3	1.2	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	2.5	1.2	1	1.0	1.1	2.1	3.4	5.1	10	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	32	57	9.1	10	5.7	5.5	5.0	4.9	5.2	5.9	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	1.3	2.6	1.8	1.8	1.8	1.8	1.9	1.9	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1.4	1.7	2.5	1.9	1.9	2.0	2.1	2.1	2.1	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.1	3.5	8.4	7.9	7.7	7.8	8.0	8.8	8.8	CMA+DE-MOS [12]	
NEWUOA	1	3.5	1.1	1.2	1.6	1.9	10	11	22	40	NEWUOA [15]	
Basic RCGA	1	1.3	3.3	17	17	27	38	47	53	65	Basic RCGA [16]	
SPSA	51	202	70	76	48	52	68	698	11449	<i>42e-6/1e5</i>	SPSA [8]	

Table 68: 05-D, running time excess ERT/ERT_{best} on f_{108} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	108 Sphere unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	0.20	14	703	1855	3138	3952	5735	7305	11152	
(1,2)-CMA-ES	1	1.7	55	<i>23e-1/1e4</i>	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	2.7	34	33	<i>18e-1/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.1	40	64	<i>19e-1/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	2.8	114	101	<i>22e-1/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.7	7.5	23	80	<i>11e-1/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.4	31	11	<i>84e-2/1e4</i>	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	3.7	20	19	<i>94e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.7	31	100	<i>15e-1/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	3.0	195	64	<i>27e-1/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	5825	9728	366	20	12	11	14	15	21	67	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	12	13	1	1	1.0	1	1.1	1.1	1.4	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.7	11	1.2	1.1	1	1.2	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	3.1	139	195	247	418	288	227	<i>89e-2/1e5</i>	CMA+DE-MOS [12]
NEWUOA	1	48	97	93	<i>41e-1/5e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1	19	47	111	<i>16e-2/5e4</i>	.	.	.	Basic RCGA [16]
SPSA	436	1305	112	14	378	<i>15e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 69: 05-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	109 Sphere Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.20	1e+02 0.20	1e+01 4.2	1e+00 13	1e-01 24	1e-02 39	1e-03 57	1e-04 74	1e-05 91	1e-07 127	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	2.7	2.9	2.4	3.2	3.7	3.9	4.8	4.7	5.1	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	3.3	2.2	2.2	2.2	2.0	2.1	2.0	1.9	2.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.3	1.8	1.9	1.8	1.6	1.6	1.7	1.7	1.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	3.1	3.1	3.6	3.8	4.5	4.6	4.6	5.1	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.1	1.8	2.0	1.8	1.9	2.0	2.1	2.2	2.1	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.5	1.2	1.4	1.6	1.6	1.7	1.8	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.6	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.2	1.6	1.2	1.4	1.4	1.4	1.3	1.3	1.3	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.5	2.2	3.1	46	90	<i>67e-4/6e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	41	62	11	7.3	5.5	210	4881	<i>17e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.1	1.6	1.7	1.9	2.0	1.9	2.0	2.2	2.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.5	1.9	2.0	2.1	2.1	2.2	2.2	2.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	3.2	7.7	8.6	9.3	9.4	10	10	11	CMA+DE-MOS [12]
NEWUOA	1	1.7	2.6	11	148	1690	<i>41e-3/5e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1.3	4.7	18	22	27	32	38	48	80	Basic RCGA [16]
SPSA	50	101	73	839	6210	<i>13e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 74: 05-D, running time excess ERT/ERT_{best} on f_{114} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	114 Step-ellipsoid unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	2.9	490	1317	5378	9801	10047	10047	10047	10293	
(1,2)-CMA-ES	1.3	116	32	<i>11e+0/1e4</i>	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.5	70	7.9	<i>63e-1/1e4</i>	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.3	112	17	<i>79e-1/1e4</i>	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	38	45	18	<i>73e-1/1e4</i>	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2.3	44	5.7	<i>46e-1/1e4</i>	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.3	14	4.3	<i>30e-1/1e4</i>	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	53	21	5.9	112	<i>21e-1/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.4	18	6.6	<i>53e-1/1e4</i>	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1.3	91	23	<i>11e+0/6e3</i>	.	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	1787	581	47	135	<i>19e-1/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.3	28	1.0	1.4	1.0	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.3	33	1	1	1	1.3	1.3	1.3	1.3	1.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1.5	2.0	19	290	71	52	79	79	79	78	CMA+DE-MOS [12]
NEWUOA	1	121	14	<i>89e-1/5e3</i>	.	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1.2	1	3.7	35	65	<i>41e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	1025	428	57	548	<i>29e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 75: 05-D, running time excess ERT/ERT_{best} on f_{115} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	115 Step-ellipsoid Cauchy										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1.9	3.3	4.9	7.0	58	<i>13e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.5	2.2	1.7	3.0	5.8	50	99	99	99	159	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	2.6	2.6	2.1	1.9	6.6	41	64	64	64	164	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1.2	2.6	4.4	13	44	<i>17e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.7	1.5	1.6	2.1	4.9	21	97	97	97	79	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.4	1.2	1.1	1.7	2.2	12	19	19	19	46	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.5	1.2	2.7	2.0	4.1	23	35	35	35	37	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.5	1.4	1.8	2.2	6.1	41	65	65	65	<i>11e-3/1e4</i>	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.3	1	5.2	24	<i>10e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	55	11	7.9	521	1588	2865	2019	2019	2019	<i>31e-2/1e5</i>	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.1	1.7	1.6	1	1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.1	1	1.5	2.9	2.4	2.7	2.2	2.2	2.2	1.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1.4	2.1	4.9	23	28	23	17	17	17	13	CMA+DE-MOS [12]
NEWUOA	1.9	1.1	2.7	17	37	<i>34e-2/4e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1.2	1.5	68	84	96	707	511	511	511	400	Basic RCGA [16]
SPSA	51	55	204	2021	3406	<i>12e-1/1e5</i>	.	.	.	.	SPSA [8]

Table 80: 05-D, running time excess ERT/ERT_{best} on f_{120} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	120 Sum of diff powers unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	0.21	2.8	443	2447	5038	9959	16295	28976	72546	
(1,2)-CMA-ES	1	1.4	89	43	<i>14e-1/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	32	53	104	61	<i>11e-1/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.6	40	34	<i>10e-1/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	59	59	44	<i>14e-1/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	10	41	21	<i>77e-2/1e4</i>	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	2.7	15	8.6	<i>66e-2/1e4</i>	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	52	74	13	<i>69e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.8	44	20	<i>83e-2/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	40	109	64	<i>15e-1/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	1223	2046	778	111	51	33	72	<i>13e-3/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.1	21	1	1	1.1	1.2	1.2	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	7.0	2.1	1.0	1	1	1	1.3	1.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	2.9	83	199	97	49	47	55	22	CMA+DE-MOS [12]
NEWUOA	1	31	150	72	<i>24e-1/5e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.2	1	22	18	32	<i>50e-3/5e4</i>	.	.	.	Basic RCGA [16]
SPSA	194	1014	318	217	<i>84e-2/1e5</i>	.	.	.	.	.	SPSA [8]

Table 81: 05-D, running time excess ERT/ERT_{best} on f_{121} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	121 Sum of diff powers Cauchy										
$\Delta\text{ftarget}$ ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$ ERT_{best}/D
(1,2)-CMA-ES	1	1.1	2.6	4.0	3.3	4.7	5.7	6.6	7.5	16	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.4	1.4	1.6	1.6	1.7	2.1	2.9	3.2	5.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1.5	1.5	1.5	1.2	1.7	1.7	1.9	2.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	3.9	3.1	4.1	3.9	4.0	11	9.4	16	48	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.8	1	1.7	1.6	1.6	1.9	1.9	2.0	2.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.5	2.0	1.6	1.5	1.5	1.8	1.6	1.7	2.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.1	1.2	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.7	1.5	1.4	1.3	1.2	1.2	1.2	1.3	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1	2.9	2.5	4.6	78	1122	<i>38e-3/6e3</i>	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	46	55	9.4	6.0	5.1	686	8809	<i>55e-4/1e5</i>	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.9	1.8	1.6	1.8	1.6	1.5	1.4	1.4	1.5	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.4	1.1	1.6	1.8	1.6	2.1	2.9	3.5	4.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.1	2.0	6.8	7.1	5.7	4.4	4.1	3.8	4.4	CMA+DE-MOS [12]
NEWUOA	1	3.5	2.8	21	132	<i>86e-3/4e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1.2	1.2	16	20	16	59	2413	<i>22e-5/5e4</i>	.	Basic RCGA [16]
SPSA	42	66	69	9513	<i>11e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 84: 05-D, running time excess ERT/ERT_{best} on f_{124} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	124 Schaffer F7 Cauchy										
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.20	0.21	3.3	50	443	1531	3792	4933	8445	11261	ERT_{best}/D
(1,2)-CMA-ES	1	1	6.5	103	328	<i>52e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1.1	2.0	2.2	14	97	<i>65e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1.2	2.5	4.5	10	<i>60e-3/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1.7	57	225	<i>88e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	2.9	1.7	17	56	<i>13e-2/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1.4	2.1	7.1	46	<i>41e-3/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.2	1.1	6.1	8.4	93	<i>46e-3/1e4</i>	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1.6	10	16	34	<i>10e-2/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.9	3.6	72	<i>63e-2/6e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	54	71	11	4.6	38	<i>44e-3/6e4</i>	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.2	1.6	1	1	1	1	1	1.0	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.7	1.6	1.0	1.9	1.2	1.3	1.2	1	1.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1	4.8	6.8	4.0	2.6	2.3	3.6	3.2	CMA+DE-MOS [12]
NEWUOA	1	1.1	1.8	129	<i>11e-1/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.4	52	19	11	11	71	<i>55e-5/5e4</i>	.	Basic RCGA [16]
SPSA	59	90	306	13461	<i>39e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 85: 05-D, running time excess ERT/ERT_{best} on f_{125} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	125 Griewank-Rosenbrock Gauss											
Δf_{target} ERT_{best}/D	1e+03 0.20	1e+02 0.20	1e+01 0.20	1e+00 3.1	1e-01 162	1e-02 18741	1e-03 25208	1e-04 27184	1e-05 27488	1e-07 28028	Δf_{target} ERT_{best}/D	
(1,2)-CMA-ES	1	1	1	7.8	73	<i>92e-3/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1.3	4.5	18	<i>69e-3/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	2.4	41	<i>81e-3/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	16	128	<i>11e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1.3	16	<i>58e-3/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.5	16	<i>58e-3/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1.3	15	<i>54e-3/1e4</i>	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	3.1	29	<i>82e-3/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.0	5.3	12	<i>36e-3/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	49	65	70	10	4.2	7.6	<i>10e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1	1	1.7	3.9	1	1	1	1	1	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	1	1	1.7	3.2	1.1	1.5	2.2	2.2	2.2	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1	1.2	2.2	1	6.6	31	28	28	28	CMA+DE-MOS [12]	
NEWUOA	1	1	3.9	1	7.5	3.7	<i>40e-3/5e3</i>	.	.	.	NEWUOA [15]	
Basic RCGA	1	1	1.1	1.7	1.9	1.8	<i>82e-4/5e4</i>	.	.	.	Basic RCGA [16]	
SPSA	41	60	35786	2327	65	75	<i>51e-3/1e5</i>	.	.	.	SPSA [8]	

Table 86: 05-D, running time excess ERT/ERT_{best} on f_{126} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	126 Griewank-Rosenbrock unif										
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	0.20	0.20	6.5	114	1.04e5	2.42e6	3.74e6	3.76e6	3.78e6	
(1,2)-CMA-ES	1	1	1.1	62	1304	<i>25e-2/1e4</i>	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	19	<i>22e-2/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	22	<i>20e-2/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	32	18	1262	<i>26e-2/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	16	<i>15e-2/1e4</i>	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	11	410	<i>12e-2/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	2.5	202	<i>12e-2/1e4</i>	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1.2	8.6	629	<i>18e-2/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	22	50	800	<i>26e-2/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	1548	1777	5228	242	176	14	<i>23e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1.9	14	2.4	<i>51e-4/4e5</i>	.	.	.	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.9	18	2.0	1	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.2	1.0	1	<i>23e-3/1e5</i>	.	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	1.2	32	611	<i>26e-2/5e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1	2.5	1	<i>11e-3/5e4</i>	.	.	.	Basic RCGA [16]
SPSA	1.00e6	2.00e6	3.25e6	99552	12626	<i>16e+2/1e5</i>	.	.	.	.	SPSA [8]

Table 87: 05-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.20	0.20	0.20	2.9	131	16697	33988	34990	35477	36152	
(1,2)-CMA-ES	1	1	1	5.9	21	8.9	<i>55e-3/1e4</i>	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	2.2	7.9	4.2	<i>44e-3/1e4</i>	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	1.8	6.9	8.9	<i>29e-3/1e4</i>	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1.3	4.1	57	<i>64e-3/1e4</i>	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	1.2	12	<i>32e-3/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.2	6.1	8.6	<i>24e-3/1e4</i>	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	1.7	12	<i>42e-3/1e4</i>	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	1.2	15	8.7	<i>29e-3/1e4</i>	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	2.0	1.3	8.0	<i>53e-3/6e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	44	62	77	13	3.0	5.5	<i>92e-4/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.1	2.1	4.7	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.0	2.4	1.1	1.2	1.4	1.4	1.4	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.2	2.4	1	1.5	9.3	43	43	42	CMA+DE-MOS [12]
NEWUOA	1	1	2.5	1	11	<i>62e-3/4e3</i>	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	2.8	1.5	2.8	<i>95e-4/5e4</i>	.	.	.	Basic RCGA [16]
SPSA	45	56	122	1499	5186	<i>15e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 90: 05-D, running time excess ERT/ERT_{best} on f_{130} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy											
$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$
	0.20	0.20	11	689	2109	2125	2140	2154	2163	2188	
(1,2)-CMA-ES	1	1	14	11	6.5	7.7	8.9	8.9	8.9	11	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	7.2	4.0	2.5	2.5	2.5	2.5	2.5	2.5	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	5.2	3.3	1.5	1.5	1.5	1.5	1.5	1.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	37	14	12	12	12	12	12	12	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	5.3	5.9	3.5	3.5	3.5	3.5	3.8	3.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	3.6	2.9	2.9	2.9	2.9	2.9	2.9	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	6.8	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	3.3	3.3	4.3	4.2	4.2	4.2	4.2	4.2	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1.3	1.5	1.7	4.6	9.2	41	<i>14e-3/6e3</i>	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	35	57	5.1	48	42	96	320	319	<i>31e-3/1e5</i>	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1.4	34	113	112	111	111	111	110	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.2	14	92	113	113	112	112	111	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	2.4	69	63	93	92	92	92	91	CMA+DE-MOS [12]
NEWUOA	1	1	2.2	2.6	2.9	15	<i>62e-3/4e3</i>	.	.	.	NEWUOA [15]
Basic RCGA	1	1	2.5	59	21	23	23	29	29	31	Basic RCGA [16]
SPSA	40	62	141	460	<i>19e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 91: 10-D, running time excess ERT/ERT_{best} on f_{101} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	101 Sphere moderate Gauss										
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.59	1e+01 5.5	1e+00 12	1e-01 18	1e-02 22	1e-03 24	1e-04 26	1e-05 28	1e-07 31	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	8.4	6.4	4.8	4.3	4.4	4.8	5.1	5.5	6.4	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	2.4	3.4	2.6	2.4	2.7	3.0	3.2	3.4	4.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	4.9	2.7	2.0	1.9	2.1	2.4	2.6	2.8	3.3	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	9.1	6.5	4.4	4.2	4.4	4.9	5.3	5.8	6.7	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1.6	2.4	2.0	2.0	2.2	2.4	2.7	2.8	3.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.8	1.9	1.7	1.6	1.9	2.1	2.3	2.4	2.9	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	2.1	1.5	1.3	1.3	1.4	1.6	1.8	1.9	2.3	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	2.4	2.2	1.8	1.7	1.8	2.1	2.3	2.5	2.9	(1,4s)-CMA-ES [3]
avg NEWUOA	1	3.3	1.4	1.2	1	1	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	153	43	16	11	8.5	8.3	8.5	8.9	9.1	10	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.1	2.4	2.4	2.4	2.7	3.1	3.4	3.7	4.4	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.9	2.7	2.5	2.5	2.9	3.2	3.6	3.8	4.4	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	7.9	11	8.9	10	12	12	13	16	CMA+DE-MOS [12]
NEWUOA	1	2.5	1	1	1.1	1.4	1.5	1.6	1.7	2.1	NEWUOA [15]
Basic RCGA	1	1.2	13	21	28	40	97	175	214	274	Basic RCGA [16]
SPSA	104	30	2098	1945	2334	3543	4564	4869	5882	<i>34e-5/1e5</i>	SPSA [8]

Table 92: 10-D, running time excess ERT/ERT_{best} on f_{102} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.10	0.41	7.5	13	18	23	27	32	37	52	ERT_{best}/D
(1,2)-CMA-ES	1	12	5.0	4.6	4.9	4.7	4.8	4.8	4.9	4.6	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	6.0	2.5	2.4	2.6	2.6	2.7	2.7	2.7	2.4	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	5.8	1.7	2.0	2.1	2.1	2.2	2.2	2.2	2.0	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	6.3	7.7	6.5	6.5	6.0	6.2	6.0	6.2	6.9	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	5.3	2.0	2.0	2.3	2.3	2.4	2.4	2.4	2.2	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1.9	1.6	1.6	1.7	1.8	1.9	1.9	2.0	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	3.5	1.2	1.4	1.5	1.5	1.6	1.6	1.6	1.4	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	4.1	1.6	1.5	1.7	1.8	1.8	1.9	1.9	1.8	(1,4s)-CMA-ES [3]
avg NEWUOA	1	7.5	1	1	1	1	1	1	1	1	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	147	60	12	10	10	8.9	8.4	8.0	7.7	6.6	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.4	1.7	2.2	2.5	2.6	2.7	2.8	2.9	2.5	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.5	1.8	2.3	2.6	2.6	2.7	2.8	2.9	2.6	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.5	6.7	10	9.3	10	11	10	11	9.4	CMA+DE-MOS [12]
NEWUOA	1	4.4	1.2	2.5	9.0	27	40	60	105	317	NEWUOA [15]
Basic RCGA	1	1	9.1	18	29	38	85	143	168	165	Basic RCGA [16]
SPSA	124	45	53809	1.08e5	<i>21e+0/1e5</i>	.	.	.	.	.	SPSA [8]

Table 93: 10-D, running time excess ERT/ERT_{best} on f_{103} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	103 Sphere moderate Cauchy											
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.53	1e+01 6.2	1e+00 13	1e-01 22	1e-02 31	1e-03 41	1e-04 49	1e-05 58	1e-07 76	Δf_{target} ERT_{best}/D	
(1,2)-CMA-ES	1	6.5	6.0	4.3	3.6	3.4	3.2	3.2	3.2	3.3	(1,2)-CMA-ES [4, 2]	
(1,2m)-CMA-ES	1	5.1	2.9	2.2	1.9	1.8	1.8	1.8	1.9	1.8	(1,2m)-CMA-ES [4]	
(1,2ms)-CMA-ES	1	3.1	2.6	2.1	1.7	1.6	1.5	1.5	1.5	1.5	(1,2ms)-CMA-ES [4]	
(1,2s)-CMA-ES	1	4.9	5.1	3.8	3.1	2.8	2.7	2.8	2.9	2.9	(1,2s)-CMA-ES [2]	
(1,4)-CMA-ES	1	3.0	2.5	2.0	1.7	1.6	1.6	1.6	1.6	1.7	(1,4)-CMA-ES [5, 3]	
(1,4m)-CMA-ES	1	2.5	2.0	1.6	1.5	1.4	1.3	1.4	1.4	1.4	(1,4m)-CMA-ES [5]	
(1,4ms)-CMA-ES	1	2.7	1.5	1.2	1.1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]	
(1,4s)-CMA-ES	1	3.2	2.0	1.5	1.4	1.3	1.2	1.3	1.3	1.3	(1,4s)-CMA-ES [3]	
avg NEWUOA	1	5.9	1.3	1	1	3.1	22	74	948	<i>39e-6/8e3</i>	avg NEWUOA [15]	
CMA-EGS (IPOP,r1)	121	42	14	8.9	6.7	5.5	4.8	4.8	4.8	4.8	CMA-EGS (IPOP,r1) [7]	
IPOP-aCMA-ES	1	1.5	2.1	2.1	2.0	1.9	1.8	1.9	1.9	1.9	IPOP-aCMA-ES [11]	
IPOP-CMA-ES	1	2.0	2.1	2.1	1.9	1.9	1.9	1.9	1.9	1.9	IPOP-CMA-ES [14]	
CMA+DE-MOS	1	1.1	6.8	10	7.2	7.5	7.3	8.2	8.1	8.6	CMA+DE-MOS [12]	
NEWUOA	1	2.8	1	1.2	2.9	13	83	179	656	<i>15e-5/6e3</i>	NEWUOA [15]	
Basic RCGA	1	1	14	19	25	34	73	115	125	121	Basic RCGA [16]	
SPSA	105	138	48	38	32	40	930	3126	<i>18e-5/1e5</i>	.	SPSA [8]	

Table 98: 10-D, running time excess ERT/ERT_{best} on f_{108} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	108 Sphere unif										
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.51	1e+01 785	1e+00 1992	1e-01 3283	1e-02 5974	1e-03 7657	1e-04 11196	1e-05 13940	1e-07 23700	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	198	<i>28e+0/1e4</i>	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	309	<i>26e+0/1e4</i>	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	180	<i>29e+0/1e4</i>	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	148	<i>27e+0/1e4</i>	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	180	85	<i>18e+0/1e4</i>	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	188	190	<i>17e+0/1e4</i>	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	138	42	<i>16e+0/1e4</i>	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	175	<i>22e+0/1e4</i>	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	279	<i>27e+0/7e3</i>	.	.	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	11234	4430	5.8	5.5	6.2	5.7	6.6	6.0	10	15	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	73	1.3	1	1.4	1.1	1.4	1.2	1.4	1.1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	12	1	1.0	1	1	1	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.2	58	756	<i>74e-1/1e5</i>	.	.	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	116	<i>28e+0/4e3</i>	.	.	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	5.9	356	<i>21e-1/5e4</i>	.	.	.	.	.	Basic RCGA [16]
SPSA	3022	1591	7.2	35	<i>78e-2/1e5</i>	.	.	.	.	.	SPSA [8]

Table 99: 10-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	109 Sphere Cauchy										
$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$
	0.10	0.44	9.4	20	33	45	60	77	93	127	
(1,2)-CMA-ES	1	13	4.4	3.5	4.2	4.1	4.2	4.2	4.5	4.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	7.1	1.8	1.7	1.7	2.0	1.9	1.9	2.0	2.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	6.5	1.7	1.4	1.4	1.5	1.5	1.5	1.5	1.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	12	4.1	3.7	3.6	3.5	3.5	3.5	3.8	4.0	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	3.6	1.6	1.6	1.6	1.9	2.0	2.1	2.2	2.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	3.0	1.2	1.2	1.3	1.5	1.6	1.6	1.6	1.7	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	2.7	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	4.4	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.5	(1,4s)-CMA-ES [3]
avg NEWUOA	1	4.5	3.3	55	1014	<i>31e-2/7e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	125	46	9.1	6.8	5.4	884	<i>49e-4/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	2.3	1.3	1.7	1.8	2.0	2.1	2.2	2.3	2.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.4	1.3	1.5	1.7	1.9	2.0	2.0	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.3	4.6	6.7	7.3	8.2	9.4	10	10	11	CMA+DE-MOS [12]
NEWUOA	1	3.7	3.6	112	<i>57e-2/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	8.3	15	18	42	90	92	89	78	Basic RCGA [16]
SPSA	101	167	147	532	19908	<i>36e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 111: 10-D, running time excess ERT/ERT_{best} on f_{121} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	121 Sum of diff powers Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.19	1e+01 8.0	1e+00 23	1e-01 38	1e-02 71	1e-03 161	1e-04 319	1e-05 514	1e-07 1031	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	11	5.3	4.7	5.0	5.7	5.2	5.9	7.8	140	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	5.3	2.2	1.8	1.9	2.1	2.2	2.4	2.7	3.5	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	2.8	1.5	1.3	1.5	1.5	1.5	1.5	1.7	2.3	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	9.4	4.0	4.1	4.0	4.4	6.0	8.9	11	144	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	4.9	1.4	1.7	2.1	2.2	2.4	2.3	2.9	2.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	6.8	1.2	1.3	1.5	1.8	1.8	1.8	2.0	1.9	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	5.2	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	5.7	1.0	1.4	1.5	1.6	1.5	1.3	1.4	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1	8.3	1.9	216	2743	<i>76e-2/7e3</i>	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	142	107	7.7	7.0	6.8	19806	<i>20e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	3.8	1.3	1.5	1.8	2.0	1.8	1.5	1.4	1.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	2.3	1.1	1.6	1.9	2.2	2.7	3.2	3.3	3.5	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1.6	3.7	5.6	6.9	7.8	6.7	5.5	5.1	4.0	CMA+DE-MOS [12]
NEWUOA	1	4.2	3.1	303	<i>11e-1/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	2.9	16	20	49	964	<i>22e-4/5e4</i>	.	.	Basic RCGA [16]
SPSA	100	110	213	28929	<i>46e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 115: 10-D, running time excess ERT/ERT_{best} on f_{125} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	125 Griewank-Rosenbrock Gauss										
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.10	1e+01 0.10	1e+00 3.9	1e-01 22979	1e-02 69545	1e-03 1.68e5	1e-04 2.58e5	1e-05 2.59e5	1e-07 2.63e5	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	69	<i>50e-2/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	31	<i>39e-2/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	12	<i>41e-2/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	122	<i>54e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	24	<i>38e-2/1e4</i>	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	10	<i>37e-2/1e4</i>	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	13	<i>34e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	33	<i>40e-2/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	5.9	1	<i>19e-2/7e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	129	163	186	9.4	1	4.8	<i>14e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	2.9	1.2	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	2.4	1.2	1.2	1.2	1.1	1.1	1.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	11	1.4	23	<i>26e-3/1e5</i>	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	3.8	2.1	<i>22e-2/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	4.5	2.0	<i>88e-3/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	71510	71522	71531	1817	12	<i>12e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 117: 10-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	127 Griewank-Rosenbrock Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.10	1e+02 0.10	1e+01 0.10	1e+00 4.0	1e-01 3514	1e-02 32104	1e-03 76636	1e-04 1.01e5	1e-05 1.03e5	1e-07 1.05e5	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	10	<i>30e-2/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	3.4	14	<i>18e-2/1e4</i>	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	3.2	41	<i>22e-2/1e4</i>	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	13	<i>34e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	2.9	6.0	<i>15e-2/1e4</i>	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	1.9	4.5	<i>11e-2/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	2.4	4.2	<i>12e-2/1e4</i>	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	3.0	13	<i>15e-2/1e4</i>	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1	1	<i>20e-2/7e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	115	148	159	10	13	<i>72e-3/1e5</i>	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1.9	2.1	1	1	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.6	3.1	1.6	1.4	1.3	1.3	1.3	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	6.8	1	2.5	<i>66e-4/1e5</i>	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	2.4	2.0	<i>25e-2/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.2	5.1	6.4	<i>25e-3/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	112	144	652	3311	403	<i>59e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 123: 20-D, running time excess ERT/ERT_{best} on f_{103} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	103 Sphere moderate Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.05	1e+02 2.7	1e+01 7.6	1e+00 20	1e-01 29	1e-02 36	1e-03 44	1e-04 53	1e-05 61	1e-07 77	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	13	7.6	3.9	3.4	3.3	3.3	3.2	3.2	3.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	5.4	3.3	1.8	1.7	1.7	1.7	1.7	1.7	1.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	4.1	2.8	1.6	1.4	1.4	1.4	1.4	1.4	1.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	11	6.3	3.3	2.9	3.0	3.1	3.0	3.0	3.0	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	3.9	2.7	1.6	1.5	1.5	1.6	1.6	1.6	1.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	2.9	2.2	1.3	1.3	1.3	1.4	1.4	1.4	1.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	2.4	1.8	1.0	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	3.3	2.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	(1,4s)-CMA-ES [3]
avg NEWUOA	1	2.0	1.3	1	2.2	29	977	<i>14e-4/1e4</i>	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	305	15	16	7.8	6.1	5.4	4.9	4.7	4.7	4.8	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.5	2.3	1.6	1.6	1.7	1.7	1.8	1.8	1.9	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.4	2.4	1.6	1.6	1.6	1.7	1.8	1.8	1.8	IPOP-CMA-ES [14]
CMA+DE-MOS	1	3.5	10	6.3	5.1	5.7	6.2	6.5	6.6	6.9	CMA+DE-MOS [12]
NEWUOA	1	1	1	1.1	6.4	63	1836	<i>48e-4/5e3</i>	.	.	NEWUOA [15]
Basic RCGA	1	2.7	14	14	78	329	316	295	276	241	Basic RCGA [16]
SPSA	352	65	54	32	33	48	125	26503	<i>37e-5/1e5</i>	.	SPSA [8]

Table 129: 20-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
	0.05	2.8	15	26	38	52	65	79	94	123	
(1,2)-CMA-ES	1	11	3.9	4.3	4.1	4.3	4.3	4.3	4.3	4.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	5.7	1.9	1.8	2.0	2.0	2.0	2.0	2.0	1.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	3.6	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	11	3.7	3.5	3.5	3.4	3.5	3.6	3.5	3.6	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	3.5	1.4	1.7	1.9	2.0	2.0	2.1	2.2	2.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	2.0	1.2	1.3	1.5	1.6	1.7	1.7	1.7	1.8	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	2.6	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	3.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1.9	19	<i>25e-1/9e3</i>	.	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	325	14	7.8	6.7	5.5	27060	<i>19e-3/1e5</i>	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.3	1.2	1.5	1.7	1.9	2.0	2.1	2.1	2.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1.6	1.2	1.5	1.6	1.8	1.9	2.0	2.0	2.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	5.1	6.7	5.1	6.5	7.0	7.3	7.7	7.9	8.1	CMA+DE-MOS [12]
NEWUOA	1	1	19	<i>33e-1/4e3</i>	.	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	3.5	8.1	13	176	206	195	183	167	140	Basic RCGA [16]
SPSA	311	56	59	2870	7702	<i>30e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 145: 20-D, running time excess ERT/ERT_{best} on f_{125} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	125 Griewank-Rosenbrock Gauss										
Δf_{target} ERT_{best}/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 16	1e-01 1.17e5	1e-02 2.96e5	1e-03 9.83e5	1e-04 1.75e6	1e-05 6.98e6	1e-07 6.99e6	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	2812	<i>12e-1/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	453	<i>94e-2/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	379	<i>96e-2/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	<i>13e-1/1e4</i>	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	501	<i>95e-2/1e4</i>	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	253	<i>88e-2/1e4</i>	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	254	<i>95e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	733	<i>10e-1/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	1	1.5	<i>45e-2/9e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	283	321	364	2.3	4.0	<i>23e-2/1e5</i>	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	2.6	1.6	1	1.3	1.4	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	3.0	3.0	1.5	1	1	1.0	1.0	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	4.7	2.9	<i>18e-2/1e5</i>	.	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	1	1.3	<i>49e-2/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1	1	<i>33e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	1.00e6	1.00e6	1.00e6	3109	1.5	<i>12e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 146: 20-D, running time excess ERT/ERT_{best} on f_{126} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif											
Δf_{target} ERT_{best}/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 17	1e-01 2.09e5	1e-02 ∞	1e-03 ∞	1e-04 ∞	1e-05 ∞	1e-07 ∞	Δf_{target} ERT_{best}/D
(1,2)-CMA-ES	1	1	1	<i>15e-1/1e4</i>	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	<i>15e-1/1e4</i>	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	<i>15e-1/1e4</i>	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	<i>14e-1/1e4</i>	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	<i>14e-1/1e4</i>	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	<i>13e-1/1e4</i>	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	8707	<i>13e-1/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	8532	<i>13e-1/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	122	7763	<i>16e-1/9e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	2514	3109	3338	39	<i>33e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	19	<i>30e-2/2e5</i>	.	.	.	.	.	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	17	<i>28e-2/2e5</i>	.	.	.	.	.	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	4.6	<i>39e-2/1e5</i>	.	.	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	4.2	392	<i>12e-1/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1.1	1	1	<i>32e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	2.80e7	2.80e7	2.80e7	83636	<i>45e+3/1e5</i>	.	.	.	.	.	SPSA [8]

Table 147: 20-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	127 Griewank-Rosenbrock Cauchy										
$\Delta\text{ftarget}$ ERT_{best}/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 10	1e-01 11182	1e-02 59822	1e-03 1.80e5	1e-04 3.02e5	1e-05 3.07e5	1e-07 3.16e5	$\Delta\text{ftarget}$ ERT_{best}/D
(1,2)-CMA-ES	1	1	1	39	<i>70e-2/1e4</i>	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1	1	1	3.1	<i>52e-2/1e4</i>	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1	1	1	4.4	<i>48e-2/1e4</i>	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1	1	1	38	<i>67e-2/1e4</i>	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1	1	1	5.9	<i>44e-2/1e4</i>	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1	1	1	3.9	13	<i>39e-2/1e4</i>	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1	1	3.4	<i>23e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1	1	1	6.0	<i>53e-2/1e4</i>	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	1	1	7.7	1.1	<i>43e-2/9e3</i>	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	292	335	353	3.9	<i>28e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1	1.3	1	1.3	1.3	1.3	1.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	1.4	4.3	1.4	1	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	7.9	1	<i>44e-3/1e5</i>	.	.	.	.	CMA+DE-MOS [12]
NEWUOA	1	1	3.7	1.3	<i>45e-2/4e3</i>	.	.	.	.	.	NEWUOA [15]
Basic RCGA	1	1	1	1.6	4.8	<i>59e-3/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	226	276	960	11890	36	<i>10e-1/1e5</i>	.	.	.	.	SPSA [8]

Table 153: 40-D, running time excess ERT/ERT_{best} on f_{103} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy											
Δf_{target} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target} ERT_{best}/D
(1,4ms)-CMA-ES	1	1.4	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	739	10	9.4	9.0	7.7	6.7	6.1	5.8	5.8	5.9	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.0	1.1	1.4	1.4	1.5	1.6	1.7	1.7	1.8	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.2	1.4	1.4	1.5	1.6	1.7	1.7	1.7	IPOP-CMA-ES [14]
CMA+DE-MOS	1	4.2	5.4	4.6	4.1	4.4	5.2	4.9	5.2	5.3	CMA+DE-MOS [12]
Basic RCGA	1	2.8	7.5	97	534	500	466	432	398	343	Basic RCGA [16]
SPSA	864	24	23	28	31	82	322	<i>52e-5/1e5</i>	.	.	SPSA [8]

Table 159: 40-D, running time excess ERT/ERT_{best} on f_{109} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy											
Δf_{target}	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δf_{target}
ERT_{best}/D	0.03	8.3	20	31	42	56	69	82	94	121	ERT_{best}/D
(1,4ms)-CMA-ES	1	1.4	1	1	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	689	11	9.0	7.4	6.4	<i>38e-3/1e5</i>	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1.1	1.2	1.3	1.6	1.8	1.9	2.0	2.1	2.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1.1	1.3	1.6	1.8	1.9	2.0	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	4.8	5.3	4.1	5.7	5.2	5.9	6.2	6.1	6.4	CMA+DE-MOS [12]
Basic RCGA	1	3.2	8.7	297	346	319	288	265	242	204	Basic RCGA [16]
SPSA	683	28	396	1849	33291	<i>82e-2/1e5</i>	.	.	.	.	SPSA [8]

Table 176: 40-D, running time excess ERT/ERT_{best} on f_{126} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif											
$\Delta\text{ftarget}$ ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta\text{ftarget}$ ERT_{best}/D
	0.03	0.03	0.03	13	3.41e5	∞	∞	∞	∞	∞	
(1,4ms)-CMA-ES	1	1	1	<i>17e-1/1e4</i>	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	3014	3562	3755	22	<i>52e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	66	<i>51e-2/2e5</i>	.	.	.	.	.	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	57	<i>50e-2/2e5</i>	.	.	.	.	.	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	6.0	<i>54e-2/1e5</i>	.	.	.	.	.	CMA+DE-MOS [12]
Basic RCGA	1	1	1.1	1	1	<i>55e-2/5e4</i>	.	.	.	.	Basic RCGA [16]
SPSA	2.60e7	2.60e7	2.60e7	51513	<i>93e+3/1e5</i>	.	.	.	.	.	SPSA [8]

Table 177: 40-D, running time excess ERT/ERT_{best} on f_{127} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	127 Griewank-Rosenbrock Cauchy										
Δf_{target} ERT_{best}/D	1e+03 0.03	1e+02 0.03	1e+01 0.03	1e+00 10	1e-01 47116	1e-02 1.02e5	1e-03 2.77e5	1e-04 3.69e5	1e-05 4.89e5	1e-07 5.41e5	Δf_{target} ERT_{best}/D
(1,4ms)-CMA-ES	1	1	1	18	<i>78e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	711	818	968	4.1	<i>47e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1	1	1	1.8	1	1	1.2	1.6	1.3	1.2	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	1	2.0	3.4	2.4	1	1	1	1	IPOP-CMA-ES [14]
CMA+DE-MOS	1	1	1.1	7.6	2.5	<i>10e-2/1e5</i>	.	.	.	.	CMA+DE-MOS [12]
Basic RCGA	1	1	1	1	3.0	<i>16e-2/5e4</i>	Basic RCGA [16]
SPSA	431	527	4104	11818	30	<i>19e-1/1e5</i>	SPSA [8]

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