Comparison Tables: BBOB 2015 Testbed in 40-D

The BBOBies

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Abstract

This document provides tabular results of the workshop on Black-Box Optimization Benchmarking held at GECCO 2015, see `http://coco.gforge.inria.fr/doku.php?id=bbob-2015`. Overall, 18 algorithms have been tested on 24 benchmark functions in dimensions between 2 and 20. Only three of them have been tested on the optional instances in dimension 40. A description of the used objective functions can be found in [7, 5]. The experimental set-up is described in [6].

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 ($\mathrm{ERT}_{\mathrm{best}}$ is noted as infinite). See [6] 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 gives an overview on all algorithms submitted to the noise-free testbed at GECCO 2015.

Table 1: Names and references of all algorithms submitted for the noise-free testbed

algorithm short name	paper	reference
BSifeg	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
BSif	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
BSqi	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
BSrr	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
CMA-CSA	Benchmarking IPOP-CMA-ES-TPA and IPOP-CMA-ES-MSR on the BBOB Noiseless Testbed	[1]
CMA-MSR	Benchmarking IPOP-CMA-ES-TPA and IPOP-CMA-ES-MSR on the BBOB Noiseless Testbed	[1]
CMA-TPA	Benchmarking IPOP-CMA-ES-TPA and IPOP-CMA-ES-MSR on the BBOB Noiseless Testbed	[1]
GP1-CMAES	SBenchmarking Gaussian Processes and Random Forests Surrogate Models on the BBOB Noiseless Testbed	[3]
GP5-CMAES	Benchmarking Gaussian Processes and Random Forests Surrogate Models on the BBOB Noiseless Testbed	[3]
IPOPCMAv3p61	Benchmarking Gaussian Processes and Random Forests Surrogate Models on the BBOB Noiseless Testbed	[3]
LHD-10xDefault-MATSuMoT	The Impact of Initial Designs on the Performance of MATSuMoTo on the Noiseless BBOB-2015 Testbed: A Preliminary Study	[4]
LHD-2xDefault-MATSuMoTo	The Impact of Initial Designs on the Performance of MATSuMoTo on the Noiseless BBOB-2015 Testbed: A Preliminary Study	[4]
RAND-2xDefault-MATSuMoTo	The Impact of Initial Designs on the Performance of MATSuMoTo on the Noiseless BBOB-2015 Testbed: A Preliminary Study	[4]
RF1-CMAES	Benchmarking Gaussian Processes and Random Forests Surrogate Models on the BBOB Noiseless Testbed	[3]
RF5-CMAES	Benchmarking Gaussian Processes and Random Forests Surrogate Models on the BBOB Noiseless Testbed	[3]
Sifeg	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
Sif	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]
Srr	Dimension Selection in Axis-Parallel Brent-STEP Method for Black-Box Optimization of Separable Continuous Functions	[9]

Table 2: 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f1	83	83	83	83	83	83	83	30/30
CMA-CSA	10(0.7)	16(1)	22(1)	28(1)	34(3)	46(2)	58(2)	15/15
CMA-MSR	10(0.8)	16(1.0)	23(1)	29(0.9)	35(2)	48(2)	60(3)	15/15
CMA-TPA	**6.7**(0.6)^{*4}	**11**(1.0)^{*4}	**14**(0.8)^{*4}	**18**(1)^{*4}	**22**(2)^{*4}	**31**(2)^{*4}	**39**(2)^{*4}	15/15

Table 3: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f2	796	797	799	799	800	802	804	15/15
CMA-CSA	**37**(2)	**43**(2)$^{\star 2}$	**47**(3)$^{\star 3}$	**51**(3)$^{\star 3}$	**54**(3)$^{\star 3}$	**57**(2)$^{\star 4}$	**59**(2)$^{\star 4}$	15/15
CMA-MSR	45(6)	53(3)	58(4)	62(4)	64(4)	67(3)	68(1)	15/15
CMA-TPA	41(6)	50(5)	56(4)	61(5)	65(4)	67(2)	68(2)	15/15

Table 4: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f3	15526	15602	15612	15641	15646	15651	15656	15/15
CMA-CSA	∞	∞	∞	∞	∞	∞	∞ *4e6*	0/15
CMA-MSR	**11**(10)$^{\star 4}$	**66**(78)$^{\star 4}$	**142**(116)$^{\star 4}$	**144**(223)$^{\star 4}$	**147**(197)$^{\star 4}$	**154**(82)$^{\star 4}$	**160**(140)$^{\star 4}$	12/15
CMA-TPA	1829(1740)	∞	∞	∞	∞	∞	∞ *4e6*	0/15

Table 5: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f4	15536	15601	15659	15678	15703	15733	2.8e5	9/15
CMA-CSA	∞	∞	∞	∞	∞	∞	∞ *4e6*	0/15
CMA-MSR	∞	∞	∞	∞	∞	∞	∞ *4e6*	0/15
CMA-TPA	∞	∞	∞	∞	∞	∞	∞ *4e6*	0/15

Table 6: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f5	98	116	120	121	121	121	121	15/15
CMA-CSA	4.6(0.5)	4.5(0.4)	4.4(0.2)	4.4(0.4)	4.4(0.4)	4.4(0.3)	4.4(0.5)	15/15
CMA-MSR	3.9(0.7)	3.7(0.4)	3.6(0.6)	3.6(0.5)	**3.6**(0.4)	**3.6**(0.8)	**3.6**(0.7)	15/15
CMA-TPA	**3.8**(0.6)	**3.6**(0.6)	**3.5**(0.6)	**3.5**(0.5)	3.6(0.6)	3.6(0.5)	3.6(0.6)	15/15

Table 7: 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f6	3507	5523	7168	9470	11538	15007	19222	15/15
CMA-CSA	1.6(0.1)	**1.5**(0.1)	**1.4**(0.1)	**1.3**(0.1)$^{\star 3}$	**1.3**(0.1)$^{\star 4}$	**1.3**(0.1)$^{\star 4}$	**1.3**(0.1)$^{\star 4}$	15/15
CMA-MSR	3.7(2)	7.4(4)	28(21)	43(1)	36(0.8)	31(1)	27(1)	15/15
CMA-TPA	**1.6**(0.4)	1.6(0.5)	1.8(0.4)	1.9(0.4)	2.0(0.6)	2.5(0.4)	2.8(0.7)	15/15

Table 8: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f7	10698	17839	41037	66294	66294	66294	68145	15/15
CMA-CSA	**1.2**(0.6)	**2.8**(0.1)	**1.5**(0.5)	**0.97**(0.3)	**0.97**(0.2)	**0.97**(0.3)	**0.95**(0.3)	15/15
CMA-MSR	3.0(1)	3.9(1)	2.1(0.6)	1.4(0.5)	1.4(0.3)	1.4(0.4)	1.4(0.4)	15/15
CMA-TPA	3.9(9)	3.7(0.2)	1.8(2)	1.2(2)	1.2(3)	1.2(3)	1.2(0.2)	15/15

Table 9: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f8	7080	10655	11012	11265	11430	11701	11969	15/15
CMA-CSA	**5.4**(1)	5.5(2)	5.6(4)	**5.6**(3)	5.7(0.8)	5.6(2)	5.6(3)	15/15
CMA-MSR	5.8(0.8)	**5.5**(2)	**5.6**(2)	5.6(1)	**5.6**(0.8)	**5.6**(0.3)	**5.6**(2)	15/15
CMA-TPA	5.7(0.7)	5.8(1)	5.9(0.3)	5.9(0.3)	5.9(0.4)	5.9(3)	5.8(2)	15/15

Table 10: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f9	6122	12982	13300	13496	13651	13909	14142	15/15
CMA-CSA	**6.3**(0.8)	**4.2**(2)	**4.4**(2)	**4.4**(2)	**4.5**(2)	**4.5**(2)	**4.5**(2)	15/15
CMA-MSR	6.9(0.5)	4.6(0.1)	4.8(0.2)	4.8(2)	4.8(2)	4.8(0.1)	4.8(1)	15/15
CMA-TPA	6.4(1)	4.8(0.3)	4.9(3)	4.9(3)	4.9(2)	4.9(3)	4.9(3)	15/15

Table 11: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f10	25890	30368	36796	51579	56007	65128	70824	15/15
CMA-CSA	**1.2**(0.1)	**1.2**(0.1)$^{\star 2}$	**1.0**(0.1)$^{\star 3}$	**0.79**(0.0)$^{\star 4}$	**0.77**(0.0)$^{\star 4}$	**0.70**(0.0)$^{\star 4}$	**0.67**(0.0)$^{\star 4}$	15/15
CMA-MSR	1.3(0.1)	1.3(0.1)	1.2(0.1)	0.95(0.1)	0.93(0.1)	0.83(0.0)	0.78(9e-3)	15/15
CMA-TPA	1.3(0.2)	1.3(0.2)	1.2(0.1)	0.94(0.1)	0.91(0.1)	0.84(0.0)	0.78(0.0)	15/15

Table 12: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f11	2368	4855	11681	25315	29749	38949	48211	15/15
CMA-CSA	5.0(0.1)	2.6(0.1)	1.2(0.0)	0.57(0.0)	0.51(0.0)	0.42(0.0)	0.37(0.0)	15/15
CMA-MSR	4.9(0.2)	2.8(0.1)	1.3(0.0)	0.64(0.0)	0.57(0.0)	0.48(0.0)	0.42(0.0)	15/15
CMA-TPA	**4.6**(0.2)$^{\star 2}$	**2.5**(0.1)$^{\star 2}$	**1.1**(0.0)	**0.56**(8e-3)	**0.50**(0.0)	**0.41**(5e-3)	**0.36**(7e-3)	15/15

Table 13: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f12	4169	7452	9174	10751	13146	22758	25192	15/15
CMA-CSA	**1.1**(0.0)	**1.1**(1)	**1.8**(0.7)	**1.9**(0.7)	**1.9**(0.5)	**1.4**(0.2)	1.4(0.3)	15/15
CMA-MSR	2.0(1)	2.4(2)	2.7(0.6)	2.6(0.8)	2.5(0.9)	1.8(0.2)	1.8(0.6)	15/15
CMA-TPA	1.7(2)	1.7(2)	1.9(2)	2.0(0.8)	1.9(0.7)	1.4(0.5)	**1.4**(0.4)	15/15

Table 14: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f13	2029	6916	8734	11861	71936	98467	1.2e5	15/15
CMA-CSA	2.5(4)	2.5(1)	**4.6**(3)	6.0(4)	**1.2**(0.4)	1.3(0.7)	1.7(0.4)	15/15
CMA-MSR	2.8(3)	4.3(2)	5.4(1)	**5.3**(3)	1.4(0.6)	**1.2**(0.5)	**1.4**(0.5)	15/15
CMA-TPA	**2.3**(3)	**2.1**(2)	5.7(4)	6.1(2)	1.2(0.3)	1.2(0.5)	1.5(1)	15/15

Table 15: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f14	304	616	777	1105	2207	4825	57711	15/15
CMA-CSA	2.8(0.4)	2.6(0.3)	3.1(0.4)	3.8(0.2)	3.6(0.3)	4.0(0.3)	**0.59**(0.0)*	15/15
CMA-MSR	2.4(0.5)	2.1(0.2)	2.4(0.2)	2.8(0.3)	**2.5**(0.3)	**3.6**(0.2)	0.65(0.0)	15/15
CMA-TPA	**2.2**(0.3)	**1.9**(0.1)	**2.2**(0.2)$^{\star 2}$	**2.7**(0.2)	2.6(0.2)	3.6(0.2)	0.63(0.0)	15/15

Table 16: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f15	1.9e5	7.9e5	1.0e6	1.1e6	1.1e6	1.1e6	1.1e6	15/15
CMA-CSA	0.91(0.2)	**0.65**(0.2)	0.66(0.2)	0.67(0.2)	**0.67**(0.3)	**0.69**(0.2)	**0.70**(0.2)	15/15
CMA-MSR	0.81(0.3)	0.81(0.3)	0.72(0.2)	0.74(0.2)	0.76(0.2)	0.80(0.2)	0.83(0.2)	15/15
CMA-TPA	**0.62**(0.3)	0.69(0.3)	**0.66**(0.2)	**0.67**(0.2)	0.67(0.2)	0.69(0.2)	0.70(0.2)	15/15

Table 17: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f16	5244	72122	3.2e5	7.1e5	1.4e6	2.0e6	2.0e6	15/15
CMA-CSA	1.0(0.3)	1.3(1.0)	0.69(0.4)	**0.51**(0.6)	0.34(0.3)	0.44(0.2)	0.47(0.4)	15/15
CMA-MSR	**0.43**(0.1)$^{\star 2}$	1.3(0.3)	1.2(0.4)	1.3(1)	1.1(0.9)	1.0(0.6)	1.2(0.6)	14/15
CMA-TPA	1.3(0.1)	**0.93**(0.5)	**0.50**(0.4)	0.52(0.3)	**0.31**(0.2)	**0.32**(0.2)	**0.33**(0.2)	15/15

Table 18: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f17	399	4220	14158	34948	51958	1.3e5	2.7e5	14/15
CMA-CSA	1.3(0.4)	**0.56**(0.1)	**0.95**(0.9)	**1.1**(0.3)	1.3(0.9)	**0.82**(0.1)	**0.60**(0.3)	15/15
CMA-MSR	0.96(0.4)	7.3(8)	3.0(2)	1.4(1)	1.4(0.7)	1.00(0.4)	0.67(0.4)	15/15
CMA-TPA	**0.93**(0.1)	5.0(7)	1.9(1)	1.1(0.6)	**1.1**(0.7)	0.82(0.4)	0.64(0.3)	15/15

Table 19: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f18	1442	16998	47068	1.3e5	1.9e5	6.7e5	9.5e5	6/15
CMA-CSA	**1.0**(0.3)	**0.47**(0.8)*	0.98(0.4)	0.65(0.3)	0.67(0.5)	0.53(0.3)	0.40(0.2)	15/15
CMA-MSR	13(30)	1.8(2)	1.7(0.4)	1.0(0.7)	0.95(0.6)	1.0(3)	1.1(1)	13/15
CMA-TPA	1.5(3)	0.91(0.2)	**0.87**(0.1)	**0.57**(0.2)	**0.59**(0.0)	**0.34**(0.2)	**0.30**(0.1)	15/15

Table 20: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f19	1	1	1.4e6	1.7e7	2.6e7	4.5e7	4.5e7	8/15
CMA-CSA	435(146)	1.4e5(2e5)	**1.0**(0.7)	**3.5**(8)	∞	∞	∞ *4e6*	0/15
CMA-MSR	428(36)	2.2e5(2e5)	1.4(0.6)	∞	∞	∞	∞ *4e6*	0/15
CMA-TPA	**317**(77)*	**1.4e5**(2e5)	1.0(0.5)	3.6(3)	∞	∞	∞ *4e6*	0/15

Table 21: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f20	222	1.3e5	1.6e8	∞	∞	∞	∞	0
CMA-CSA	4.2(0.6)	**4.3**(2)$^{\star 4}$	**0.04**(0.0)$^{\star 4}$	**5.8e7**(4e7)$_{\downarrow}$	**5.8e7**(8e7)$_{\downarrow}$	**5.8e7**(3e7)$_{\downarrow}$	**5.9e7**(1e8)$_{\downarrow}$	1/15
CMA-MSR	3.3(0.6)	∞	∞	.	.	.	.	0/15
CMA-TPA	**2.7**(0.2)$^{\star 2}$	∞	∞	.	.	.	.	0/15

Table 22: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f21	1044	21144	1.0e5	1.0e5	1.0e5	1.0e5	1.0e5	26/30
CMA-CSA	4.3(2)	233(204)	158(189)	158(189)	158(188)	157(240)	156(347)	2/15
CMA-MSR	229(796)	312(194)	**66**(82)	**66**(98)	**66**(97)	**66**(48)	**65**(56)	5/15
CMA-TPA	**3.6**(7)	**224**(136)	153(141)	152(217)	152(366)	151(255)	150(57)	2/15

Table 23: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f22	3090	35442	6.5e5	6.5e5	6.5e5	6.5e5	6.5e5	8/30
CMA-CSA	87(93)	139(123)	∞	∞	∞	∞	∞ *2e6*	0/15
CMA-MSR	77(0.7)	106(70)	∞	∞	∞	∞	∞ *3e6*	0/15
CMA-TPA	**1.6**(3)	**80**(234)	∞	∞	∞	∞	∞ *2e6*	0/15

Table 24: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f23	7.1	11925	75453	6.6e5	1.3e6	3.2e6	3.4e6	15/15
CMA-CSA	13(9)	5.7(6)	5.7(10)	3.7(0.4)	46(65)	18(9)	17(11)	1/15
CMA-MSR	**12**(8)	**0.11**(0.0)$^{\star 4}$	**1.8**(2)	**1.5**(1)	**1.6**(0.4)$^{\star 2}$	**0.75**(0.2)	**0.79**(0.0)	15/15
CMA-TPA	13(7)	5.7(2)	4.6(4)	2.6(0.9)	14(10)	5.6(7)	5.4(7)	3/15

Table 25: 40-D, running time excess ERT/ERT$_{\text{best 2009}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension.

Δf_{opt}	1e1	1e0	1e-1	1e-2	1e-3	1e-5	1e-7	#succ
f24	5.8e6	9.8e7	3.0e8	3.0e8	3.0e8	3.0e8	3.0e8	1/15
CMA-CSA	4.5(3)	∞	∞	∞	∞	∞	∞ *4e6*	0/15
CMA-MSR	**1.9**(2)	**0.28**(0.3)	∞	∞	∞	∞	∞ *4e6*	0/15
CMA-TPA	4.5(5)	∞	∞	∞	∞	∞	∞ *4e6*	0/15

References

[1] Asma Atamna. Benchmarking IPOP-CMA-ES-TPA and IPOP-CMA-ES-MSR on the BBOB noiseless testbed. In Laredo et al. [8], pages 1135–1142.

[2] Anne Auger, Steffen Finck, Nikolaus Hansen, and Raymond Ros. BBOB 2009: Comparison tables of all algorithms on all noiseless functions. Technical Report RT-0383, INRIA, April 2010.

[3] Lukás Bajer, Zbynek Pitra, and Martin Holena. Benchmarking gaussian processes and random forests surrogate models on the BBOB noiseless testbed. In Laredo et al. [8], pages 1143–1150.

[4] Dimo Brockhoff, Bernd Bischl, and Tobias Wagner. The impact of initial designs on the performance of matsumoto on the noiseless BBOB-2015 testbed: A preliminary study. In Laredo et al. [8], pages 1159–1166.

[5] S. Finck, N. Hansen, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2009: Presentation of the noiseless functions. Technical Report 2009/20, Research Center PPE, 2009. Updated February 2010.

[6] N. Hansen, A. Auger, S. Finck, and R. Ros. Real-parameter black-box optimization benchmarking 2012: Experimental setup. Technical report, INRIA, 2012.

[7] N. Hansen, S. Finck, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2009: Noiseless functions definitions. Technical Report RR-6829, INRIA, 2009. Updated February 2010.

[8] Juan Luis Jiménez Laredo, Sara Silva, and Anna Isabel Esparcia-Alcázar, editors. *Genetic and Evolutionary Computation Conference, GECCO 2015, Madrid, Spain, July 11-15, 2015, Companion Material Proceedings*. ACM, 2015.

[9] Petr Posík and Petr Baudis. Dimension selection in axis-parallel brent-step method for black-box optimization of separable continuous functions. In Laredo et al. [8], pages 1151–1158.