

# Comparison tables: BBOB 2010 noisy testbed with BBOB 2009 as reference in 40-D

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August 31, 2010

## 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 ( $\text{ERT}_{\text{best}}$  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 3: 40-D, running time excess  $ERT/ERT_{\text{best}}$  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

<b>103 Sphere moderate Cauchy</b>											
$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\frac{\Delta f_{\text{target}}}{ERT_{\text{best}}/D}$
	0.03	5.9	13	31	42	54	68	82	95	124	
(1,4ms)-CMA-ES	<b>1</b>	<b>2.1</b>	<b>1.5</b>	<b>0.86</b>	<b>0.79</b>	<b>0.76</b>	<b>0.72</b>	<b>0.69</b>	<b>0.68</b>	<b>0.64</b>	(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	<b>1</b>	<b>1.5</b>	<b>1.7</b>	<b>1.2</b>	<b>1.1</b>	<b>1.2</b>	<b>1.1</b>	<b>1.2</b>	<b>1.2</b>	<b>1.1</b>	IPOP-aCMA-ES [9]
IPOP-CMA-ES	<b>1</b>	<b>1.5</b>	<b>1.7</b>	<b>1.2</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	IPOP-CMA-ES [12]
CMA+DE-MOS	<b>1</b>	6.4	7.9	3.9	3.3	3.4	3.7	3.4	3.5	3.4	CMA+DE-MOS [10]
Basic RCGA	<b>1</b>	4.2	11	83	424	381	334	299	269	221	Basic RCGA [13]
SPSA	864	36	34	24	25	63	231	<i>52e-5/1e5</i>	.	.	SPSA [6]













Table 9: 40-D, running time excess  $\text{ERT}/\text{ERT}_{\text{best}}$  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

<b>109 Sphere Cauchy</b>											
$\Delta f_{\text{target}}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta f_{\text{target}}$
$\text{ERT}_{\text{best}}/D$	0.03	7.7	21	36	63	92	124	156	188	251	$\text{ERT}_{\text{best}}/D$
(1,4ms)-CMA-ES	<b>1</b>	<b>1.5</b>	<b>0.94</b>	<b>0.85</b>	<b>0.68</b>	<b>0.61</b>	<b>0.56</b>	<b>0.52</b>	<b>0.50</b>	<b>0.48</b>	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	689	12	8.4	6.3	4.3	<i>38e-3/1e5</i>	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	<b>1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	IPOP-aCMA-ES [9]
IPOP-CMA-ES	<b>1</b>	<b>1.1</b>	<b>1.0</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.0</b>	<b>1.0</b>	IPOP-CMA-ES [12]
CMA+DE-MOS	<b>1</b>	5.1	4.9	3.5	3.9	3.2	3.3	3.2	3.1	3.1	CMA+DE-MOS [10]
Basic RCGA	<b>1</b>	3.4	8.2	251	234	194	161	139	122	98	Basic RCGA [13]
SPSA	683	30	371	1563	22528	<i>82e-2/1e5</i>	.	.	.	.	SPSA [6]























338 -0924212 -052512 1 -0126029 -3838 -0924212 5 -0931213 1 40 11776

Table 20: 40-D, running time excess  $ERT/ERT_{best}$  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										
$\Delta f_{target}$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta f_{target}$
$ERT_{best}/D$	0.03	1.0	4090	17701	43288	84093	2.84e5	6.09e5	1.08e6	5.96e6	$ERT_{best}/D$
(1,4ms)-CMA-ES	<b>1</b>	4473	<i>81e+0/1e4</i>	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	17083	1524	<b>6.7</b>	<b>13</b>	<b>8.4</b>	<i>24e-1/1e5</i>	.	.	.	1, 29	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	<b>1</b>		<b>0.81</b>	<b>1.00</b>	<b>1.3</b>	<b>1.2</b>	<b>0.64</b>	<b>0.47</b>			

Table 21: 40-D, running time excess  $ERT/ERT_{\text{best}} 2009$  on  $f_{121}$ , in italics is given the median final function value and the median number











Table 26: 40-D, running time excess  $ERT/ERT_{\text{best}} 2009$  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

<b>126 Griewank-Rosenbrock unif</b>											
$\Delta f_{\text{target}}$ $ERT_{\text{best}}/D$	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	$\Delta f_{\text{target}}$ $ERT_{\text{best}}/D$
	0.03	0.03	0.03	218	$\infty$	$\infty$	$\infty$	$\infty$	$\infty$	$\infty$	
(1,4ms)-CMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	<i>17e-1/1e4</i>	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	3014	3562	3755	<b>1.3</b>	<i>52e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	3.8	<i>51e-2/2e5</i>	.	.	.	.	.	IPOP-aCMA-ES [9]
IPOP-CMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	3.3	<i>50e-2/2e5</i>	.	.	.	.	.	IPOP-CMA-ES [12]
CMA+DE-MOS	<b>1</b>	<b>1</b>	<b>1.1</b>	<b>0.35</b>	<i>54e-2/1e5</i>	.	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	<b>1</b>	<b>1</b>	<b>1.1</b>	<b>0.06</b>	<b>1.36e7</b>	<i>55e-2/5e4</i>	.	.	.	.	Basic RCGA [13]
SPSA	2.60e7	2.60e7	2.60e7	2979	<i>93e+3/1e5</i>	.	.	.	.	.	SPSA [6]

Table 27: 40-D, running time excess  $ERT/ERT_{\text{best}}$  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

	<b>127 Griewank-Rosenbrock Cauchy</b>										
$\Delta\text{ftarget}$ $ERT_{\text{best}}/D$	1e+03 0.03	1e+02 0.03	1e+01 0.03	1e+00 18	1e-01 44721	1e-02 2.63e5	1e-03 3.78e5	1e-04 6.24e5	1e-05 6.49e5	1e-07 6.66e5	$\Delta\text{ftarget}$ $ERT_{\text{best}}/D$
(1,4ms)-CMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	10	<i>78e-2/1e4</i>	.	.	.	.	.	(1,4ms)-CMA-ES [1, 2]
CMA-EGS (IPOP,r1)	711	818	968	<b>2.3</b>	<i>47e-2/1e5</i>	.	.	.	.	.	CMA-EGS (IPOP,r1) [5]
IPOP-aCMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.0</b>	<b>1.1</b>	<b>0.39</b>	<b>0.89</b>	<b>0.93</b>	<b>0.95</b>	<b>0.94</b>	IPOP-aCMA-ES [9]
IPOP-CMA-ES	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.1</b>	3.6	<b>0.92</b>	<b>0.73</b>	<b>0.59</b>	<b>0.75</b>	<b>0.81</b>	IPOP-CMA-ES [12]
CMA+DE-MOS	<b>1</b>	<b>1</b>	<b>1.1</b>	4.3	<b>2.6</b>	<i>10e-2/1e5</i>	.	.	.	.	CMA+DE-MOS [10]
Basic RCGA	<b>1</b>	<b>1</b>	<b>1</b>	<b>0.57</b>	<b>3.1</b>	<i>16e-2/5e4</i>	.	.	.	.	Basic RCGA [13]
SPSA	431	527	4104	6726	31	<i>19e-1/1e5</i>	.	.	.	.	SPSA [6]







## References

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