Comparison tables: BBOB 2012 noisy testbed in 5-D

The BBOBies

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Abstract

This document provides tabular results of the workshop for Black-Box Optimization Benchmarking at GECCO 2012, see `http://coco.gforge.inria.fr/doku.php?id=bbob-2012`. 4 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 [4, 2]. The experimental set-up is described in [3].

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 [1]) 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 [3] 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 in 2012.

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

algorithm short name	paper	reference
IPOPsaACM	Black-box Optimization Benchmarking of IPOP-saACM-ES on the BBOB-2012 Noisy Testbed (Page 261)	[8]
SNES	Benchmarking Separable Natural Evolution Strategies on the Noiseless and Noisy Black-Box Optimization Testbeds (Page 205)	[7]
xNES	Benchmarking Exponential Natural Evolution Strategies on the Noiseless and Noisy Black-Box Optimization Testbeds (Page 213)	[5]
xNESas	Benchmarking Natural Evolution Strategies with Adaptation Sampling on the Noiseless and Noisy Black-Box Optimization Testbeds (Page 229)	[6]
SNES, xNES, xNESas	Comparing Natural Evolution Strategies to BIPOP-CMA-ES on Noiseless and Noisy Black-Box Optimization Testbeds (Page 237)	[9]

Table 2: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f101	11	37	44	62	69	75	15/15
IPOPsaACM	**1.9**(1)	**2.1**(0.5)	**2.2**(0.5)$^{\star 3}$	**2.2**(0.5)$^{\star 4}$	**2.5**(0.3)$^{\star 4}$	**2.8**(0.3)$^{\star 4}$	15/15
SNES	3.8(2)	2.5(0.9)	4.3(0.8)	6.1(0.7)	8.8(1.0)	11(1)	15/15
xNES	3.4(1)	2.4(1)	5.4(0.9)	10(1)	14(1)	18(0.6)	15/15
xNESas	2.8(2)	2.4(1)	5.2(2)	7.9(2)	10(2)	13(3)	15/15

Table 3: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f102	11	35	50	72	86	99	15/15
IPOPsaACM	**2.6**(2)	**2.1**(0.7)	**2.0**(0.5)$^{\star 3}$	**1.9**(0.4)$^{\star 4}$	**2.1**(0.3)$^{\star 4}$	**2.2**(0.3)$^{\star 4}$	15/15
SNES	3.5(2)	2.3(1)	3.7(1)	5.4(0.7)	7.3(0.7)	8.6(0.4)	15/15
xNES	3.1(4)	2.8(1)	4.9(1)	8.8(1)	12(1)	14(1)	15/15
xNESas	3.3(3)	2.7(2)	4.7(1)	7.3(1)	9.2(1)	10(2)	15/15

Table 4: 05-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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f103	11	28	30	31	35	115	15/15
IPOPsaACM	3.0(1)	2.8(0.7)	**3.4**(0.9)$^{\star 2}$	**4.6**(1)$^{\star 4}$	**7.1**(3)$^{\star 4}$	**3.2**(1)$^{\star 4}$	15/15
SNES	2.7(2)	**2.7**(1)	5.5(1)	13(2)	26(15)	21(11)	15/15
xNES	3.7(2)	3.6(1)	8.2(2)	20(3)	31(3)	13(1)	15/15
xNESas	**2.7**(2)	2.9(2)	7.2(2)	16(3)	24(5)	11(2)	15/15

Table 5: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f104	173	773	1287	1768	2040	2284	15/15
IPOPsaACM	**0.88**(0.3)	**1.5**(1)	**1.1**(1)	**0.89**(0.8)	**0.80**(0.7)*	**0.73**(0.7)*	15/15
SNES	1.5(0.6)	21(26)	44(42)	∞	∞	∞ *5e4*	0/15
xNES	1.4(0.7)	2.4(0.9)	5.6(10)	7.3(11)	6.4(10)	5.9(9)	15/15
xNESas	1.4(0.4)	2.4(0.6)	2.7(6)	2.3(4)	2.1(4)	2.0(3)	15/15

Table 6: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f105	167	1436	5174	10388	10824	11202	15/15
IPOPsaACM	1.4(0.5)	**1.5**(2)	**0.63**(0.4)	**0.33**(0.2)$_{\downarrow 3}$	**0.32**(0.2)$_{\downarrow 3}$	**0.32**(0.2)$_{\downarrow 3}$	15/15
SNES	1.7(0.4)	17(21)	12(12)	35(36)	∞	∞ *5e4*	0/15
xNES	**1.3**(0.5)	3.6(6)	4.9(7)	3.6(5)	4.0(5)	4.0(5)	15/15
xNESas	1.4(0.5)	4.0(4)	14(13)	11(7)	11(7)	10(7)	15/15

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Table 7: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f106	92	529	1050	2666	2887	3087	15/15
IPOPsaACM	**1.7**(0.9)	**0.89**(0.2)$^{\star 2}$	**0.60**(0.2)$^{\star 3}$	**0.30**(0.1)$^{\star 3}_{\downarrow 4}$	**0.32**(0.1)$^{\star 3}_{\downarrow 4}$	**0.36**(0.1)$^{\star 3}_{\downarrow 4}$	15/15
SNES	3.9(1)	26(32)	209(239)	276(296)	∞	∞ *5e4*	0/15
xNES	2.9(1.0)	2.0(0.8)	2.2(0.8)	1.2(0.9)	1.2(0.9)	1.3(1)	15/15
xNESas	2.7(0.8)	3.3(0.9)	3.7(5)	2.2(3)	2.2(3)	2.7(3)	15/15

Table 8: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f107	40	228	453	940	1376	1850	15/15
IPOPsaACM	**1.4**(2)	**1.1**(0.7)	1.4(1)	**1.3**(0.8)	**1.4**(1.0)	1.9(1)	15/15
SNES	4.2(6)	2.0(1)	**1.4**(0.8)	1.3(0.9)	1.4(0.7)	**1.3**(0.5)	15/15
xNES	3.2(3)	31(66)	20(33)	10(16)	7.6(11)	45(8)	14/15
xNESas	3.2(5)	7.1(1)	4.2(0.5)	6.9(11)	7.2(8)	7.0(10)	15/15

Table 9: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f108	87	5144	14469	30935	58628	80667	15/15
IPOPsaACM	**7.8**(9)	**1.1**(1)	**0.60**(0.4)$^{\star 2}$	**0.80**(0.5)$^{\star 4}$	**0.74**(0.4)$^{\star 4}$	**1.0**(0.6)	15/15
SNES	15(20)	1.5(3)	8.4(10)	∞	∞	∞ *5e4*	0/15
xNES	84(117)	18(22)	36(28)	∞	∞	∞ *7e5*	0/15
xNESas	69(120)	12(17)	56(59)	∞	∞	∞ *1e6*	0/15

Table 10: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f109	11	57	216	572	873	946	15/15
IPOPsaACM	**2.9**(2)	**1.6**(0.6)	**0.83**(0.3)	**1.2**(0.3)	**1.2**(0.3)$^{\star 2}$	**1.6**(0.4)$^{\star 3}$	15/15
SNES	4.4(2)	1.9(0.7)	0.93(0.3)	1.8(1)	13(21)	371(385)	0/15
xNES	3.4(2)	2.0(0.8)	1.4(0.3)	2.0(0.5)	2.3(0.2)	4.1(0.7)	15/15
xNESas	3.6(2)	1.7(0.7)	1.3(0.5)	1.8(0.5)	2.3(0.6)	4.1(0.8)	15/15

Table 11: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f110	949	33625	1.2e5	5.9e5	6.0e5	6.1e5	15/15
IPOPsaACM	0.71(0.3)	5.6(7)	3.5(4)	**0.78**(0.8)	**0.84**(0.8)	**0.84**(0.8)	15/15
SNES	0.76(1)	**0.33**(0.2)$_{\downarrow}$	**0.65**(0.7)	∞	∞	∞ *5e4*	0/15
xNES	0.49(0.2)	1.3(2)	2.1(3)	1.7(2)	2.2(2)	2.2(2)	7/15
xNESas	**0.44**(0.2)	1.9(2)	3.6(5)	1.2(1)	1.6(2)	2.3(3)	8/15

Table 12: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f111	6856	6.1e5	8.8e6	2.3e7	3.1e7	3.1e7	3/15
IPOPsaACM	**0.50**(0.3)	7.4(8)	1.8(2)	**1.00**(1.0)	**0.74**(0.8)	**0.74**(0.8)	3/15
SNES	1.9(2)	∞	∞	∞	∞	∞ *5e4*	0/15
xNES	7.2(9)	4.1(5)	**0.61**(0.7)	∞	∞	∞ *8e5*	0/15
xNESas	5.4(8)	**1.8**(2)	0.96(1)	∞	∞	∞ *1e6*	0/15

Table 13: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f112	107	1684	3421	4502	5132	5596	15/15
IPOPsaACM	**1.4**(0.6)*	**1.5**(2)	**1.2**(0.9)	**1.2**(0.6)	**1.2**(0.6)	**1.2**(0.6)	15/15
SNES	1.9(0.4)	16(19)	19(20)	∞	∞	∞ *5e4*	0/15
xNES	4.6(1)	3.0(5)	3.0(3)	6.5(8)	12(15)	18(28)	15/15
xNESas	2.3(1)	2.6(5)	7.9(10)	17(18)	28(23)	37(38)	15/15

Table 14: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f113	133	1883	8081	24128	24128	24402	15/15
IPOPsaACM	3.0(2)	0.82(0.8)	**0.47**(0.6)	**0.35**(0.4)	**0.35**(0.4)	**0.35**(0.4)	15/15
SNES	1.8(2)	**0.78**(0.9)	2.1(3)	3.1(3)	3.1(3)	4.1(4)	5/15
xNES	10(6)	3.3(8)	2.1(3)	1.2(2)	1.2(2)	1.2(2)	15/15
xNESas	**1.2**(1)	2.4(4)	2.5(4)	1.4(2)	1.4(2)	1.5(2)	15/15

Table 15: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f114	767	14720	56311	83272	83272	84949	15/15
IPOPsaACM	2.6(3)	**0.73**(0.4)	**0.54**(0.4)$^{\star 3}$	**0.44**(0.2)$^{\star 2}$	**0.44**(0.2)$^{\star 2}$	**0.44**(0.3)$^{\star 2}$	15/15
SNES	**2.6**(3)	2.4(3)	∞	∞	∞	∞ *5e4*	0/15
xNES	10(17)	10(10)	33(37)	∞	∞	∞ *8e5*	0/15
xNESas	8.0(13)	9.1(13)	157(166)	∞	∞	∞ *1e6*	0/15

Table 16: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f115	64	485	1829	2550	2550	2970	15/15
IPOPsaACM	1.6(0.6)	0.98(1)	**1.2**(1)	**1.2**(0.8)	**1.2**(0.8)	**1.1**(0.7)	15/15
SNES	1.6(0.8)	1.8(2)	4.4(4)	40(43)	40(47)	45(43)	4/15
xNES	1.7(1)	1.9(0.3)	2.3(5)	2.5(5)	2.5(5)	2.6(4)	15/15
xNESas	**1.3**(0.9)	**0.88**(0.4)	1.8(4)	1.8(4)	1.8(4)	1.6(3)	15/15

Table 17: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f116	5730	14472	22311	26868	30329	31661	15/15
IPOPsaACM	1.0(1)	**0.74**(0.8)	**0.56**(0.5)	**0.59**(0.5)	**0.56**(0.4)$_{\downarrow}$	**0.56**(0.4)$_{\downarrow}$	15/15
SNES	1.6(1)	5.9(6)	∞	∞	∞	∞ *5e4*	0/15
xNES	**0.62**(1)	0.78(1)	1.3(2)	1.2(1)	1.2(1)	1.2(1)	14/15
xNESas	1.4(2)	1.2(2)	1.1(2)	1.3(1)	1.6(2)	1.8(2)	15/15

Table 18: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f117	26686	76052	1.1e5	1.4e5	1.7e5	1.9e5	15/15
IPOPsaACM	**0.60**(0.5)$^{\star 2}$	**0.43**(0.3)$^{\star 2}$	**0.42**(0.3)$^{\star 2}_{\downarrow 2}$	**0.54**(0.3)$_{\downarrow}$	**0.59**(0.3)	**0.60**(0.2)	15/15
SNES	6.3(6)	∞	∞	∞	∞	∞ *5e4*	0/15
xNES	9.4(13)	47(49)	∞	∞	∞	∞ *8e5*	0/15
xNESas	8.4(6)	39(47)	∞	∞	∞	∞ *1e6*	0/15

Table 19: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f118	429	1217	1555	1998	2430	2913	15/15
IPOPsaACM	$\mathbf{0.49}(0.1)^{\star 3}_{\downarrow 4}$	$\mathbf{0.25}(0.1)^{\star 3}_{\downarrow 4}$	$\mathbf{0.33}(0.1)^{\star 2}_{\downarrow 4}$	$\mathbf{0.48}(0.1)^{\star 2}_{\downarrow 4}$	$\mathbf{0.63}(0.1)^{\star 2}_{\downarrow 3}$	$\mathbf{0.74}(0.3)^{\star}_{\downarrow 2}$	15/15
SNES	11(9)	33(36)	∞	∞	∞	∞ *5e4*	0/15
xNES	1.0(0.4)	0.50(0.1)$_{\downarrow 4}$	0.52(0.1)$_{\downarrow 4}$	0.73(0.1)$_{\downarrow 2}$	1.0(0.2)	1.6(0.2)	15/15
xNESas	1.00(0.4)	0.48(0.1)$_{\downarrow 4}$	0.48(0.1)$_{\downarrow 4}$	0.69(0.2)$_{\downarrow 2}$	0.96(0.2)	1.1(0.2)	15/15

Table 20: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f119	12	657	1136	10372	35296	49747	15/15
IPOPsaACM	4.9(10)	1.1(2)	0.99(0.9)	**0.50**(0.5)	**0.47**(0.2)$_{\downarrow 2}$	**0.61**(0.5)$^{\star 2}$	15/15
SNES	3.9(6)	0.64(0.9)	**0.64**(0.5)	0.84(0.9)	∞	∞ *5e4*	0/15
xNES	**1.9**(2)	**0.38**(0.4)	0.66(0.2)	2.6(3)	1.5(1)	12(13)	9/15
xNESas	3.8(4)	2.1(1)	6.3(13)	1.6(2)	2.3(3)	5.9(6)	15/15

Table 21: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f120	16	2900	18698	72438	3.3e5	5.5e5	15/15
IPOPsaACM	26(56)	1.1(1)	**0.80**(0.5)*	**0.52**(0.3)$^{\star 4}$	**0.36**(0.3)$_{\downarrow 3}$	**0.64**(0.5)	15/15
SNES	12(32)	**0.72**(0.9)	38(42)	∞	∞	∞ *5e4*	0/15
xNES	**9.0**(12)	14(17)	43(42)	∞	∞	∞ *8e5*	0/15
xNESas	51(18)	13(21)	25(34)	∞	∞	∞ *1e6*	0/15

Table 22: 05-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 of function evaluations to reach this value divided by dimension

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f121	8.6	111	273	1583	3870	6195	15/15
IPOPsaACM	3.3(4)	0.98(0.5)	0.97(0.5)	**1.0**(0.6)	**0.95**(0.4)	**0.86**(0.2)	15/15
SNES	**2.6**(3)	1.1(0.8)	**0.77**(0.4)	11(14)	∞	∞ *5e4*	0/15
xNES	2.7(3)	0.96(0.5)	1.2(0.2)	1.3(0.5)	1.2(1)	1.7(2)	15/15
xNESas	2.6(2)	**0.85**(0.6)	0.96(0.5)	1.6(0.8)	1.5(2)	2.3(3)	15/15

Table 23: 05-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f122	10	1727	9190	30087	53743	1.1e5	15/15
IPOPsaACM	2.6(3)	1.2(0.8)	**0.75**(0.5)	**0.58**(0.2)$_{\downarrow}^{\star 4}$	**0.77**(0.3)$^{\star 4}$	**0.66**(0.3)$_{\downarrow}$	15/15
SNES	7.8(10)	**0.65**(0.6)	2.3(3)	∞	∞	∞ *5e4*	0/15
xNES	**1.7**(2)	1.9(2)	6.4(4)	200(214)	∞	∞ *8e5*	0/15
xNESas	5.0(4)	5.5(11)	8.9(8)	583(644)	∞	∞ *1e6*	0/15

Table 24: 05-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f123	11	16066	81505	3.4e5	6.7e5	2.2e6	15/15
IPOPsaACM	23(52)	**0.74**(0.4)	**0.70**(0.5)	**0.58**(0.3)	**0.80**(0.7)	**0.71**(0.5)	15/15
SNES	12(16)	3.1(3)	∞	∞	∞	∞ *5e4*	0/15
xNES	36(70)	10(9)	∞	∞	∞	∞ *8e5*	0/15
xNESas	**6.6**(9)	7.2(7)	∞	∞	∞	∞ *1e6*	0/15

Table 25: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f124	10	202	1040	20478	45337	95200	15/15
IPOPsaACM	2.6(2)	1.3(0.6)	3.1(4)	**0.85**(0.7)	**0.97**(0.8)$^{\star 3}$	**4.1**(8)	15/15
SNES	2.9(4)	1.2(1.0)	**1.2**(0.9)	∞	∞	∞ *5e4*	0/15
xNES	**2.5**(2)	1.4(0.4)	3.8(10)	2.0(2)	19(21)	112(125)	1/15
xNESas	2.9(3)	**1.2**(0.5)	2.0(0.7)	1.1(1)	36(37)	60(67)	1/15

Table 26: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f125	1	1	1	2.4e5	2.4e5	2.5e5	15/15
IPOPsaACM	1.5(0)	**18**(18)	4308(4084)	**0.56**(0.6)	**0.79**(0.9)	**4.8**(6)	15/15
SNES	1.2(0.5)	33(34)	**3958**(3495)	∞	∞	∞ *5e4*	0/15
xNES	**1.1**(0)	29(26)	9476(1e4)	∞	∞	∞ *8e5*	0/15
xNESas	1.3(0.5)	23(22)	7786(7916)	∞	∞	∞ *1e6*	0/15

Table 27: 05-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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f126	1	1	1	∞	∞	∞	0
IPOPsaACM	**1**(0)	165(444)	**9361**(8720)	**1.3e7**(1e7)	**1.3e7**(1e7)	**1.3e7**(1e7)	5/15
SNES	1.4(1)	**32**(50)	5.2e4(5e4)	.	.	.	0/15
xNES	1.1(0)	88(191)	4.4e4(5e4)	.	.	.	0/15
xNESas	1.1(0.5)	44(88)	4.2e4(5e4)	.	.	.	0/15

Table 28: 05-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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f127	1	1	1	3.4e5	3.9e5	4.0e5	15/15
IPOPsaACM	**1**(0)	20(22)	**2432**(3044)	**0.30**(0.3)	**0.32**(0.3)$_{\downarrow}$	**0.33**(0.3)$_{\downarrow}$	15/15
SNES	1.1(0.5)	**19**(16)	3060(2752)	∞	∞	∞ *5e4*	0/15
xNES	1.1(0)	19(22)	3395(5420)	31(36)	∞	∞ *7e5*	0/15
xNESas	1.1(0.5)	20(16)	3858(5345)	∞	∞	∞ *1e6*	0/15

Table 29: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f128	111	4248	7808	12447	17217	21162	15/15
IPOPsaACM	**1.3**(1.0)	16(21)	265(321)	203(342)	147(247)	124(148)	11/15
SNES	1.6(2)	**1.1**(1)	**0.78**(0.8)	**0.51**(0.5)	**0.40**(0.3)$_{\downarrow 2}$	**0.45**(0.4)$_{\downarrow 2}$	15/15
xNES	7.1(2)	7.3(11)	5.2(6)	3.3(4)	2.4(3)	2.0(2)	15/15
xNESas	22(67)	6.2(9)	5.7(7)	3.6(4)	2.6(3)	2.1(2)	15/15

Table 30: 05-D, running time excess ERT/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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f129	64	10710	59443	2.8e5	5.1e5	5.8e5	15/15
IPOPsaACM	9.1(12)	10(21)	19(42)	13(18)	**7.1**(10)	**6.3**(9)	9/15
SNES	**7.6**(14)	**1.2**(1)	**1.8**(2)	∞	∞	∞ *5e4*	0/15
xNES	38(34)	15(10)	10(8)	**11**(13)	∞	∞ *7e5*	0/15
xNESas	17(16)	11(11)	8.6(11)	14(16)	∞	∞ *1e6*	0/15

Table 31: 05-D, running time excess ERT/ERT$_{\text{best 2009}}$ 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

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f130	55	812	3034	32823	33889	34528	10/15
IPOPsaACM	**1.4**(0.9)	27(27)	126(131)	42(76)	41(74)	40(72)	13/15
SNES	2.9(7)	**4.8**(5)	**1.6**(2)	**0.19**(0.2)	**0.44**(0.4)	2.7(2)	3/15
xNES	13(1)	67(84)	25(25)	2.4(2)	2.3(2)	**2.3**(2)	15/15
xNESas	17(0.9)	67(79)	28(48)	2.6(4)	2.5(4)	2.5(4)	15/15

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