

Comparison tables: BBOB 2010 noisy testbed in 3-D

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: 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 2: 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 3: 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 4: 03-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	2.9	6.0	8.8	65	224	271	288	300	310	332	ERT_{best}/D
(1,2)-CMA-ES	2.0	3.7	7.5	10	13	28	37	64	62	58	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.2	1.7	4.4	4.7	5.1	6.5	6.3	6.5	6.3	6.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.7	2.0	2.7	2.7	5.8	8.2	8.4	8.2	8.0	7.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	7.4	11	20	15	21	48	87	84	102	96	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	1.3	1.8	2.5	5.6	2.9	2.6	2.6	2.5	2.5	2.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	1.7	1.6	2.3	2.1	1.1	1.1	1.1	1.1	1.2	1.2	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1	1.3	1.7	1.9	1	1	1	1	1	1	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1.9	1.9	2.4	5.9	3.9	4.5	4.4	4.3	4.2	4.0	(1,4s)-CMA-ES [3]
avg NEWUOA	1.2	1	1	3.2	2.3	2.6	2.6	3.0	2.9	2.7	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	29	23	33	146	229	190	179	228	221	211	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	1.2	1.4	3.1	2.0	1.1	1.2	1.3	1.3	1.3	1.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.3	2.5	3.7	2.8	1.8	1.9	2.1	2.1	2.2	2.2	IPOP-CMA-ES [14]
CMA+DE-MOS	1.6	4.0	10	3.4	2.7	3.0	3.4	3.7	3.8	4.1	CMA+DE-MOS [12]
NEWUOA	1.3	1.1	1.1	1	2.4	6.5	14	20	24	27	NEWUOA [15]
Basic RCGA	1.6	4.8	12	42	152	440	1145	1120	<i>66e-3/5e4</i>	.	Basic RCGA [16]
SPSA	294	361	32646	<i>15e+0/1e5</i>	.	.	.	.	.	.	SPSA [8]

Table 5: 03-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}	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	2.0	8.4	14	113	560	760	845	908	929	975	ERT_{best}/D
(1,2)-CMA-ES	2.9	4.8	5.6	7.3	9.0	19	35	48	47	147	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	1.8	5.0	4.0	2.6	4.4	12	23	27	35	33	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	1.9	1.7	1.9	1.7	3.0	7.9	17	48	47	45	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.1	4.8	4.6	5.6	7.8	18	31	51	156	<i>91e-4/1e4</i>	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2.4	1.6	2.5	5.0	3.5	5.7	8.9	8.7	8.7	8.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2.6	2.0	2.1	2.9	1.8	3.1	2.8	3.2	3.2	3.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1.4	1	1.0	2.9	3.4	3.3	3.2	3.0	3.0	2.9	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	2.8	1.7	1.5	3.3	5.8	6.5	10	16	18	18	(1,4s)-CMA-ES [3]
avg NEWUOA	1.9	1.2	1.2	1.1	1	4.5	11	42	88	<i>20e-4/6e3</i>	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	6.1	8.9	189	261	555	773	719	1513	1442	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	2.1	1.8	2.2	2.6	1.2	1.1	1.0	1	1	1	IPOP-aCMA-ES [11]
IPOP-CMA-ES	2.0	1.9	2.7	3.5	2.8	2.3	2.2	2.1	2.1	2.1	IPOP-CMA-ES [14]
CMA+DE-MOS	2.4	2.8	6.2	2.1	1.1	1	1	1.0	1.1	1.2	CMA+DE-MOS [12]
NEWUOA	3.5	1.5	1	1	1.2	2.9	10	25	81	79	NEWUOA [15]
Basic RCGA	1	3.3	9.2	17	66	154	282	808	<i>26e-3/5e4</i>	.	Basic RCGA [16]
SPSA	359	118	97943	<i>18e+0/1e5</i>	.	.	.	.	.	.	SPSA [8]

Table 6: 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 7: 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	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	19	36	63	104	131	164	231	
∞	(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 8: 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 9: 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 12: 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 13: 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 14: 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 15: 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 16: 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 18: 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}	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	4.6	9.4	38	160	218	236	261	280	304	350	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 19: 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 20: 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	.	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 21: 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 0.33	1e+02 0.33	1e+01 0.84	1e+00 11	1e-01 25	1e-02 55	1e-03 154	1e-04 272	1e-05 397	1e-07 621	Δf_{target} ERT_{best}/D	
(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 22: 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 23: 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 24: 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 25: 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 26: 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 27: 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 28: 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 0.33	1e+02 0.33	1e+01 2.3	1e+00 231	1e-01 845	1e-02 1107	1e-03 1130	1e-04 1188	1e-05 1199	1e-07 1309	Δf_{target} ERT_{best}/D	
(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 29: 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}	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	ERT_{best}/D
(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 30: 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]

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