

Comparison tables: BBOB 2010 function 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 [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 in BBOB-2009 (see [2]) if an algorithm from BBOB-2009 reached the given target function value. The ERT value is given otherwise (ERT_{best} is noted as infinite). 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: 40-D, running time excess $ERT/ERT_{\text{best}} 2009$ on f_1 , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere											
Δf_{target} ERT_{best}/D	1e+03 0.03	1e+02 2.1	1e+01 2.1	1e+00 2.1	1e-01 2.1	1e-02 2.1	1e-03 2.1	1e-04 2.1	1e-05 2.1	1e-07 2.1	Δf_{target} ERT_{best}/D
(1+1)-CMA-ES	1	3.2	7.1	11	15	19	23	27	31	39	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	1	2.7	6.1	10	13	17	20	24	27	35	(1+2ms)-CMA-ES [1]
avg NEWUOA	1	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	139	7.7	15	22	30	37	44	52	59	74	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	1	65	205	383	594	823	1086	1353	1573	2016	Adap DE (F-AUC) [5]
DE (Uniform)	1	113	376	642	898	1164	1442	1709	1982	2502	DE (Uniform) [4]
IPOP-aCMA-ES	1	3.3	10	16	21	28	34	40	46	58	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	3.3	9.4	16	21	27	33	39	45	57	IPOP-CMA-ES [15]
CMA+DE-MOS	1	18	50	58	65	76	106	126	134	162	CMA+DE-MOS [12]
NBC-CMA	1	4.7	12	19	26	32	38	45	52	66	NBC-CMA [14]
PM-AdapSS-DE	1	75	212	364	524	694	871	1063	1252	1643	PM-AdapSS-DE [4, 5]
Basic RCGA	1	12	72	1089	4155	5781	7051	8001	8768	9840	Basic RCGA [17]
SPSA	478	11	15	20	24	29	33	37	41	50	SPSA [8]

Table 4: 40-D, running time excess $ERT/ERT_{\text{best}}^{2009}$ on f_4 , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	4 Skew Rastrigin-Bueche separ										
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
	11	134	388	390	391	392	393	393	393	7060	
(1+1)-CMA-ES	24	<i>49e+1/1e4</i>	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	10	<i>51e+1/1e4</i>	.	.	.	.	.	.	.	.	(1+2ms)-CMA-ES [1]
avg NEWUOA	7.5	<i>36e+1/3e4</i>	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	2.4	405	<i>75e+0/1e5</i>	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	20	<i>23e+1/1e5</i>	.	.	.	.	.	.	.	.	Adap DE (F-AUC) [5]
DE (Uniform)	39	<i>22e+1/1e5</i>	.	.	.	.	.	.	.	.	DE (Uniform) [4]
IPOP-aCMA-ES	0.98	3.1	<i>30e+0/2e5</i>	.	.	.	.	.	.	.	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1.2	3.5	<i>30e+0/2e5</i>	.	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	3.7	5.6	116	118	152	154	155	156	157	8.9	CMA+DE-MOS [12]
NBC-CMA	1.3	40	<i>90e+0/7e3</i>	.	.	.	.	.	.	.	NBC-CMA [14]
PM-AdapSS-DE	22	243	<i>60e+0/1e5</i>	.	.	.	.	.	.	.	PM-AdapSS-DE [4, 5]
Basic RCGA	2.3	78	<i>50e+0/5e4</i>	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	1411	<i>74e+1/1e5</i>	.	.	.	.	.	.	.	.	SPSA [8]

Table 6: 40-D, running time excess $ERT/ERT_{\text{best}} 2009$ on f_6 , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector											
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+1)-CMA-ES	3.6	10	298	<i>17e+0/1e4</i>	.	.	.	.	.	.	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	2.7	5.6	1605	<i>13e+0/1e4</i>	.	.	.	.	.	.	(1+2ms)-CMA-ES [1]
avg NEWUOA	4.7	1.5	1.3	1.3	1.2	1.2	1.1	1.2	1.1	1.1	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	20	4.5	4.0	3.7	3.8	3.7	4.0	4.4	5.1	12	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	82	33	32	30	32	30	30	30	30	30	Adap DE (F-AUC) [5]
DE (Uniform)	245	70	58	51	50	46	44	45	45	43	DE (Uniform) [4]
IPOP-aCMA-ES	5.2	1.7	1.5	1.4	1.4	1.3	1.3	1.3	1.3	1.3	IPOP-aCMA-ES [11]
IPOP-CMA-ES	6.3	1.8	1.7	1.5	1.5	1.4	1.4	1.4	1.4	1.4	IPOP-CMA-ES [15]
CMA+DE-MOS	21	5.3	4.4	3.7	3.4	3.1	3.0	2.9	2.8	2.7	CMA+DE-MOS [12]
NBC-CMA	63	59	32	21	16	13	11	9.4	8.8	7.5	NBC-CMA [14]
PM-AdapSS-DE	120	41	38	35	35	34	35	36	38	39	PM-AdapSS-DE [4, 5]
Basic RCGA	35	107	128	107	105	88	79	73	147	1505	Basic RCGA [17]
SPSA	9975	<i>42e+1/1e5</i>	.	.	.	.	.	.	.	.	SPSA [8]

Table 13: 40-D, running time excess ERT/ERT_{best} 2009 on f_{13} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge											
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+1)-CMA-ES	3.2	3.4	3.1	5.4	10	25	10	8.6	14	23	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	2.9	2.9	2.8	3.2	7.2	14	7.0	16	29	<i>82e-5/1e4</i>	(1+2ms)-CMA-ES [1]
CMA-EGS (IPOP,r1)	7.6	6.4	2.7	4.2	37	215	780	669	570	<i>67e-4/1e5</i>	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	78	105	37	17	18	17	3.3	3.3	3.2	3.3	Adap DE (F-AUC) [5]
DE (Uniform)	145	168	54	22	23	20	4.0	3.9	3.8	3.9	DE (Uniform) [4]
IPOP-aCMA-ES	4.4	4.7	1.6	2.1	4.7	5.9	1.3	1.4	1.6	1.9	IPOP-aCMA-ES [11]
IPOP-CMA-ES	4.8	5.1	2.8	3.5	6.6	10	2.3	2.9	2.7	2.9	IPOP-CMA-ES [15]
CMA+DE-MOS	26	14	6.4	7.0	11	15	3.1	3.4	3.2	3.6	CMA+DE-MOS [12]
NBC-CMA	5.6	5.7	2.5	5.0	16	26	10	25	<i>63e-4/7e3</i>	.	NBC-CMA [14]
PM-AdapSS-DE	85	102	34	15	16	15	3.1	3.2	3.2	3.3	PM-AdapSS-DE [4, 5]
Basic RCGA	29	733	319	177	724	1169	402	<i>20e-2/5e4</i>	.	.	Basic RCGA [17]
SPSA	75	4772	14665	8631	6843	<i>52e+0/1e5</i>	.	.	.	.	SPSA [8]

Table 14: 40-D, running time excess ERT/ERT_{best} 2009 on f_{14} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers											
$\frac{\Delta \text{ftarget}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta \text{ftarget}}{ERT_{\text{best}}/D}$
(1+1)-CMA-ES	1	36	1.7	1.6	1.8	2.1	2.0	3.0	5.1	1.0	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	1	57	1.7	1.5	1.7	1.9	1.9	2.7	4.2	0.85	(1+2ms)-CMA-ES [1]
CMA-EGS (IPOP,r1)	85	316	5.4	3.8	4.3	5.1	6.3	10	19	4.3	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	1	128	38	46	63	68	47	37	34	4.0	Adap DE (F-AUC) [5]
DE (Uniform)	1	74	72	80	99	95	61	45	40	4.5	DE (Uniform) [4]
IPOP-aCMA-ES	1	31	2.5	2.4	3.0	3.7	3.4	3.5	3.9	0.57	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	32	2.7	2.5	3.0	3.9	4.3	5.2	6.7	1.1	IPOP-CMA-ES [15]
CMA+DE-MOS	1.1	118	12	7.8	7.7	10	12	16	19	2.7	CMA+DE-MOS [12]
NBC-CMA	1.1	44	2.9	2.6	3.2	4.4	5.3	8.1	11	1.8	NBC-CMA [14]
PM-AdapSS-DE	1.1	90	44	47	59	60	41	32	30	3.7	PM-AdapSS-DE [4, 5]
Basic RCGA	1	51	12	28	366	484	1403	<i>10e-4/5e4</i>	.	.	Basic RCGA [17]
SPSA	195	1670	58	41	36	33	41	130	6065	<i>22e-6/1e5</i>	SPSA [8]

Table 21: 40-D, running time excess ERT/ERT_{best} 2009 on f_{21} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

	21 Gallagher 101 peaks										
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+1)-CMA-ES	1	1	5.0	1.9	0.97	0.97	0.97	0.97	0.97	0.97	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	1	1	2.4	2.3	1.1	1.1	1.1	1.1	1.1	1.1	(1+2ms)-CMA-ES [1]
CMA-EGS (IPOP,r1)	20	224	14	107	62	62	62	62	62	62	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	1	1	293	758	258	258	257	256	256	255	Adap DE (F-AUC) [5]
DE (Uniform)	1	1	36	287	557	555	553	552	550	548	DE (Uniform) [4]
IPOP-aCMA-ES	1	1	9.2	161	118	118	118	117	117	116	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	10	166	83	83	83	83	82	82	IPOP-CMA-ES [15]
CMA+DE-MOS	1	1	15	224	101	101	101	100	100	100	CMA+DE-MOS [12]
NBC-CMA	1	1	73	199	42	42	41	41	41	41	NBC-CMA [14]
PM-AdapSS-DE	1	1	295	1231	<i>21e-1/1e5</i>	.	.	.	.	.	PM-AdapSS-DE [4, 5]
Basic RCGA	1	1	7.7	89	31	33	33	34	34	35	Basic RCGA [17]
SPSA	188	541	880	2650	<i>25e-1/1e5</i>	.	.	.	.	.	SPSA [8]

Table 22: 40-D, running time excess ERT/ERT_{best} 2009 on f_{22} , in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks											
Δ_{ftarget} ERT_{best}/D	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δ_{ftarget} ERT_{best}/D
(1+1)-CMA-ES	1	1	9.1	6.2	2.0	2.0	2.0	2.0	2.0	2.0	(1+1)-CMA-ES [3]
(1+2ms)-CMA-ES	1	1	1.9	4.9	9.0	8.9	8.9	8.9	8.9	8.9	(1+2ms)-CMA-ES [1]
CMA-EGS (IPOP,r1)	21	205	326	226	<i>20e-1/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [7]
Adap DE (F-AUC)	1	1	478	312	<i>26e-1/1e5</i>	.	.	.	.	.	Adap DE (F-AUC) [5]
DE (Uniform)	1	1	661	453	<i>73e-1/1e5</i>	.	.	.	.	.	DE (Uniform) [4]
IPOP-aCMA-ES	1	1	295	174	<i>20e-1/7e4</i>	.	.	.	.	.	IPOP-aCMA-ES [11]
IPOP-CMA-ES	1	1	367	133	<i>20e-1/8e4</i>	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	1	1	490	205	<i>20e-1/1e5</i>	.	.	.	.	.	CMA+DE-MOS [12]
NBC-CMA	1	1	49	23	<i>51e-1/7e3</i>	.	.	.	.	.	NBC-CMA [14]
PM-AdapSS-DE	1	1	654	1581	<i>56e-1/1e5</i>	.	.	.	.	.	PM-AdapSS-DE [4, 5]
Basic RCGA	1	1	335	101	<i>20e-1/5e4</i>	Basic RCGA [17]
SPSA	183	630	769	737	<i>51e-1/1e5</i>	SPSA [8]

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