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 $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.33	0.33	1.9	6.9	11	13	14	15	16	18	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
(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 $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.1	9.1	17	24	30	32	33	35	$\mathrm{ERT}_{\mathrm{best}}$/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 $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.3	7.5	10	13	30	39	44	75	$\mathrm{ERT}_{\mathrm{best}}$/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 $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	2.9	6.0	8.8	65	224	271	288	300	310	332	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
(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	*66e-3/5e4*	.	Basic RCGA [16]
SPSA	294	361	32646	*15e+0/1e5*	.	.	.	.	.	.	SPSA [8]

Table 5: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.0	8.4	14	113	560	760	845	908	929	975	$\mathrm{ERT}_{\mathrm{best}}$/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	*91e-4/1e4*	(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	*20e-4/6e3*	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	*26e-3/5e4*	.	Basic RCGA [16]
SPSA	359	118	97943	*18e+0/1e5*	.	.	.	.	.	.	SPSA [8]

Table 6: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	3.7	6.9	10	55	97	153	267	285	299	324	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
(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	*43e-3/5e4*	.	.	Basic RCGA [16]
SPSA	448	624	792	3788	*19e-1/1e5*	.	.	.	.	.	SPSA [8]

Table 7: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.2	19	36	63	104	131	164	231	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	19	10	15	27	28	47	208	*28e-6/1e4*	(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	*16e-3/6e3*	.	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	*57e-4/5e3*	.	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	*11e-1/1e5*	.	.	SPSA [8]

Table 8: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/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	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	22	3.4	42	*15e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	23	15	**3.0**	10	37	*84e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	34	**3.0**	18	80	*10e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	19	4.9	15	78	*88e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.1**	19	**1.2**	4.7	38	*42e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	19	**2.2**	**4.6**	**14**	*18e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.1**	**6.3**	**1.7**	7.3	37	*38e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	22	**2.4**	6.8	76	*39e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	77	10	99	*39e-2/6e3*	.	.	.	.	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	*41e-2/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1**	**1.3**	**1.2**	19	20	25	41	118	*18e-4/5e4*	Basic RCGA [16]
SPSA	111	264	175	20	45	384	*28e-3/1e5*	.	.	.	SPSA [8]

Table 9: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.5	8.6	21	35	47	64	79	107	$\mathrm{ERT}_{\mathrm{best}}$/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	*20e-5/1e5*	.	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	*17e-5/5e3*	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	*43e-4/1e5*	.	SPSA [8]

Table 10: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	3.5	10	33	387	2139	5592	8069	8206	8334	8625	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	6.4	9.4	5.6	**2.3**	**1.6**	3.1	18	*12e-3/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.2	3.8	3.2	**1.1**	**1.3**	**1.2**	**2.5**	8.5	*19e-4/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.8**	3.6	**2.1**	**1.2**	**1**	**1.7**	4.0	8.2	*43e-4/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**2.0**	6.0	5.9	3.6	3.1	4.6	*17e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.5**	**1.8**	**1.1**	**2.2**	**1.7**	3.1	4.1	5.4	8.4	17	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.4**	5.7	3.5	**1.9**	**1.2**	**1.8**	5.5	**5.4**	17	*43e-4/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	12	7.1	**2.4**	**1**	**1.0**	**1.4**	**2.5**	8.7	8.6	8.3	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.1**	**1**	**1.5**	**1.6**	**1.2**	**1**	3.7	17	*48e-4/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	7.5	16	8.6	5.3	8.2	*34e-2/6e3*	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	49	74	100	48	101	251	*20e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	**1**	**1.3**	**1**	**1.0**	**2.6**	**1.4**	**1**	**1**	**1**	**1**	IPOP-aCMA-ES [11]
IPOP-CMA-ES	**1.5**	**1.5**	**1.2**	**1.3**	4.7	3.2	**2.3**	**2.4**	**2.4**	**2.4**	IPOP-CMA-ES [14]
CMA+DE-MOS	**1.5**	3.9	3.5	3.9	19	9.2	6.5	6.5	**6.4**	**6.3**	CMA+DE-MOS [12]
NEWUOA	10	17	14	7.1	4.2	13	*22e-2/5e3*	.	.	.	NEWUOA [15]
Basic RCGA	**1.7**	4.6	3.9	4.6	20	28	*94e-3/5e4*	.	.	.	Basic RCGA [16]
SPSA	103	107	931	*35e-1/1e5*	.	.	.	.	.	.	SPSA [8]

Table 11: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.4	35	136	997	31367	2.54e5	3.08e5	3.66e5	4.21e5	4.39e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	13	9.4	10	148	*19e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	5.5	4.3	6.9	14	*98e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	18	5.2	8.8	18	*14e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	15	14	16	36	*29e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.9	3.2	**2.1**	4.5	**1.3**	*27e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	6.3	4.9	**2.5**	**3.1**	**1**	*32e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	13	4.0	4.0	3.5	*35e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	15	3.7	5.1	13	*85e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	40	32	24	*45e-1/6e3*	.	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	187	31	40	17	10	**2.7**	*13e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	10	6.1	**2.1**	**1**	**1.3**	**1**	**1**	**1**	**1**	**1.0**	IPOP-aCMA-ES [11]
IPOP-CMA-ES	**1.8**	**1.0**	**1**	**1.1**	5.2	**1.6**	**1.4**	**1.2**	**1.0**	**1**	IPOP-CMA-ES [14]
CMA+DE-MOS	**1.5**	**1**	7.4	14	5.3	**1.2**	6.4	*98e-3/1e5*	.	.	CMA+DE-MOS [12]
NEWUOA	25	21	36	37	**2.5**	*74e-1/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.1**	5.0	3.7	**1.4**	**1.4**	**1.1**	*91e-3/5e4*	.	.	Basic RCGA [16]
SPSA	86	42	81	*16e-1/1e5*	.	.	.	.	.	.	SPSA [8]

Table 12: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.8	6.4	12	151	397	482	530	559	578	610	$\mathrm{ERT}_{\mathrm{best}}$/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	*20e-3/6e3*	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	28	27	18	229	752	2915	*26e-2/1e5*	.	.	.	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	*44e-4/5e3*	.	NEWUOA [15]
Basic RCGA	**1.3**	4.1	8.6	14	95	159	654	1267	*23e-3/5e4*	.	Basic RCGA [16]
SPSA	647	2011	2223	9313	*29e-1/1e5*	.	.	.	.	.	SPSA [8]

Table 13: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.36	1.5	10	172	544	613	832	832	832	860	$\mathrm{ERT}_{\mathrm{best}}$/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	*57e-3/6e3*	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	*74e-3/5e3*	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	*71e-2/1e5*	.	.	.	SPSA [8]

Table 14: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	1.7	13	475	1847	3819	3949	3949	3949	4189	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1.1**	**2.9**	21	8.1	23	*31e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.1**	4.7	11	4.9	24	*30e-2/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.1**	36	20	16	26	*22e-2/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.1**	20	19	8.5	*52e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.3**	38	13	**2.6**	8.7	38	*11e-2/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.8**	**1.3**	**4.2**	**1.8**	**6.5**	**17**	35	35	35	*83e-3/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.8**	15	16	**2.8**	13	*16e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	17	8.3	12	4.5	12	*22e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	82	66	19	*11e-1/6e3*	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	877	1311	351	90	167	*14e-2/1e5*	.	.	.	.	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	*11e-1/5e3*	.	.	.	.	.	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	*29e-2/1e5*	.	.	.	.	SPSA [8]

Table 15: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.36	0.89	3.9	35	172	223	266	266	266	323	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1.6**	3.4	5.1	3.0	9.1	52	71	71	71	*54e-4/1e4*	(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	*43e-3/1e5*	.	.	.	SPSA [8]

Table 16: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	14	58	333	1187	1812	2090	2154	2224	2285	2404	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	6.3	6.1	**2.9**	7.0	78	*68e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.9**	4.8	**2.4**	**3.0**	6.8	10	15	15	64	*54e-3/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.8	5.3	4.5	4.2	5.6	33	*45e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	6.4	15	6.8	9.3	38	34	70	*61e-2/1e4*	.	.	(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	*96e-5/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	7.8	3.1	**1.4**	**1.7**	3.2	6.9	14	20	*18e-3/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	8.9	11	11	21	*30e-1/6e3*	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	659	573	334	1262	*97e-1/1e5*	.	.	.	.	.	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	*49e-1/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1.2**	8.0	10	20	42	63	*67e-3/5e4*	.	.	.	Basic RCGA [16]
SPSA	45	375	687	1203	*20e+0/1e5*	.	.	.	.	.	SPSA [8]

Table 17: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	13	204	1405	4535	7374	8317	11323	13136	14079	17704	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	20	4.9	9.0	32	*84e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.0	4.9	3.8	32	*56e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	5.3	**2.9**	7.5	10	*93e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	18	6.1	7.5	*95e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	6.2	**2.6**	**2.9**	15	*34e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.9	**1.7**	3.2	**7.1**	**6.3**	18	*18e-1/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	15	**2.6**	**1.5**	*23e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	10	**2.2**	3.2	10	20	*22e-1/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	31	18	19	*44e+0/6e3*	.	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	260	59	205	310	190	*20e+0/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [7]
IPOP-aCMA-ES	**4.8**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	IPOP-aCMA-ES [11]
IPOP-CMA-ES	9.2	**2.0**	**1.3**	**1.1**	**1.2**	**1.5**	**1.2**	**1.1**	**1.1**	**1.0**	IPOP-CMA-ES [14]
CMA+DE-MOS	**1**	**1.2**	3.7	8.5	8.2	**14**	**13**	**11**	**10**	**8.4**	CMA+DE-MOS [12]
NEWUOA	22	10	55	*23e+0/5e3*	.	.	.	.	.	.	NEWUOA [15]
Basic RCGA	**1.2**	**2.1**	4.2	10	29	87	64	*57e-2/5e4*	.	.	Basic RCGA [16]
SPSA	146	45	75	*81e-1/1e5*	.	.	.	.	.	.	SPSA [8]

Table 18: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.6	9.4	38	160	218	236	261	280	304	350	$\mathrm{ERT}_{\mathrm{best}}$/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	*43e-4/6e3*	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	38	59	688	1269	2993	5962	*21e-1/1e5*	.	.	.	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	*19e-3/5e3*	.	.	NEWUOA [15]
Basic RCGA	**2.4**	57	136	231	732	1533	2870	*75e-2/5e4*	.	.	Basic RCGA [16]
SPSA	128	184	1352	2830	*41e-1/1e5*	.	.	.	.	.	SPSA [8]

Table 19: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.84	21	54	141	514	1648	2711	4116	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	5.8	4.6	14	24	62	*24e-4/1e4*	.	.	(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	*14e-5/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	**1.9**	**1.6**	3.8	4.2	5.9	40	*18e-5/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.1**	24	7.4	10	56	143	*50e-4/1e4*	.	.	(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	*63e-6/1e4*	(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	*48e-6/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	3.7	37	3.9	5.3	4.6	6.3	11	52	*18e-5/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	20	8.7	41	73	*13e-3/6e3*	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	24	36	22	26	64	197	251	422	*11e-4/1e5*	.	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	*31e-3/5e3*	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.3**	**2.1**	7.1	16	11	12	10	36	*17e-6/5e4*	Basic RCGA [16]
SPSA	35	55	163	6303	27530	10543	*10e-1/1e5*	.	.	.	SPSA [8]

Table 20: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.84	95	1133	2242	6359	12487	21134	44226	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	41	37	8.7	16	*11e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	4.0	50	**2.2**	8.1	*54e-3/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	57	8.9	15	65	*14e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.3**	19	10	15	29	*13e-2/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	3.1	7.8	3.1	6.9	64	*71e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.4**	23	3.5	**3.8**	*44e-3/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.7**	**4.6**	4.8	5.3	63	*31e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	47	5.1	7.6	*51e-3/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	24	104	19	21	*36e-2/6e3*	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	779	1826	1833	241	80	76	73	118	*11e-3/1e5*	.	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	*42e-2/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.5**	**2.6**	**1.6**	10	**27**	54	*85e-4/5e4*	.	.	Basic RCGA [16]
SPSA	99	281	477	70	179	*12e-2/1e5*	.	.	.	.	SPSA [8]

Table 21: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.84	11	25	55	154	272	397	621	$\mathrm{ERT}_{\mathrm{best}}$/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	*47e-4/5e3*	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	18	34	25	10	7.2	404	1338	5180	*11e-4/1e5*	.	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	*62e-4/5e3*	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.4**	**1.3**	3.3	20	16	55	78	310	*19e-6/5e4*	Basic RCGA [16]
SPSA	36	101	241	3498	5677	3438	9408	*24e-2/1e5*	.	.	SPSA [8]

Table 22: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.7	88	481	990	1707	2112	3299	5708	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	5.3	5.1	9.2	66	*15e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.8**	3.7	**2.1**	6.3	34	*21e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.3**	4.6	4.2	12	68	*35e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.7**	6.9	7.0	70	*16e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.3**	4.4	4.8	7.6	69	*20e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.3	**2.6**	**4.5**	14	*85e-4/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	**2.2**	**1**	6.6	16	86	*18e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.3**	7.9	6.9	13	149	*61e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.1**	10	30	*37e-2/6e3*	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	29	35	8.0	5.5	62	214	245	664	*52e-3/1e5*	.	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	*65e-2/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1.1**	**1.1**	**1**	11	16	**12**	**20**	**27**	107	*67e-6/5e4*	Basic RCGA [16]
SPSA	69	158	75	3555	*20e-1/1e5*	.	.	.	.	.	SPSA [8]

Table 23: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.36	2.9	898	4071	11932	23354	32415	53261	1.35e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	5.6	16	6.4	*73e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.2**	20	4.2	*62e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	19	27	**2.9**	*65e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.1**	28	8.8	*90e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.4**	16	4.1	35	*34e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	**2.6**	**1.8**	*32e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	17	3.0	*45e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	35	47	6.0	*59e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	12	67	19	*16e-1/6e3*	.	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	374	514	397	27	**31**	125	*75e-3/1e5*	.	.	.	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	*12e-1/5e3*	.	.	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.1**	**1.2**	7.7	83	*36e-2/5e4*	.	.	.	.	Basic RCGA [16]
SPSA	64	43456	13041	740	*14e-1/1e5*	.	.	.	.	.	SPSA [8]

Table 24: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.36	2.2	30	253	572	1301	2699	5034	6734	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	24	16	41	*82e-3/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.4**	**1.3**	**1**	3.2	8.2	109	*70e-4/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.5**	**2.2**	4.8	4.5	15	*73e-4/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.2**	3.5	22	95	*13e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.8**	19	36	10	22	109	*79e-4/1e4*	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.5**	**1.9**	**2.6**	5.7	12	53	*10e-4/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	**2.0**	5.2	**1.5**	**2.9**	**10**	*91e-5/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.9**	12	5.6	5.1	11	114	*45e-4/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.4**	6.2	17	72	*18e-2/5e3*	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	15	22	8.6	13	37	206	*11e-3/1e5*	.	.	.	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	*14e-2/5e3*	.	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1.1**	**1**	10	27	21	32	57	145	*80e-5/5e4*	Basic RCGA [16]
SPSA	27	48	3392	4731	5907	*11e-1/1e5*	.	.	.	.	SPSA [8]

Table 25: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.33	2.7	69	1010	5516	8125	9253	9555	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	**2.4**	**2.8**	9.4	*69e-4/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	**1.1**	**1**	5.7	27	18	*38e-4/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	**1.3**	**1.4**	4.0	27	18	*53e-4/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.3**	**1.3**	3.8	8.5	*68e-4/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**1**	3.3	7.0	13	*55e-4/1e4*	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	**1.3**	**2.5**	4.5	13	18	16	*31e-4/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**1.1**	**1.4**	3.6	6.0	18	*31e-4/1e4*	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	**1.8**	**2.7**	7.8	27	*69e-4/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.4**	**1.2**	**1.6**	**2.3**	4.5	10	8.7	*40e-4/6e3*	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**	*19e-4/5e3*	NEWUOA [15]
Basic RCGA	**1**	**1**	**1.3**	**1.2**	**1.4**	**1.5**	7.7	12	77	*54e-5/5e4*	Basic RCGA [16]
SPSA	25	38	41	8.2	105	20	*36e-4/1e5*	.	.	.	SPSA [8]

Table 26: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.33	2.2	79	494	24438	73344	1.01e5	1.56e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1.1**	21	15	139	*26e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	14	13	144	*22e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	23	6.1	64	*20e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	32	23	*38e-3/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1.2**	**2.4**	5.2	87	*18e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	**1.7**	6.8	31	*10e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**1**	4.7	67	*12e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	32	15	6.7	49	*12e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.7**	40	26	*49e-3/6e3*	.	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	630	728	1797	401	34	78	6.3	9.2	*22e-4/1e5*	.	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	*27e-4/1e5*	.	.	CMA+DE-MOS [12]
NEWUOA	**1**	**1**	13	41	36	158	*48e-3/5e3*	.	.	.	NEWUOA [15]
Basic RCGA	**1**	**1**	**1.1**	**1.1**	**1.5**	**2.8**	**1**	**1.7**	**7.3**	*15e-5/5e4*	Basic RCGA [16]
SPSA	18	46208	75111	31067	1298	1452	*54e-3/1e5*	.	.	.	SPSA [8]

Table 27: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	0.33	1.6	60	225	10765	16315	16562	17133	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1.3**	**2.3**	**2.1**	32	*76e-4/1e4*	.	.	.	(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	*54e-4/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	**2.7**	3.6	38	13	*73e-4/1e4*	.	.	(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	*61e-4/5e3*	.	.	.	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	14	24	30	12	**1.3**	53	29	86	*17e-4/1e5*	.	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	*61e-4/4e3*	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	*22e-3/1e5*	.	.	.	SPSA [8]

Table 28: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.3	231	845	1107	1130	1188	1199	1309	$\mathrm{ERT}_{\mathrm{best}}$/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	*45e-3/6e3*	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	30	40	10	8.5	21	34	83	200	355	*90e-5/1e5*	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	*89e-4/5e3*	.	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	*13e-1/1e5*	.	.	SPSA [8]

Table 29: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.3	713	3563	7429	23646	70382	86332	88752	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	37	**2.6**	**1.7**	19	*23e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	15	**2.1**	**1.5**	5.9	6.0	*61e-3/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	22	**3.0**	**2.5**	6.4	6.2	*27e-3/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	20	4.3	3.6	10	*90e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	10	**2.3**	**1.3**	**2.0**	**1.8**	**2.1**	**1.7**	*11e-3/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.6	**1.2**	**1**	**1.9**	**1.9**	**1**	*47e-4/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	6.7	**1.9**	**1.4**	**2.2**	6.0	*30e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	16	**1.8**	**1.7**	**2.7**	6.3	**2.1**	*14e-3/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	36	5.7	3.8	5.3	3.5	**1.2**	*23e-2/6e3*	.	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	*79e-2/5e3*	.	.	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	*14e-2/1e5*	.	.	.	SPSA [8]

Table 30: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ 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

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	2.2	242	1310	1574	1587	1594	1605	1621	$\mathrm{ERT}_{\mathrm{best}}$/D
(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	*90e-5/5e3*	avg NEWUOA [15]
CMA-EGS (IPOP,r1)	22	37	10	18	20	42	64	186	258	*99e-5/1e5*	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	*86e-4/5e3*	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	*51e-3/1e5*	SPSA [8]

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