Comparison tables: BBOB 2010 noisy testbed with BBOB 2009 as reference in 40-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 [8, 4]. The experimental set-up is described in [7].

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 in BBOB-2009 (see [3]) if an algorithm from BBOB-2009 reached the given target function value. The ERT value is given otherwise ($\mathrm{ERT}_{\mathrm{best}}$ is noted as infinite). See [7] 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: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	6.5	15	23	31	39	48	56	64	81	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1.7**	**1.2**	**1.1**	**1.0**	**1.0**	**0.98**	**0.97**	**0.96**	**0.94**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	736	15	12	10	7.8	6.7	5.9	5.4	5.0	4.5	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1.4**	**1.5**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.5**	**1.6**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	6.0	7.1	5.3	4.4	4.2	5.0	4.7	4.4	4.4	CMA+DE-MOS [10]
Basic RCGA	**1**	4.1	10	97	270	307	305	298	285	253	Basic RCGA [13]
SPSA	536	48	*52e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 2: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	8.4	21	32	44	55	66	77	89	113	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1.5**	**1.0**	**0.92**	**0.88**	**0.87**	**0.88**	**0.88**	**0.92**	**0.98**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	686	11	8.5	6.8	5.6	4.8	4.4	4.0	3.8	3.4	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	6.1	5.1	3.8	3.1	**3.0**	3.7	3.4	3.1	3.3	CMA+DE-MOS [10]
Basic RCGA	**1**	**3.0**	7.3	68	199	218	222	214	204	181	Basic RCGA [13]
SPSA	488	927	*78e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 3: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	5.9	13	31	42	54	68	82	95	124	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**2.1**	**1.5**	**0.86**	**0.79**	**0.76**	**0.72**	**0.69**	**0.68**	**0.64**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	739	16	14	7.7	6.1	5.1	4.4	4.0	3.9	3.8	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1.5**	**1.7**	**1.2**	**1.1**	**1.2**	**1.1**	**1.2**	**1.2**	**1.1**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.5**	**1.7**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	6.4	7.9	3.9	3.3	3.4	3.7	3.4	3.5	3.4	CMA+DE-MOS [10]
Basic RCGA	**1**	4.2	11	83	424	381	334	299	269	221	Basic RCGA [13]
SPSA	864	36	34	24	25	63	231	*52e-5/1e5*	.	.	SPSA [6]

Table 4: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	19	243	77238	89865	91381	92161	92647	93045	93422	94099	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1.1**	**0.51**	*32e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	6.4	**0.81**	*25e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.4**	**0.42**	**0.33**	**0.31**	**0.31**	**0.31**	**0.32**	**0.32**	**0.32**	**0.32**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.4**	**0.42**	**0.97**	**0.88**	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**	IPOP-CMA-ES [12]
CMA+DE-MOS	5.7	30	*38e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	9.4	21	*38e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	24	*27e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 5: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	24	166	1.40e5	1.48e5	1.51e5	1.52e5	1.53e5	1.54e5	1.55e5	1.57e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**0.88**	**1.9**	*40e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	5.2	**1.4**	*34e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.1**	**0.51**	**0.49**	**0.50**	**0.50**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.1**	**0.95**	**0.79**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.81**	IPOP-CMA-ES [12]
CMA+DE-MOS	4.4	**0.80**	*38e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	7.5	35	*38e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	23	*27e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 6: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	17	48	1731	2271	2388	2452	2488	2518	2544	2596	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1.2**	**1.1**	**0.54**	**0.65**	**0.66**	**0.65**	**0.66**	**0.66**	**0.66**	**0.66**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	6.6	4.0	12	24	23	23	27	49	82	110	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.5**	**1.4**	**0.81**	**0.94**	**0.97**	**0.98**	**0.99**	**1.00**	**1.00**	**1.00**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.4**	**1.00**	**1.1**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	IPOP-CMA-ES [12]
CMA+DE-MOS	6.2	3.0	3.9	4.5	4.7	4.8	4.9	5.0	5.0	5.0	CMA+DE-MOS [10]
Basic RCGA	11	112	*37e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	85	5844	*25e+1/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 7: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	225	960	1444	1873	2170	2443	2724	3015	3617	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	*24e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	738	**1.1**	**1.5**	**1.9**	**2.3**	**2.8**	**3.2**	**3.2**	**3.6**	**4.3**	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**2.2**	**1.2**	**1.2**	**1.2**	**1.6**	**2.1**	**2.2**	**2.8**	**2.6**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.8**	**1.1**	**0.96**	**0.92**	**0.94**	**0.95**	**0.97**	**0.98**	**1.0**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	241	1545	1028	*57e+0/1e5*	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**2.3**	16	12	13	15	14	13	17	18	Basic RCGA [13]
SPSA	476	2924	*14e+1/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 8: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	2343	5366	14044	23379	37376	45909	52525	70438	1.06e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	*25e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	29020	**2.0**	**2.8**	**2.4**	**2.9**	**3.2**	**16**	*78e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**0.91**	**1.2**	**1.3**	**1.2**	**1.1**	**1.6**	**2.0**	**1.8**	**1.6**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**0.71**	**0.88**	**0.76**	**0.76**	**0.67**	**0.76**	**0.87**	**0.83**	**0.87**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	286	*15e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	16	*92e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	27994	**2.0**	*20e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 9: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	7.7	21	36	63	92	124	156	188	251	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1.5**	**0.94**	**0.85**	**0.68**	**0.61**	**0.56**	**0.52**	**0.50**	**0.48**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	689	12	8.4	6.3	4.3	*38e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.1**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	5.1	4.9	3.5	3.9	3.2	3.3	3.2	3.1	3.1	CMA+DE-MOS [10]
Basic RCGA	**1**	3.4	8.2	251	234	194	161	139	122	98	Basic RCGA [13]
SPSA	683	30	371	1563	22528	*82e-2/1e5*	.	.	.	.	SPSA [6]

Table 10: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	388	4139	∞	∞	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	*32e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	299	98	*12e+2/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.3**	**0.53**	*37e+0/1e6*	.	.	.	.	.	.	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.4**	**0.54**	*37e+0/9e5*	.	.	.	.	.	.	.	IPOP-CMA-ES [12]
CMA+DE-MOS	152	179	*47e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**0.87**	**2.6**	*51e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	722	*17e+2/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 11: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	2641	15539	∞	∞	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	*29e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	*97e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**0.86**	**0.79**	*38e+0/1e6*	.	.	.	.	.	.	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**0.86**	**0.66**	*38e+0/1e6*	.	.	.	.	.	.	.	IPOP-CMA-ES [12]
CMA+DE-MOS	*39e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**8.4**	*63e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	26	*77e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 12: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	18	72	4454	6347	6669	6799	6887	6959	7031	7155	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1.2**	**0.68**	**0.41**	**0.51**	**0.51**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	7.0	**2.7**	*38e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.3**	**0.84**	**0.92**	**1.0**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.3**	**0.60**	**1.00**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [12]
CMA+DE-MOS	5.7	**2.0**	**2.3**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	CMA+DE-MOS [10]
Basic RCGA	10	81	*37e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	61	1905	*10e+1/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 13: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}$/D	52	1434	10997	63545	67375	75001	75001	75001	75001	75144	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	*17e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	**2.3**	**0.86**	4.4	*52e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**2.1**	**0.79**	**0.54**	**0.24**	**0.26**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**2.5**	**0.71**	**0.75**	**0.63**	**0.72**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**	IPOP-CMA-ES [12]
CMA+DE-MOS	7.7	169	*11e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1.0**	**1.6**	**3.1**	*70e-1/5e4*	.	.	.	.	.	.	Basic RCGA [13]
SPSA	3.1	*21e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 14: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	165	7217	41989	1.64e5	2.51e5	2.88e5	2.88e5	2.88e5	2.88e5	2.92e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	*16e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	27	**3.1**	**34**	*25e+0/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**4.0**	**0.72**	**0.52**	**0.41**	**0.35**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**4.3**	**0.72**	**0.60**	**0.75**	**0.66**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	IPOP-CMA-ES [12]
CMA+DE-MOS	167	*74e+1/1e5*	.	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1.2**	*32e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	26	*28e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [6]

Table 15: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	4.1	27	514	4858	9316	10456	10456	10456	10456	10493	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1.8**	**1.7**	*24e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	13	4.0	**0.41**	*30e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1.4**	**1.1**	**0.83**	**0.84**	**0.57**	**0.56**	**0.56**	**0.56**	**0.56**	**0.57**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.1**	**0.96**	**1.5**	**3.7**	**2.5**	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**	IPOP-CMA-ES [12]
CMA+DE-MOS	5.2	4.0	49	*58e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**2.9**	6.3	21	*45e-1/5e4*	.	.	.	.	.	.	Basic RCGA [13]
SPSA	6.3	7.2	*21e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 16: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	13071	60167	1.04e5	1.08e5	1.13e5	1.17e5	1.21e5	1.25e5	1.28e5	1.36e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	*13e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	*12e+4/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**0.39**	**0.26**	**0.22**	**0.25**	**0.25**	**0.26**	**0.27**	**0.28**	**0.28**	**0.29**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**0.97**	**0.68**	**0.77**	**0.88**	**0.91**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [12]
CMA+DE-MOS	*47e+2/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**2.0**	*70e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	*40e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [6]

Table 17: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	31303	1.35e5	2.11e5	2.97e5	3.40e5	3.65e5	4.33e5	4.57e5	4.79e5	5.28e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	*12e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	*31e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**0.38**	**0.32**	**0.31**	**0.31**	**0.37**	**0.38**	**0.35**	**0.36**	**0.38**	**0.52**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**0.72**	**0.54**	**0.66**	**0.74**	**0.72**	**0.81**	**0.76**	**0.78**	**0.80**	**0.81**	IPOP-CMA-ES [12]
CMA+DE-MOS	*47e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	*95e+2/5e4*	.	.	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	*42e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [6]

Table 18: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	139	363	980	1197	2046	2406	2717	2918	3113	3289	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**0.50**	**0.50**	**0.37**	**0.51**	**0.41**	**0.45**	**0.50**	**0.53**	**0.55**	**0.57**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	**2.3**	**1.9**	**1.1**	546	*20e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**0.78**	**0.71**	**0.50**	**0.67**	**0.53**	**0.54**	**0.57**	**0.58**	**0.60**	**0.63**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**0.94**	**1.2**	**1.0**	**1.4**	**1.1**	**1.1**	**1.2**	**1.3**	**1.3**	**1.4**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1.7**	**1.7**	**1.4**	**1.8**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.6**	CMA+DE-MOS [10]
Basic RCGA	76	*30e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	7.5	3935	*18e+1/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 19: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	1.3	1060	3076	3928	13306	53029	1.18e5	2.51e5	3.20e5	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	260	*50e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	1209	34	**1.3**	**4.6**	**4.1**	**2.6**	*27e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	4.3	**3.8**	**0.79**	**0.71**	**0.95**	**0.68**	**0.53**	**0.35**	**0.19**	**0.21**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1.3**	**6.6**	**0.65**	**0.65**	**0.66**	**0.52**	**0.83**	**0.88**	**0.87**	**0.91**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1.1**	10	113	482	378	*88e-1/1e5*	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1.9**	4.0	18	19	54	*25e-2/5e4*	.	.	.	Basic RCGA [13]
SPSA	437	14	*34e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 20: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}$/D	0.03	1.0	4090	17701	43288	84093	2.84e5	6.09e5	1.08e6	5.96e6	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	4473	*81e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	17083	1524	**6.7**	**13**	**8.4**	*24e-1/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	122	**0.81**	**1.00**	**1.3**	**1.2**	**0.64**	**0.47**	**0.30**	**0.22**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**102**	**0.83**	**0.72**	**0.72**	**0.83**	**0.83**	**0.76**	**0.79**	**2.5**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1.1**	**19**	*28e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**3.0**	*19e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	34780	1644	*23e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 21: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}$/D	0.03	1.4	18	43	84	205	689	1429	2435	5045	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	5.7	**1.2**	**0.86**	**0.67**	**0.50**	**0.32**	**0.32**	**0.35**	**0.50**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	673	20	10	9.3	612	*89e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1.8**	**1.2**	**1.1**	**1.1**	**0.94**	**0.68**	**0.63**	**0.59**	**0.60**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1.7**	**1.2**	**1.1**	**1.1**	**1.1**	**1.00**	**1.3**	**1.6**	**2.0**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1.1**	**2.3**	5.2	**2.9**	3.2	**2.9**	**2.2**	**2.2**	**2.2**	**2.1**	CMA+DE-MOS [10]
Basic RCGA	**1**	**1.5**	5.9	21	112	82	*38e-4/5e4*	.	.	.	Basic RCGA [13]
SPSA	517	65	35833	*18e+0/1e5*	.	.	.	.	.	.	SPSA [6]

Table 22: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ 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	0.03	0.03	123	6832	16079	26832	70248	1.12e5	3.02e5	8.23e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	13	1135	*12e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
IPOP-aCMA-ES	**1**	**1**	**3.5**	**0.67**	**0.83**	**1.2**	**0.77**	**0.66**	**0.45**	**0.71**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	6.4	**3.1**	**0.78**	**0.77**	**0.90**	**0.53**	**0.63**	**0.50**	**0.84**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1.3**	14	*64e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1.5**	**1.1**	**49**	*30e-1/5e4*	.	.	.	.	.	Basic RCGA [13]
SPSA	6.00e6	6.01e6	11348	*68e+3/1e5*	.	.	.	.	.	.	SPSA [6]

Table 23: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ 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	0.03	0.03	331	59218	2.36e5	3.88e5	5.98e5	9.40e5	5.67e6	1.83e7	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	*17e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
IPOP-aCMA-ES	**1**	**1**	**3.4**	**0.88**	**0.78**	**1.1**	**2.9**	**7.8**	*12e-4/1e6*	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	14	**2.8**	**0.90**	**0.93**	**0.97**	**0.86**	**1.3**	*25e-6/1e6*	.	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1.3**	246	*97e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1.2**	**2.7**	*75e-1/5e4*	.	.	.	.	.	.	Basic RCGA [13]
SPSA	1.60e7	1.60e7	*10e+4/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 24: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	0.03	14	754	5312	6585	9160	20490	28640	55992	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	18	30	*58e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
IPOP-aCMA-ES	**1**	**3.0**	**1.1**	4.3	**1.8**	**1.8**	**1.5**	**0.94**	**0.86**	**0.64**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	3.3	**0.97**	**0.83**	**0.53**	**0.72**	**0.81**	**0.50**	**0.63**	**0.73**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1.3**	6.2	**2.0**	**0.68**	**0.92**	**1.1**	**0.84**	**0.90**	**0.83**	CMA+DE-MOS [10]
Basic RCGA	**1**	**1.3**	**1.6**	**1.5**	**2.4**	3.3	4.9	11	*21e-5/5e4*	.	Basic RCGA [13]
SPSA	1.60e7	1.60e7	*94e+3/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 25: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}$/D	0.03	0.03	0.03	115	2.64e6	2.74e6	1.36e7	∞	∞	∞	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	*16e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	717	916	1032	**0.36**	*45e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**1**	**2.9**	**0.21**	**0.40**	**0.40**	*95e-4/1e6*	.	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**1**	3.2	**0.55**	**0.75**	*48e-2/3e5*	.	.	.	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	**1.1**	**0.66**	*51e-2/1e5*	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	**1.1**	**0.10**	**0.08**	*52e-2/5e4*	.	.	.	.	Basic RCGA [13]
SPSA	*11e+4/1e5*	.	.	.	.	.	.	.	.	.	SPSA [6]

Table 26: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ 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	0.03	0.03	0.03	218	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	*17e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	3014	3562	3755	**1.3**	*52e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**1**	3.8	*51e-2/2e5*	.	.	.	.	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**1**	3.3	*50e-2/2e5*	.	.	.	.	.	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	**1.1**	**0.35**	*54e-2/1e5*	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	**1.1**	**0.06**	**1.36e7**	*55e-2/5e4*	.	.	.	.	Basic RCGA [13]
SPSA	2.60e7	2.60e7	2.60e7	2979	*93e+3/1e5*	.	.	.	.	.	SPSA [6]

Table 27: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}$/D	0.03	0.03	0.03	18	44721	2.63e5	3.78e5	6.24e5	6.49e5	6.66e5	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	10	*78e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	711	818	968	**2.3**	*47e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**1**	**1.0**	**1.1**	**0.39**	**0.89**	**0.93**	**0.95**	**0.94**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**1**	**1.1**	3.6	**0.92**	**0.73**	**0.59**	**0.75**	**0.81**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	**1.1**	4.3	**2.6**	*10e-2/1e5*	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	**1**	**0.57**	**3.1**	*16e-2/5e4*	.	.	.	.	Basic RCGA [13]
SPSA	431	527	4104	6726	31	*19e-1/1e5*	.	.	.	.	SPSA [6]

Table 28: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	0.03	1.03e5	9.57e5	2.82e6	2.82e6	2.82e6	2.82e6	2.82e6	2.82e6	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1**	*81e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	673	930	**1.1**	**0.45**	**0.15**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**0.16**	**0.62**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**0.75**	**1.3**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	*77e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	*69e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	560	629	*80e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 29: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	0.03	8.67e5	9.40e5	2.54e6	2.55e6	2.56e6	2.58e6	2.59e6	2.62e6	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1**	*82e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	1358	1503	*69e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**0.61**	**1.3**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**0.38**	**0.82**	**0.62**	**0.62**	**0.62**	**0.62**	**0.63**	**0.63**	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	*76e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	*69e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [13]
SPSA	3993	8599	*78e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

Table 30: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ 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	0.03	0.03	317	6925	42118	42165	42224	42282	42361	42474	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**0.52**	**0.41**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	658	840	25	40	**6.6**	**6.7**	*20e-1/1e5*	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	**1**	**1**	**1.1**	47	23	23	23	23	23	23	IPOP-aCMA-ES [9]
IPOP-CMA-ES	**1**	**1**	**1.8**	83	57	57	57	57	57	57	IPOP-CMA-ES [12]
CMA+DE-MOS	**1**	**1**	49	**40**	10	10	**9.5**	**9.5**	**9.5**	**9.4**	CMA+DE-MOS [10]
Basic RCGA	**1**	**1**	29	**9.4**	**2.6**	**2.9**	**2.9**	**3.0**	**3.0**	**3.0**	Basic RCGA [13]
SPSA	606	755	*84e+0/1e5*	.	.	.	.	.	.	.	SPSA [6]

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