Comparison tables: BBOB 2012 function testbed with BBOB 2009 as reference

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`. 27 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 ($\mathrm{ERT}_{\mathrm{best}}$ 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
ACOR	An ACO Algorithm Benchmarked on the BBOB Noiseless Function Testbed (Page 159)	[5]
BIPOPaCMA	Black-Box Optimization Benchmarking of IPOP-SaACM-ES and BIPOP-SaACM-ES on the BBOB-2012 Noiseless Testbed (Page 175)	[12]
BIPOPsaACM	Black-box Optimization Benchmarking of IPOP-SaACM-ES and BIPOP-SaACM-ES on the BBOB-2012 Noiseless Testbed (Page 175)	[12]
CMA	Comparing Mirrored Mutations and Active Covariance Matrix Adaptation in the IPOP-CMA-ES on the Noiseless BBOB Testbed (Page 297)	[14]
CMAES	Benchmarking the Differential Evolution with Adaptive Encoding on Noiseless Functions (Page 189)	[9]
CMAa	Comparing Mirrored Mutations and Active Covariance Matrix Adaptation in the IPOP-CMA-ES on the Noiseless BBOB Testbed (Page 297)	[14]
CMAm	Comparing Mirrored Mutations and Active Covariance Matrix Adaptation in the IPOP-CMA-ES on the Noiseless BBOB Testbed (Page 297)	[14]
CMAma	On the Impact of a Small Initial Population Size in the IPOP Active CMA-ES with Mirrored Mutations on the Noiseless BBOB Testbed (Page 285)	[19]
CMAmah	On the Impact of a Small Initial Population Size in the IPOP Active CMA-ES with Mirrored Mutations on the Noiseless BBOB Testbed (Page 285)	[19]
CMAmh	On the Impact of Active Covariance Matrix Adaptation in the CMA-ES With Mirrored Mutations and Small Initial Population Size on the Noiseless BBOB Testbed (Page 291)	[20]
DBRCGA	Black-Box Optimization Benchmarking for Noiseless Function Testbed Using A Direction-Based RCGA (Page 167)	[11]
DE	Benchmarking the Differential Evolution with Adaptive Encoding on Noiseless Functions (Page 189)	[9]
DE-AUTO	MEMPSODE: An Empirical Assessment of Local Search Algorithm Impact on a Memetic Algorithm Using Noiseless Testbed (Page 245)	[17]
DE-BFGS	MEMPSODE: Comparing Particle Swarm Optimization and Differential Evolution Within a Hybrid Memetic Global Optimization Framework (Page 253)	[18]
DE-ROLL	MEMPSODE: An Empirical Assessment of Local Search Algorithm Impact on a Memetic Algorithm Using Noiseless Testbed (Page 245)	[17]
DE-SIMPLEX	MEMPSODE: An Empirical Assessment of Local Search Algorithm Impact on a Memetic Algorithm Using Noiseless Testbed (Page 245)	[17]
DEctpb	JADE, an Adaptive Differential Evolution Algorithm, Benchmarked on the BBOB Noiseless Testbed (Page 197)	[16]
IPOPsaACM	Black-box Optimization Benchmarking of NIPOP-aCMA-ES and NBIPOP-aCMA-ES on the BBOB-2012 Noiseless Testbed (Page 269)	[14]
JADEctpb	JADE, an Adaptive Differential Evolution Algorithm, Benchmarked on the BBOB Noiseless Testbed (Page 197)	[16]
MVDE	Benchmarking the Multi-View Differential Evolution on the Noiseless BBOB-2012 Function Testbed (Page 183)	[10]
NBIPOPaCMA	Black-box Optimization Benchmarking of NIPOP-aCMA-ES and NBIPOP-aCMA-ES on the BBOB-2012 Noiseless Testbed (Page 269)	[13]
NIPOPaCMA	Black-box Optimization Benchmarking of NIPOP-aCMA-ES and NBIPOP-aCMA-ES on the BBOB-2012 Noiseless Testbed (Page 269)	[13]
PSO-BFGS	MEMPSODE: Comparing Particle Swarm Optimization and Differential Evolution Within a Hybrid Memetic Global Optimization Framework (Page 253)	[18]
SNES	Benchmarking Separable Natural Evolution Strategies on the Noiseless and Noisy Black-box Optimization Testbeds (Page 205)	[8]
xNES	Benchmarking Exponential Natural Evolution Strategies on the Noiseless and Noisy Black-Box Optimization Testbeds (Page 213)	[6]
xNESas	Benchmarking Natural Evolution Strategies with Adaptation Sampling on the Noiseless and Noisy Black-Box Optimization Testbeds (Page 229)	[7]
xNESas	Investigating the Impact of Adaptation Sampling in Natural Evolution Strategies on Black-Box Optimization Testbeds (Page 221)	[15]

Table 2: 02-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-3	1e-5	1e-7	#succ
f1	1.8	5.7	5.7	6.2	6.2	6.2	15/15
ACOR	**1.4**(1)	4.4(5)	11(9)	31(8)	50(4)	72(9)	15/15
BIPOPaCMA	3.3(5)	3.9(3)	7.8(6)	18(6)	26(7)	36(5)	15/15
BIPOPsaACM	5.4(6)	5.1(5)	8.3(4)	12(1)	16(3)	19(2)	15/15
CMA	**2.9**(2)	4.3(3)	10(3)	18(4)	27(7)	36(6)	15/15
CMAES	3.7(5)	4.9(4)	9.5(6)	19(5)	29(5)	40(5)	15/15
CMAa	3.4(6)	**3.2**(3)	8.2(5)	18(6)	26(6)	38(8)	15/15
CMAm	3.1(4)	3.3(3)	**6.4**(5)	15(4)	22(4)	30(5)	15/15
CMAma	3.0(5)	3.8(3)	7.8(4)	14(5)	22(7)	29(7)	15/15
CMAmah	3.4(4)	**3.3**(2)	**6.1**(3)	13(4)	19(4)	27(5)	15/15
CMAmh	4.1(6)	**2.6**(3)	**6.3**(3)	**11**(4)	21(5)	28(3)	15/15
DBRCGA	**1.8**(1)	4.8(4)	15(10)	36(6)	54(10)	77(13)	15/15
DE	**1.9**(2)	3.6(4)	12(7)	32(10)	49(13)	67(20)	15/15
DE-AUTO	**1.6**(1)	3.3(4)	8.8(4)	**10**(0.2)	**10**(0.2)	**10**(0.2)	15/15
DE-BFGS	**2.9**(3)	4.1(2)	9.2(2)	**9.1**(0.2)	**9.1**(0.2)	**9.1**(0.2)	15/15
DE-ROLL	**2.1**(1)	**2.5**(3)	12(4)	13(1)	**13**(1)	**13**(1)	15/15
DE-SIMPLEX	**2.9**(2)	5.2(4)	10(6)	13(1)	16(2)	18(2)	15/15
DEctpb	**2.6**(2)	4.7(5)	13(7)	35(8)	52(7)	72(7)	15/15
IPOPsaACM	3.1(2)	3.6(3)	**7.0**(5)	12(1)	15(2)	19(1)	15/15
JADEctpb	**2.3**(2)	4.0(4)	9.2(5)	22(7)	36(6)	51(7)	15/15
MVDE	**2.3**(3)	3.7(3)	20(17)	78(22)	129(29)	175(40)	15/15
NBIPOPaCMA	4.8(6)	4.0(4)	7.6(5)	16(7)	27(5)	37(5)	15/15
NIPOPaCMA	**2.6**(3)	3.8(4)	7.6(5)	16(5)	26(4)	34(7)	15/15
PSO-BFGS	**1.9**(3)	5.3(4)	9.1(3)	**9.2**(0.2)	**9.2**(0.2)	**9.2**(0.2)	15/15
SNES	6.5(6)	4.5(3)	7.1(6)	19(9)	39(6)	51(12)	15/15
xNES	4.2(5)	4.2(4)	7.4(6)	18(8)	32(7)	44(7)	15/15
xNESas	6.6(9)	4.3(5)	8.0(7)	18(8)	28(9)	40(10)	15/15

Table 3: 02-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-3	1e-5	1e-7	#succ
f2	16	19	25	26	28	29	15/15
ACOR	13(3)	14(2)	13(2)	17(3)	20(2)	24(3)	15/15
BIPOPaCMA	14(10)	16(9)	14(5)	16(3)	17(3)	19(3)	15/15
BIPOPsaACM	6.3(2)	7.0(2)	5.7(2)	6.4(1)	6.8(1)	7.4(1.0)	15/15
CMA	12(10)	18(10)	17(4)	20(3)	21(3)	22(2)	15/15
CMAES	17(12)	22(7)	20(3)	21(4)	23(3)	24(3)	15/15
CMAa	12(8)	16(6)	14(2)	16(3)	16(2)	18(2)	15/15
CMAm	12(12)	20(10)	17(8)	19(5)	20(4)	21(3)	15/15
CMAma	13(9)	19(4)	16(2)	17(3)	17(2)	19(2)	15/15
CMAmah	19(14)	23(12)	20(3)	21(3)	21(3)	22(3)	15/15
CMAmh	22(15)	27(15)	26(3)	27(3)	27(2)	28(3)	15/15
DBRCGA	11(8)	15(8)	16(6)	20(6)	23(4)	29(6)	15/15
DE	11(3)	12(2)	11(3)	15(3)	18(3)	21(4)	15/15
DE-AUTO	**4.3**(0.3)	**3.8**(0.2)	**3.1**(0.2)	**3.2**(0.3)	**3.3**(0.3)	**3.4**(0.5)	15/15
DE-BFGS	**4.0**(0.3)	**3.7**(0.3)	**3.0**(0.2)	**3.2**(0.4)	**3.2**(0.3)	**3.3**(0.3)	15/15
DE-ROLL	**5.0**(4)	**4.5**(3)	**3.6**(2)	**3.7**(2)	**3.8**(2)	**4.1**(2)	15/15
DE-SIMPLEX	5.1(1)	5.3(1)	4.3(1)	4.7(0.9)	4.9(0.9)	5.2(0.8)	15/15
DEctpb	10(4)	12(4)	12(3)	17(3)	19(4)	23(5)	15/15
IPOPsaACM	5.1(3)	5.7(2)	5.4(1)	5.9(0.8)	6.1(0.9)	6.8(0.9)	15/15
JADEb	6.4(1)	7.6(3)	7.2(2)	9.1(2)	11(2)	13(2)	15/15
JADEctpb	7.5(3)	9.5(2)	9.4(2)	12(2)	15(3)	17(2)	15/15
MVDE	23(8)	28(10)	29(7)	40(6)	50(7)	60(5)	15/15
NBIPOPaCMA	14(10)	18(6)	15(3)	17(3)	17(4)	19(3)	15/15
NIPOPaCMA	11(8)	15(7)	14(4)	16(2)	17(2)	19(2)	15/15
PSO-BFGS	**4.2**(0.3)	**3.8**(0.4)	**3.1**(0.4)	**3.2**(0.4)	**3.1**(0.4)	**3.3**(0.4)	15/15
SNES	11(7)	12(6)	11(3)	14(3)	17(2)	20(2)	15/15
xNES	6.6(6)	11(7)	11(4)	13(3)	15(4)	18(4)	15/15
xNESas	8.9(8)	19(20)	17(18)	28(22)	38(19)	43(22)	15/15

Table 4: 02-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	15	271	445	450	454	464	15/15
ACOR	5.2(4)	**1.8**(2)	17(58)	18(58)	18(57)	18(56)	15/15
BIPOPaCMA	3.3(2)	3.9(3)	7.6(9)	7.9(9)	8.1(9)	8.2(8)	15/15
BIPOPsaACM	6.2(3)	**1.9**(2)	5.0(6)	6.8(6)	6.8(6)	7.1(6)	15/15
CMA	4.0(5)	5.5(5)	8.0(7)	8.5(8)	8.8(8)	9.0(8)	15/15
CMAES	3.9(4)	4.2(4)	10(11)	10(11)	10(11)	10(11)	15/15
CMAa	**2.6**(3)	3.2(3)	5.2(4)	5.7(5)	5.9(5)	6.0(5)	15/15
CMAm	**2.8**(2)	3.3(3)	5.9(8)	6.6(9)	6.9(9)	7.0(9)	15/15
CMAma	**2.5**(2)	**2.8**(3)	6.0(7)	10(10)	10(10)	11(10)	15/15
CMAmah	5.6(5)	5.2(4)	6.1(4)	6.7(4)	6.9(4)	7.1(4)	15/15
CMAmh	6.8(16)	3.9(4)	6.4(7)	7.8(8)	8.2(8)	8.3(8)	15/15
DBRCGA	**2.8**(2)	**2.0**(0.7)	**2.4**(2)	**2.8**(2)	3.1(2)	3.7(2)	15/15
DE	3.9(3)	**0.96**(0.3)	**1.9**(3)	**2.1**(3)	**2.3**(3)	**2.5**(3)	15/15
DE-AUTO	3.6(2)	3.7(5)	5.8(6)	5.9(6)	5.8(6)	5.7(6)	15/15
DE-BFGS	6.5(8)	**1.6**(1)	**1.7**(0.8)	**1.7**(0.9)	**1.7**(0.9)	**1.7**(0.9)	15/15
DE-ROLL	4.5(3)	**0.50**(0.4)	**1.5**(2)	**1.5**(2)	**1.5**(2)	**1.5**(2)	15/15
DE-SIMPLEX	8.9(8)	**2.8**(2)	**2.6**(2)	**2.7**(2)	**2.7**(2)	**2.7**(2)	15/15
DEctpb	4.1(3)	**1.3**(0.7)	**1.4**(0.7)	**1.9**(0.8)	**2.3**(0.7)	**2.6**(0.6)	15/15
IPOPsaACM	3.1(3)	**3.0**(3)	5.2(3)	7.0(7)	7.2(9)	7.2(9)	15/15
JADEb	4.0(2)	**1.3**(2)	3.4(3)	3.5(3)	3.7(3)	3.7(3)	15/15
JADEctpb	3.2(2)	**0.96**(0.6)	**0.76**(0.4)	**1.3**(0.4)	**1.5**(0.3)	**1.7**(0.3)	15/15
MVDE	6.3(4)	**1.9**(0.8)	**1.7**(0.6)	**2.4**(0.3)	3.3(0.3)	4.0(0.5)	15/15
NBIPOPaCMA	5.9(3)	**2.4**(4)	8.8(9)	10(9)	10(9)	10(9)	15/15
NIPOPaCMA	3.4(2)	3.1(4)	10(12)	16(26)	16(27)	17(27)	15/15
PSO-BFGS	7.0(6)	**1.6**(2)	**3.0**(3)	**3.0**(3)	**2.9**(3)	**2.9**(3)	15/15
SNES	13(7)	5.8(8)	21(29)	34(47)	34(47)	33(46)	15/15
xNES	13(2)	13(15)	23(27)	24(27)	24(27)	23(26)	15/15
xNESas	13(38)	6.6(7)	20(28)	20(28)	20(27)	20(27)	15/15

Table 5: 02-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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	22	344	459	523	544	566	15/15
ACOR	4.4(2)	22(75)	92(110)	82(97)	79(93)	76(89)	15/15
BIPOPaCMA	4.0(2)	8.1(15)	41(48)	39(50)	39(51)	38(51)	15/15
BIPOPsaACM	3.8(2)	6.3(7)	34(46)	92(93)	230(387)	224(369)	15/15
CMA	**2.6**(2)	6.7(9)	50(44)	95(110)	104(119)	105(121)	15/15
CMAES	4.5(2)	4.4(5)	42(30)	42(39)	40(38)	39(36)	15/15
CMAa	**2.1**(1)	11(10)	66(50)	140(231)	151(257)	154(262)	15/15
CMAm	**2.1**(1)	8.2(10)	74(80)	164(130)	175(134)	178(135)	15/15
CMAma	**2.1**(2)	10(11)	112(91)	218(210)	241(232)	243(234)	15/15
CMAmah	6.6(13)	7.3(12)	56(53)	133(246)	144(262)	144(261)	15/15
CMAmh	3.7(3)	7.0(11)	71(93)	144(210)	162(261)	162(259)	15/15
DBRCGA	3.6(3)	**1.8**(1)	**2.7**(2)	**2.7**(2)	**2.9**(2)	3.1(2)	15/15
DE	3.2(2)	**2.1**(2)	3.8(5)	3.6(4)	4.0(4)	4.0(4)	15/15
DE-AUTO	**2.6**(0.7)	4.0(8)	8.4(7)	7.4(7)	7.1(6)	6.8(6)	15/15
DE-BFGS	3.5(3)	**1.6**(1)	**2.7**(4)	**2.4**(3)	**2.4**(3)	**2.3**(3)	15/15
DE-ROLL	**2.3**(2)	**1.1**(1)	**2.4**(2)	**2.2**(2)	**2.1**(2)	**2.0**(2)	15/15
DE-SIMPLEX	4.7(3)	**1.9**(1)	4.2(7)	3.7(6)	3.6(6)	3.5(6)	15/15
DEctpb	4.2(1)	**1.2**(0.7)	**2.2**(3)	**2.3**(2)	**2.6**(3)	**2.8**(2)	15/15
IPOPsaACM	**2.5**(2)	4.5(4)	69(84)	283(189)	1074(1460)	1130(1399)	14/15
JADEb	4.4(2)	**2.6**(4)	6.9(6)	6.2(5)	6.1(5)	6.0(5)	15/15
JADEctpb	**2.6**(2)	**1.1**(0.5)	**1.4**(2)	**1.5**(1)	**1.7**(1)	**1.8**(1)	15/15
MVDE	5.7(4)	**1.7**(0.7)	**1.7**(0.5)	**2.4**(0.5)	3.0(0.3)	3.5(0.4)	15/15
NBIPOPaCMA	**2.4**(2)	8.0(6)	67(64)	71(71)	71(85)	69(84)	15/15
NIPOPaCMA	3.8(2)	5.7(7)	120(231)	177(271)	178(264)	175(255)	15/15
PSO-BFGS	4.5(5)	**2.1**(2)	4.4(4)	4.0(4)	3.8(4)	4.4(6)	15/15
SNES	8.4(2)	12(20)	47(49)	44(43)	42(41)	41(39)	15/15
xNES	8.6(2)	20(20)	64(58)	57(51)	55(49)	53(47)	15/15
xNESas	11(30)	11(12)	46(72)	44(63)	42(61)	41(58)	15/15

Table 6: 02-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-3	1e-5	1e-7	#succ
f5	3.7	4.4	4.4	4.4	4.4	4.4	15/15
ACOR	4.0(1)	14(0.9)	15(1)	15(1)	15(1)	15(1)	15/15
BIPOPaCMA	**2.9**(2)	5.3(4)	5.7(5)	5.7(5)	5.7(5)	5.7(5)	15/15
BIPOPsaACM	3.9(3)	5.8(4)	6.5(4)	6.5(4)	6.5(4)	6.5(4)	15/15
CMA	3.8(4)	7.8(7)	8.4(7)	8.4(7)	8.4(7)	8.4(7)	15/15
CMAES	3.1(2)	5.8(3)	6.1(3)	6.2(3)	6.2(3)	6.2(3)	15/15
CMAa	4.7(5)	6.1(5)	6.2(4)	6.3(4)	6.3(4)	6.3(4)	15/15
CMAm	**2.7**(2)	**4.2**(2)	**4.6**(2)	**4.6**(2)	**4.6**(2)	**4.6**(2)	15/15
CMAma	**3.0**(2)	**4.3**(2)	**4.5**(2)	**4.7**(2)	**4.7**(2)	**4.7**(2)	15/15
CMAmah	3.3(2)	**4.7**(3)	**5.1**(4)	**5.1**(4)	**5.1**(4)	**5.1**(4)	15/15
CMAmh	**2.2**(2)	**3.2**(2)	**3.5**(2)	**3.5**(2)	**3.5**(2)	**3.5**(2)	15/15
DBRCGA	3.4(3)	8.7(5)	11(5)	11(5)	11(5)	11(5)	15/15
DE	3.4(3)	7.6(5)	8.1(7)	8.1(7)	8.1(7)	8.1(7)	15/15
DE-AUTO	3.6(2)	8.8(3)	10(4)	10(4)	10(4)	10(4)	15/15
DE-BFGS	5.9(2)	12(3)	13(1)	13(1)	13(1)	13(1)	15/15
DE-ROLL	3.6(3)	8.8(2)	11(3)	11(3)	12(3)	12(3)	15/15
DE-SIMPLEX	4.9(2)	8.2(2)	11(6)	12(7)	14(10)	36(61)	15/15
DEctpb	4.5(4)	9.4(8)	10(8)	11(7)	11(7)	11(7)	15/15
IPOPsaACM	**3.0**(3)	6.1(6)	6.8(6)	6.8(6)	6.8(6)	6.8(6)	15/15
JADEb	3.5(4)	6.4(5)	7.7(6)	7.8(6)	7.8(6)	7.8(6)	15/15
JADEctpb	3.1(3)	9.3(8)	11(8)	11(8)	11(8)	11(8)	15/15
MVDE	5.2(6)	34(11)	44(15)	45(15)	45(15)	45(15)	15/15
NBIPOPaCMA	4.1(3)	5.9(4)	6.3(3)	6.3(3)	6.3(3)	6.3(3)	15/15
NIPOPaCMA	3.2(2)	4.9(3)	5.4(3)	5.4(3)	5.4(3)	5.4(3)	15/15
PSO-BFGS	6.3(7)	13(0.3)	13(0.3)	13(0.3)	13(0.3)	13(0.3)	15/15
SNES	5.3(3)	10(6)	11(7)	11(7)	11(7)	11(7)	15/15
xNES	6.9(4)	14(12)	14(12)	14(12)	14(12)	14(12)	15/15
xNESas	5.9(5)	19(29)	20(29)	20(30)	20(30)	20(30)	15/15

Table 7: 02-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-3	1e-5	1e-7	#succ
f6	13	23	41	67	95	124	15/15
ACOR	**2.1**(3)	6.1(3)	6.0(3)	8.1(2)	8.4(2)	8.9(2)	15/15
BIPOPaCMA	**2.0**(2)	3.5(3)	3.1(1)	3.5(1)	3.8(1.0)	3.8(0.9)	15/15
BIPOPsaACM	**2.3**(2)	**3.1**(1)	3.1(0.7)	4.0(2)	4.0(2)	4.2(2)	15/15
CMA	**2.2**(3)	3.8(3)	4.1(2)	3.9(0.9)	4.1(0.9)	4.1(0.9)	15/15
CMAES	**2.7**(2)	4.0(4)	4.3(2)	4.3(1)	4.2(1)	4.3(0.9)	15/15
CMAa	**3.0**(4)	4.3(3)	3.2(3)	3.9(1)	3.9(1)	3.9(0.7)	15/15
CMAm	4.0(6)	5.5(2)	4.3(2)	4.4(1.0)	4.5(2)	4.6(1)	15/15
CMAma	**2.0**(3)	3.8(4)	4.0(2)	4.0(2)	4.2(0.8)	4.3(0.7)	15/15
CMAmah	**2.4**(3)	3.6(2)	**2.8**(1)	**3.0**(0.6)	**2.9**(0.5)	**2.9**(0.4)	15/15
CMAmh	**2.5**(2)	3.3(3)	3.2(2)	3.4(1)	3.2(1)	3.3(0.8)	15/15
DBRCGA	**2.0**(2)	6.4(3)	6.7(3)	7.4(2)	7.5(2)	8.1(2)	15/15
DE	**2.8**(3)	4.7(3)	6.2(2)	7.5(2)	8.0(2)	8.3(2)	15/15
DE-AUTO	**1.6**(2)	**3.1**(1)	**2.3**(1)	**1.9**(0.7)	**1.7**(0.7)	**1.5**(0.5)	15/15
DE-BFGS	**1.9**(2)	3.1(2)	**2.4**(0.8)	**1.8**(0.5)	**1.5**(0.3)	**1.6**(0.6)	15/15
DE-ROLL	**1.4**(1)	9.5(7)	22(49)	18(36)	51(52)	135(305)	14/15
DE-SIMPLEX	**2.1**(2)	**3.0**(1)	**2.2**(0.4)	**1.9**(0.8)	**1.6**(0.5)	**1.6**(0.7)	15/15
DEctpb	3.5(3)	6.0(3)	6.3(3)	8.9(2)	8.9(1)	9.3(2)	15/15
IPOPsaACM	**2.6**(2)	3.3(2)	4.2(4)	3.8(2)	3.9(2)	3.9(1)	15/15
JADEb	**2.4**(3)	**3.0**(2)	3.2(2)	3.8(1)	4.3(1)	4.4(1)	15/15
JADEctpb	**1.7**(1)	3.6(2)	3.4(2)	4.5(1)	4.9(0.9)	5.1(0.6)	15/15
MVDE	**1.9**(2)	8.6(8)	12(5)	22(9)	28(6)	30(8)	15/15
NBIPOPaCMA	**2.8**(4)	3.8(3)	3.5(2)	3.9(1)	4.0(1)	4.0(0.8)	15/15
NIPOPaCMA	4.0(4)	3.9(3)	3.2(2)	3.8(0.9)	3.9(0.6)	3.9(0.4)	15/15
PSO-BFGS	3.2(3)	3.8(1)	**2.7**(0.7)	**2.1**(0.5)	**1.7**(0.3)	**1.6**(0.4)	15/15
SNES	**2.6**(3)	3.3(2)	3.4(2)	4.8(2)	5.0(1)	5.3(1)	15/15
xNES	5.2(4)	4.6(2)	4.5(4)	5.8(3)	5.5(4)	5.2(3)	15/15
xNESas	5.6(6)	6.2(4)	14(2)	11(3)	9.3(2)	8.5(2)	15/15

Table 8: 02-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-3	1e-5	1e-7	#succ
f7	3.2	21	60	217	217	241	15/15
ACOR	4.7(5)	4.1(4)	3.7(2)	**2.0**(1)	**2.0**(1)	**2.5**(2)	15/15
BIPOPaCMA	6.2(6)	5.5(6)	3.2(2)	**1.9**(1)	**1.9**(1)	**1.9**(1)	15/15
BIPOPsaACM	4.4(4)	**2.8**(3)	**2.5**(2)	**1.2**(1.0)	**1.2**(1.0)	**1.2**(0.9)	15/15
CMA	**3.2**(2)	**2.2**(3)	**1.7**(2)	**1.4**(1)	**1.4**(1)	**1.8**(2)	15/15
CMAES	5.2(5)	**2.7**(4)	**2.5**(2)	**1.6**(3)	**1.6**(3)	**2.2**(2)	15/15
CMAa	5.0(6)	**2.6**(2)	**2.1**(2)	**1.3**(0.9)	**1.3**(0.9)	**1.3**(0.8)	15/15
CMAm	5.3(9)	3.6(5)	**2.1**(2)	**1.1**(1)	**1.1**(1)	**1.2**(1)	15/15
CMAma	6.4(8)	3.6(3)	3.1(3)	**1.2**(1)	**1.2**(1)	**1.4**(1.0)	15/15
CMAmah	**3.2**(3)	**2.0**(2)	**2.7**(3)	**1.7**(1)	**1.7**(1)	**1.9**(1)	15/15
CMAmh	**2.5**(2)	**2.3**(3)	4.5(4)	**1.7**(1)	**1.7**(1)	**2.0**(2)	15/15
DBRCGA	4.3(4)	3.1(3)	**2.9**(3)	**2.9**(2)	**2.9**(2)	3.7(4)	15/15
DE	5.2(7)	**2.9**(3)	**2.9**(1)	**1.7**(1)	**1.7**(1)	**1.9**(1)	15/15
DE-AUTO	**3.1**(4)	4.4(10)	12(13)	9.3(7)	9.3(7)	8.4(7)	15/15
DE-BFGS	3.4(3)	11(4)	5.9(2)	**2.3**(0.8)	**2.3**(0.8)	5.4(5)	15/15
DE-ROLL	5.1(7)	6.9(7)	6.5(8)	3.7(3)	3.7(3)	4.1(3)	15/15
DE-SIMPLEX	4.7(5)	**2.6**(2)	**2.2**(1)	**1.1**(1.0)	**1.1**(1.0)	**1.2**(0.9)	15/15
DEctpb	8.6(10)	3.7(3)	3.4(1.0)	**1.7**(0.8)	**1.7**(0.8)	**2.1**(0.9)	15/15
IPOPsaACM	4.5(3)	5.0(6)	3.7(3)	**1.3**(0.8)	**1.3**(0.8)	**1.6**(0.8)	15/15
JADEb	**2.5**(3)	**1.8**(2)	4.1(0.6)	34(6)	34(6)	31(5)	14/15
JADEctpb	5.8(8)	**2.6**(2)	**2.0**(1.0)	**0.97**(0.2)	**0.97**(0.2)	**1.1**(0.3)	15/15
MVDE	6.2(5)	4.2(4)	5.6(4)	4.0(2)	4.0(2)	5.1(2)	15/15
NBIPOPaCMA	5.9(3)	3.5(3)	3.2(3)	**1.7**(1)	**1.7**(1)	**1.8**(2)	15/15
NIPOPaCMA	4.5(5)	**3.0**(3)	3.6(3)	**1.6**(1)	**1.6**(1)	**1.6**(1)	15/15
PSO-BFGS	18(28)	53(111)	78(102)	27(29)	27(29)	90(116)	12/15
SNES	6.5(6)	33(93)	21(34)	11(19)	11(19)	22(36)	13/15
xNES	48(7)	39(49)	28(33)	12(16)	12(16)	11(17)	15/15
xNESas	5.1(4)	37(94)	25(34)	7.4(9)	7.4(9)	7.8(8)	15/15

Table 9: 02-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-3	1e-5	1e-7	#succ
f8	5.4	12	37	86	94	112	15/15
ACOR	6.0(6)	12(8)	12(3)	17(4)	32(7)	39(6)	15/15
BIPOPaCMA	4.3(3)	8.9(8)	8.1(5)	5.2(2)	5.6(2)	5.2(2)	15/15
BIPOPsaACM	4.8(5)	**6.2**(8)	**3.9**(3)	**2.5**(1)	**2.6**(1)	**2.4**(1)	15/15
CMA	6.2(6)	12(17)	7.5(7)	5.4(3)	5.8(3)	5.4(2)	15/15
CMAES	6.6(6)	12(19)	10(6)	6.1(4)	6.5(3)	6.0(2)	15/15
CMAa	7.0(3)	13(14)	8.2(9)	5.1(4)	5.5(3)	5.2(3)	15/15
CMAm	4.8(4)	8.0(12)	10(8)	6.1(3)	6.5(3)	5.9(2)	15/15
CMAma	6.7(7)	8.4(10)	5.7(6)	4.4(3)	4.7(3)	4.5(2)	15/15
CMAmah	**3.7**(4)	**6.4**(10)	7.3(6)	5.3(2)	5.4(2)	5.1(2)	15/15
CMAmh	4.1(3)	14(22)	9.5(11)	7.1(4)	7.3(4)	6.6(3)	15/15
DBRCGA	4.4(4)	7.1(5)	13(22)	15(14)	18(15)	19(14)	15/15
DE	6.9(6)	9.5(8)	7.4(4)	6.2(2)	8.7(3)	9.4(3)	15/15
DE-AUTO	5.4(5)	**6.5**(4)	**3.0**(1)	**1.6**(0.5)	**1.5**(0.5)	**1.3**(0.4)	15/15
DE-BFGS	5.4(6)	8.6(3)	**3.7**(0.9)	**1.8**(0.4)	**1.7**(0.3)	**1.5**(0.3)	15/15
DE-ROLL	30(5)	49(86)	105(143)	208(116)	312(117)	1189(1102)	6/15
DE-SIMPLEX	5.0(5)	**6.3**(6)	**3.3**(2)	**1.7**(0.7)	**1.7**(0.6)	**1.5**(0.5)	15/15
DEctpb	11(13)	18(22)	12(12)	8.7(7)	12(5)	13(4)	15/15
IPOPsaACM	5.7(5)	11(14)	6.5(6)	3.8(2)	3.8(2)	3.4(2)	15/15
JADEb	4.8(4)	11(16)	7.9(8)	5.4(4)	6.0(3)	6.1(3)	15/15
JADEctpb	**3.9**(4)	7.0(6)	6.8(5)	6.0(3)	7.1(3)	7.2(2)	15/15
MVDE	9.2(7)	20(13)	20(20)	22(8)	32(10)	36(9)	15/15
NBIPOPaCMA	**4.0**(4)	11(13)	7.7(7)	5.2(3)	5.5(3)	5.1(3)	15/15
NIPOPaCMA	5.0(4)	10(8)	7.6(7)	5.2(3)	5.4(2)	5.0(2)	15/15
PSO-BFGS	8.1(6)	10(2)	4.1(0.9)	**2.0**(0.4)	**1.9**(0.3)	**1.6**(0.3)	15/15
SNES	6.4(5)	881(1273)	578(1260)	728(704)	1282(1071)	1523(919)	13/15
xNES	6.4(7)	15(18)	21(14)	13(10)	13(10)	12(8)	15/15
xNESas	**3.7**(3)	17(20)	17(32)	10(14)	11(14)	10(12)	15/15

Table 10: 02-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-3	1e-5	1e-7	#succ
f9	1	18	30	68	81	92	15/15
ACOR	28(18)	5.0(4)	7.8(5)	12(8)	21(12)	26(18)	15/15
BIPOPaCMA	28(30)	**3.3**(2)	7.1(4)	5.3(2)	5.3(1)	5.4(1)	15/15
BIPOPsaACM	19(14)	6.0(6)	7.5(5)	4.6(3)	4.2(2)	3.9(2)	15/15
CMA	40(24)	7.9(5)	11(8)	7.6(4)	7.4(3)	7.2(2)	15/15
CMAES	21(20)	5.8(10)	9.0(8)	6.6(4)	6.6(3)	6.5(3)	15/15
CMAa	26(28)	6.9(9)	10(8)	6.8(3)	6.5(3)	6.3(3)	15/15
CMAm	25(20)	6.6(11)	10(10)	6.9(5)	6.7(4)	6.4(3)	15/15
CMAma	**19**(21)	5.0(5)	8.4(8)	5.8(4)	5.6(3)	5.5(2)	15/15
CMAmah	39(24)	5.7(2)	8.8(6)	6.4(2)	6.2(2)	6.2(2)	15/15
CMAmh	44(15)	10(15)	13(11)	9.3(5)	8.6(4)	8.2(4)	15/15
DBRCGA	31(28)	6.2(4)	12(12)	18(15)	18(12)	18(13)	15/15
DE	45(42)	7.7(6)	10(7)	8.4(6)	10(3)	12(3)	15/15
DE-AUTO	35(27)	5.9(2)	**4.8**(2)	**2.5**(0.7)	**2.1**(0.6)	**1.9**(0.5)	15/15
DE-BFGS	22(28)	4.9(2)	**3.8**(2)	**2.1**(0.7)	**1.9**(0.6)	**1.7**(0.5)	15/15
DE-ROLL	23(23)	33(66)	95(135)	207(150)	295(171)	1536(1712)	9/15
DE-SIMPLEX	37(21)	**4.1**(2)	**3.4**(2)	**1.9**(0.8)	**1.8**(0.7)	**1.7**(0.6)	15/15
DEctpb	38(27)	8.6(6)	15(8)	12(5)	14(5)	16(4)	15/15
IPOPsaACM	**19**(20)	6.4(7)	7.8(6)	4.6(3)	4.2(2)	3.8(2)	15/15
JADEb	26(27)	5.6(8)	8.3(11)	6.2(5)	6.3(4)	6.4(3)	15/15
JADEctpb	31(21)	**4.0**(2)	6.3(3)	5.7(2)	6.8(2)	7.3(1)	15/15
MVDE	30(41)	11(8)	22(13)	28(14)	37(15)	44(16)	15/15
NBIPOPaCMA	25(25)	7.2(7)	9.0(7)	6.6(3)	6.4(3)	6.1(3)	15/15
NIPOPaCMA	27(14)	6.7(11)	8.8(8)	5.9(3)	5.9(3)	5.8(3)	15/15
PSO-BFGS	42(30)	**4.3**(2)	**3.6**(1)	**2.0**(0.4)	**1.8**(0.3)	**1.6**(0.3)	15/15
SNES	**16**(15)	14(18)	175(126)	445(430)	735(787)	1047(1004)	13/15
xNES	**18**(16)	10(14)	16(17)	16(21)	15(23)	14(20)	15/15
xNESas	27(31)	4.7(5)	14(20)	12(17)	11(15)	10(13)	15/15

Table 11: 02-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-3	1e-5	1e-7	#succ
f10	30	46	54	68	82	98	15/15
ACOR	79(126)	140(185)	282(346)	554(395)	761(519)	875(633)	15/15
BIPOPaCMA	7.0(6)	6.6(3)	6.6(2)	6.0(1)	5.7(1)	5.4(0.9)	15/15
BIPOPsaACM	3.6(1)	**2.6**(0.7)	**2.4**(0.6)	**2.3**(0.5)	**2.2**(0.3)	**2.0**(0.3)	15/15
CMA	8.8(7)	8.2(3)	7.9(2)	7.2(1)	6.8(1)	6.3(1)	15/15
CMAES	10(6)	8.1(3)	7.6(2)	7.3(2)	6.9(1)	6.5(1)	15/15
CMAa	5.9(5)	5.8(3)	6.2(2)	5.9(1)	5.6(1)	5.4(0.8)	15/15
CMAm	7.1(6)	7.3(4)	8.3(2)	7.6(1)	7.1(1)	6.4(0.9)	15/15
CMAma	6.4(4)	6.2(3)	6.3(1)	5.7(1)	5.5(0.9)	5.0(1)	15/15
CMAmah	10(8)	10(2)	9.1(2)	8.2(2)	7.4(1)	6.7(1)	15/15
CMAmh	13(10)	11(7)	12(1)	10(2)	9.3(1)	8.5(1.0)	15/15
DBRCGA	7.8(3)	17(16)	23(32)	28(25)	27(21)	28(18)	15/15
DE	11(9)	11(6)	12(4)	15(6)	16(5)	17(4)	15/15
DE-AUTO	**2.3**(0.1)	**1.6**(0.1)	**1.4**(0.1)	**1.2**(0.2)	**1.1**(0.1)	**1.9**(0.2)	15/15
DE-BFGS	**2.3**(0.3)	**1.6**(0.2)	**1.4**(0.2)	**1.2**(0.3)	**1.1**(0.3)	**1.1**(0.4)	15/15
DE-ROLL	29(34)	83(102)	235(150)	341(207)	440(136)	1265(666)	5/15
DE-SIMPLEX	**2.8**(0.7)	**2.1**(0.4)	**1.9**(0.4)	**1.7**(0.2)	**1.7**(0.2)	**1.5**(0.1)	15/15
DEctpb	11(8)	11(4)	12(3)	13(3)	15(3)	16(2)	15/15
IPOPsaACM	3.3(1)	**2.6**(1)	**2.9**(1)	**2.7**(0.9)	**2.5**(0.7)	**2.4**(0.6)	15/15
JADEb	5.8(3)	6.8(6)	7.5(5)	8.0(4)	7.9(3)	7.4(3)	15/15
JADEctpb	4.9(3)	5.4(3)	5.7(2)	6.7(2)	7.2(1)	7.4(1)	15/15
MVDE	21(18)	27(13)	33(13)	44(5)	53(9)	56(8)	15/15
NBIPOPaCMA	6.4(5)	5.6(4)	5.7(2)	5.5(1)	5.4(0.9)	5.3(1.0)	15/15
NIPOPaCMA	7.7(6)	7.0(3)	7.0(2)	6.4(0.8)	6.2(1)	5.8(0.8)	15/15
PSO-BFGS	**2.4**(0.4)	**1.6**(0.2)	**1.4**(0.2)	**1.2**(0.3)	**1.1**(0.3)	**1.2**(0.6)	15/15
SNES	275(68)	365(243)	1554(1472)	1.4e4(1e4)	∞	∞ *2e5*	0/15
xNES	5.8(3)	5.7(2)	5.6(2)	6.1(1)	5.9(1)	5.8(0.9)	15/15
xNESas	3.5(2)	4.8(2)	5.0(1)	5.7(4)	8.3(3)	7.7(3)	15/15

Table 12: 02-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-3	1e-5	1e-7	#succ
f11	35	45	50	67	81	97	15/15
ACOR	82(102)	196(216)	317(296)	600(472)	806(445)	882(502)	15/15
BIPOPaCMA	6.6(4)	6.5(3)	7.2(1)	6.3(1.0)	5.9(0.8)	5.5(0.8)	15/15
BIPOPsaACM	**2.6**(0.8)	**2.5**(0.5)	**2.5**(0.3)	**2.2**(0.3)	**2.0**(0.2)	**1.9**(0.2)	15/15
CMA	7.2(6)	9.2(3)	9.1(2)	7.7(1)	7.1(1)	6.4(1)	15/15
CMAES	6.7(6)	7.8(3)	8.3(2)	7.4(1)	6.9(0.6)	6.5(0.7)	15/15
CMAa	4.3(3)	5.9(3)	6.8(0.9)	6.1(0.8)	5.9(0.8)	5.6(0.6)	15/15
CMAm	7.2(6)	8.6(5)	8.8(2)	7.6(2)	6.8(1)	6.3(1)	15/15
CMAma	4.5(4)	6.7(3)	6.8(2)	5.8(1)	5.4(1)	5.1(0.9)	15/15
CMAmah	8.2(6)	9.3(5)	10(2)	8.5(1)	7.6(1)	6.9(0.9)	15/15
CMAmh	7.1(8)	8.8(7)	12(2)	11(1)	9.4(0.8)	8.4(0.7)	15/15
DBRCGA	7.9(4)	10(11)	13(11)	15(8)	17(8)	20(9)	15/15
DE	7.1(3)	9.4(4)	11(4)	13(7)	15(6)	15(4)	15/15
DE-AUTO	**2.0**(0.2)	**1.6**(0.2)	**1.5**(0.2)	**1.2**(0.1)	**1.1**(0.1)	**1.4**(0.2)	15/15
DE-BFGS	**1.9**(0.2)	**1.5**(0.1)	**1.4**(0.1)	**1.1**(0.1)	**1.0**(0.1)	**0.92**(0.1)	15/15
DE-ROLL	193(317)	207(316)	310(264)	414(253)	482(311)	1584(1643)	7/15
DE-SIMPLEX	**2.4**(0.6)	**2.2**(0.5)	**2.1**(0.3)	**1.8**(0.2)	**1.7**(0.2)	**1.6**(0.1)	15/15
DEctpb	8.5(4)	9.5(3)	12(4)	13(2)	15(2)	15(2)	15/15
IPOPsaACM	**2.8**(1)	**2.9**(0.8)	**2.9**(0.9)	**2.5**(0.6)	**2.2**(0.5)	**2.2**(0.5)	15/15
JADEb	4.6(4)	7.2(6)	7.8(6)	7.4(5)	7.5(4)	7.5(3)	15/15
JADEctpb	4.3(2)	5.4(2)	6.1(1)	6.5(1)	7.0(1)	6.9(1)	15/15
MVDE	16(12)	28(15)	34(12)	41(7)	49(9)	53(10)	15/15
NBIPOPaCMA	5.7(5)	6.7(4)	7.1(2)	6.3(1)	5.9(1)	5.4(1)	15/15
NIPOPaCMA	5.2(4)	6.8(3)	6.7(3)	6.2(2)	5.8(1)	5.4(1)	15/15
PSO-BFGS	**1.9**(0.2)	**1.6**(0.1)	**1.5**(0.1)	**1.2**(0.1)	**1.1**(0.1)	**1.0**(0.1)	15/15
SNES	28(29)	808(1635)	1470(1816)	5275(5526)	1.7e4(2e4)	2.9e4(4e4)	1/15
xNES	4.7(4)	6.3(5)	7.1(4)	6.5(3)	6.5(3)	6.3(2)	15/15
xNESas	6.6(7)	6.9(6)	7.5(5)	7.4(3)	7.3(3)	6.9(3)	15/15

Table 13: 02-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-3	1e-5	1e-7	#succ
f12	35	46	75	105	153	195	15/15
ACOR	12(4)	47(84)	54(106)	140(256)	177(312)	184(277)	15/15
BIPOPaCMA	4.7(4)	6.7(5)	6.9(5)	7.2(7)	6.4(7)	6.0(6)	15/15
BIPOPsaACM	**3.1**(1)	**3.2**(2)	6.2(1)	6.2(7)	5.1(5)	4.3(4)	15/15
CMA	9.0(9)	15(16)	15(16)	14(16)	11(13)	10(12)	15/15
CMAES	7.1(4)	6.9(3)	5.4(3)	5.6(1)	4.9(1.0)	4.6(1)	15/15
CMAa	4.9(4)	12(19)	11(18)	11(15)	10(12)	8.5(11)	15/15
CMAm	4.8(5)	7.1(4)	7.8(4)	7.5(5)	7.3(7)	6.9(7)	15/15
CMAma	7.6(8)	12(18)	10(14)	9.3(12)	7.6(9)	6.8(8)	15/15
CMAmah	13(15)	21(23)	17(19)	15(17)	12(14)	11(13)	15/15
CMAmh	10(8)	11(7)	8.8(4)	8.6(2)	7.7(5)	7.2(7)	15/15
DBRCGA	5.6(3)	30(11)	33(28)	41(44)	41(57)	39(54)	15/15
DE	10(8)	18(28)	19(30)	21(32)	19(25)	18(21)	15/15
DE-AUTO	**1.7**(0.7)	**1.6**(0.3)	**1.2**(0.3)	**1.1**(0.7)	**1.1**(0.9)	**1.0**(1.0)	15/15
DE-BFGS	**1.9**(0.4)	**1.8**(0.3)	**1.4**(0.8)	**1.3**(0.9)	**1.1**(0.8)	**1.0**(0.7)	15/15
DE-ROLL	16(31)	47(65)	48(65)	68(80)	110(124)	311(504)	12/15
DE-SIMPLEX	**2.4**(0.6)	**3.0**(2)	**2.6**(3)	**2.5**(3)	**2.1**(2)	**1.9**(2)	15/15
DEctpb	16(5)	24(7)	22(13)	25(17)	23(18)	23(16)	15/15
IPOPsaACM	5.1(4)	6.1(6)	4.7(5)	4.2(4)	3.4(3)	3.2(3)	15/15
JADEb	12(21)	19(37)	19(34)	20(30)	16(23)	15(19)	15/15
JADEctpb	5.2(3)	5.9(2)	5.0(2)	7.5(5)	7.9(5)	7.6(6)	15/15
MVDE	17(12)	29(18)	25(18)	713(21)	506(38)	409(55)	14/15
NBIPOPaCMA	5.8(4)	7.7(3)	5.6(2)	5.0(1)	4.1(1)	3.6(0.9)	15/15
NIPOPaCMA	9.3(5)	13(20)	11(20)	10(15)	8.6(11)	7.7(8)	15/15
PSO-BFGS	3.1(3)	4.0(5)	**3.4**(4)	**2.9**(4)	**2.4**(3)	**2.1**(3)	15/15
SNES	22(29)	128(135)	503(1041)	2206(2916)	2633(3284)	2065(2575)	5/15
xNES	5.8(5)	17(28)	24(75)	29(76)	24(56)	22(46)	15/15
xNESas	3.7(2)	9.2(12)	14(17)	19(41)	21(44)	27(51)	15/15

Table 14: 02-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-3	1e-5	1e-7	#succ
f13	23	35	46	71	95	122	15/15
ACOR	4.9(5)	16(15)	53(52)	278(267)	1.4e4(2e4)	3.3e5(4e5)	1/15
BIPOPaCMA	4.6(3)	4.9(3)	5.1(2)	5.8(2)	5.7(1)	5.5(0.9)	15/15
BIPOPsaACM	**2.4**(2)	**2.8**(1.0)	**2.9**(1)	**2.8**(1.0)	**2.7**(0.9)	**2.7**(0.7)	15/15
CMA	5.3(5)	6.1(3)	5.9(2)	6.6(2)	7.1(1)	6.7(1)	15/15
CMAES	3.9(4)	7.1(5)	7.3(3)	7.3(2)	7.7(2)	7.5(1)	15/15
CMAa	4.5(3)	5.1(3)	5.7(2)	5.6(1)	5.5(0.6)	5.4(0.7)	15/15
CMAm	7.2(6)	9.0(4)	9.1(5)	8.3(2)	8.0(2)	7.9(1)	15/15
CMAma	4.6(5)	5.0(4)	6.5(3)	6.4(2)	6.1(1)	5.9(1)	15/15
CMAmah	7.9(10)	10(6)	10(4)	9.3(3)	9.0(2)	8.4(2)	15/15
CMAmh	6.6(9)	9.2(8)	10(7)	11(7)	12(6)	13(5)	15/15
DBRCGA	4.1(2)	6.5(2)	9.4(2)	14(7)	25(24)	42(34)	15/15
DE	5.9(3)	7.4(3)	9.3(3)	20(24)	20(18)	23(16)	15/15
DE-AUTO	**2.7**(1)	**2.2**(0.2)	**1.8**(0.1)	**1.3**(0.1)	**1.1**(0.1)	**1.6**(2)	15/15
DE-BFGS	**2.8**(0.3)	**2.0**(0.2)	**1.7**(0.2)	**1.3**(0.2)	**1.1**(0.1)	**1.4**(1)	15/15
DE-ROLL	10(11)	30(31)	43(29)	54(24)	57(18)	175(116)	14/15
DE-SIMPLEX	**2.2**(1)	**2.3**(0.6)	**2.1**(0.5)	**1.7**(0.3)	**1.5**(0.3)	**1.4**(0.2)	15/15
DEctpb	4.4(5)	8.5(3)	11(2)	14(2)	15(3)	15(3)	15/15
IPOPsaACM	**2.9**(1)	**2.9**(0.9)	3.3(1)	**2.8**(0.9)	**2.7**(0.5)	**2.5**(0.6)	15/15
JADEb	3.7(2)	4.8(4)	5.3(4)	6.3(3)	8.3(6)	9.1(6)	15/15
JADEctpb	**2.7**(1)	4.2(2)	5.2(2)	6.5(0.9)	7.0(1.0)	6.8(0.7)	15/15
MVDE	7.9(6)	19(6)	26(13)	43(9)	49(13)	55(9)	15/15
NBIPOPaCMA	3.8(2)	4.5(2)	4.6(2)	5.7(1)	5.7(1)	5.4(0.9)	15/15
NIPOPaCMA	3.9(5)	5.4(3)	5.8(3)	5.4(1)	5.8(1.0)	5.6(0.7)	15/15
PSO-BFGS	3.0(0.2)	**2.2**(0.3)	**1.9**(0.3)	**1.4**(0.2)	**1.2**(0.3)	**1.3**(0.6)	15/15
SNES	21(46)	71(196)	320(456)	1602(1271)	5289(5788)	2.4e4(2e4)	0/15
xNES	7.6(4)	7.4(8)	7.3(5)	7.1(3)	6.9(4)	6.6(3)	15/15
xNESas	3.5(2)	4.6(2)	5.6(4)	6.8(5)	7.1(4)	8.5(3)	15/15

Table 15: 02-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-3	1e-5	1e-7	#succ
f14	1.4	7.4	16	38	67	90	15/15
ACOR	**0.95**(0.4)	**2.6**(3)	6.9(2)	10(2)	49(50)	868(885)	15/15
BIPOPaCMA	**2.6**(5)	**2.2**(2)	3.1(2)	4.3(2)	5.3(0.9)	5.6(1)	15/15
BIPOPsaACM	**2.1**(3)	**2.8**(3)	3.1(2)	3.5(0.8)	**2.7**(0.7)	**3.0**(0.9)	15/15
CMA	**2.3**(5)	3.6(3)	3.6(2)	4.9(2)	6.3(2)	6.7(1)	15/15
CMAES	**2.1**(2)	**2.5**(3)	3.5(2)	4.7(2)	6.4(2)	7.5(1)	15/15
CMAa	3.1(2)	3.5(2)	4.0(2)	4.8(2)	5.4(1)	5.7(2)	15/15
CMAm	**2.5**(2)	**2.9**(4)	3.2(2)	4.1(2)	5.9(2)	7.2(1)	15/15
CMAma	**2.1**(3)	3.2(2)	4.2(2)	5.5(2)	5.5(1)	6.1(0.8)	15/15
CMAmah	**2.0**(2)	**1.7**(2)	**2.3**(0.9)	4.2(2)	6.4(1)	8.0(0.8)	15/15
CMAmh	**2.0**(2)	**2.4**(2)	**2.7**(1)	5.8(3)	8.9(3)	10(4)	15/15
DBRCGA	**1.2**(0.4)	**3.0**(3)	6.7(5)	8.8(2)	12(6)	21(15)	15/15
DE	**1.5**(1)	**2.9**(3)	5.0(4)	9.1(2)	10(4)	12(3)	15/15
DE-AUTO	**1.7**(1)	3.7(4)	3.4(1)	**2.0**(0.3)	**1.4**(0.2)	6.1(5)	15/15
DE-BFGS	**2.3**(2)	**2.9**(2)	3.7(0.3)	**2.0**(0.2)	**1.4**(0.1)	**2.7**(3)	15/15
DE-ROLL	**1.3**(1)	**2.7**(2)	5.2(2)	59(79)	147(97)	445(669)	14/15
DE-SIMPLEX	**1.1**(0.7)	3.8(3)	3.7(0.3)	**2.3**(0.3)	**1.7**(0.3)	**1.5**(0.2)	15/15
DEctpb	**1.9**(1)	4.0(3)	7.3(4)	9.1(3)	11(3)	12(3)	15/15
IPOPsaACM	5.0(7)	4.7(4)	3.5(2)	3.8(1)	3.1(0.9)	**3.0**(0.7)	15/15
JADEb	**2.5**(2)	4.3(4)	3.8(1)	5.0(2)	5.1(1)	6.0(3)	15/15
JADEctpb	**2.0**(2)	**2.2**(2)	4.1(2)	5.6(2)	6.2(2)	6.7(2)	15/15
MVDE	**1.6**(1)	4.9(4)	13(5)	21(6)	31(7)	41(12)	15/15
NBIPOPaCMA	3.0(3)	**2.3**(2)	3.3(3)	4.5(2)	5.6(0.9)	6.1(1.0)	15/15
NIPOPaCMA	**2.6**(3)	**2.9**(3)	3.1(3)	4.7(2)	5.0(0.9)	5.6(1)	15/15
PSO-BFGS	**1.8**(1)	4.6(4)	4.0(0.4)	**2.2**(0.2)	**1.5**(0.1)	13(1)	15/15
SNES	4.1(6)	3.3(4)	**2.9**(2)	19(25)	1962(1526)	7540(6895)	1/15
xNES	3.8(6)	3.3(2)	3.7(2)	5.8(3)	5.8(2)	6.2(2)	15/15
xNESas	**1.3**(1)	**2.3**(4)	**2.6**(2)	4.6(1)	5.1(1)	5.3(2)	15/15

Table 16: 02-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-3	1e-5	1e-7	#succ
f15	37	291	1033	1113	1231	1412	15/15
ACOR	**2.1**(2)	**2.3**(1)	11(26)	11(24)	10(22)	9.0(19)	15/15
BIPOPaCMA	**1.3**(1)	**1.8**(2)	**2.7**(2)	**2.6**(2)	**2.5**(2)	**2.2**(2)	15/15
BIPOPsaACM	**2.4**(5)	**2.0**(1)	**2.8**(3)	**2.7**(3)	**2.5**(2)	**2.2**(2)	15/15
CMA	**0.93**(0.7)	**2.5**(4)	**2.9**(1)	**2.9**(1)	**2.8**(1)	**2.5**(1)	15/15
CMAES	**1.1**(1.0)	**2.6**(3)	3.8(4)	3.6(4)	3.3(4)	**2.9**(3)	15/15
CMAa	**1.4**(0.8)	**2.0**(2)	**2.0**(3)	**2.0**(3)	**1.9**(3)	**1.7**(2)	15/15
CMAm	**1.2**(1.0)	**1.8**(1)	**1.9**(2)	**2.4**(2)	**2.3**(2)	**2.1**(2)	15/15
CMAma	**1.3**(1.0)	3.1(4)	**2.4**(2)	**2.6**(2)	**2.5**(2)	**2.2**(2)	15/15
CMAmah	**1.2**(1)	**2.9**(4)	**2.7**(2)	**2.7**(2)	**2.6**(2)	**2.4**(2)	15/15
CMAmh	**2.6**(7)	3.8(4)	**2.6**(2)	**2.7**(2)	**2.6**(2)	**2.4**(2)	15/15
DBRCGA	**1.8**(2)	**2.4**(3)	**1.8**(2)	**1.8**(2)	**1.8**(2)	**1.6**(1)	15/15
DE	**2.5**(2)	**1.9**(1)	**1.8**(3)	**1.9**(3)	**1.8**(2)	**1.7**(2)	15/15
DE-AUTO	7.4(12)	10(9)	6.9(6)	6.4(6)	5.8(5)	5.1(4)	15/15
DE-BFGS	**1.4**(0.7)	**0.71**(0.7)	**0.46**(0.4)	**0.44**(0.4)	**0.41**(0.4)	**0.36**(0.3)$_{\downarrow}$	15/15
DE-ROLL	3.4(1.0)	4.5(7)	7.3(6)	6.9(6)	6.3(5)	5.6(5)	15/15
DE-SIMPLEX	**2.7**(5)	**1.7**(1)	**2.8**(4)	**2.6**(3)	**2.4**(3)	**2.1**(3)	15/15
DEctpb	**2.3**(2)	**2.6**(1)	**1.2**(0.7)	**1.6**(0.4)	**1.7**(0.7)	**1.7**(0.5)	15/15
IPOPsaACM	**1.3**(1)	**2.6**(3)	**1.4**(1)	**1.8**(2)	**1.7**(2)	**1.5**(2)	15/15
JADEb	**1.3**(0.9)	3.4(4)	3.4(3)	3.3(3)	3.0(3)	**2.7**(2)	15/15
JADEctpb	**1.1**(0.7)	**1.4**(0.5)	**0.95**(0.8)	**1.1**(0.8)	**1.1**(0.7)	**1.1**(0.6)	15/15
MVDE	**2.7**(2)	4.9(2)	244(484)	227(450)	206(407)	180(355)	12/15
NBIPOPaCMA	**1.4**(0.9)	**2.6**(4)	**2.8**(4)	3.0(4)	**2.8**(3)	**2.6**(3)	15/15
NIPOPaCMA	**1.7**(1)	3.7(3)	**2.8**(3)	**2.9**(3)	**2.7**(3)	**2.5**(3)	15/15
PSO-BFGS	**2.0**(1)	**2.8**(2)	**2.0**(2)	**1.9**(2)	**1.7**(1)	**1.5**(1)	15/15
SNES	**1.5**(2)	5.9(7)	10(13)	10(12)	8.9(11)	7.8(9)	15/15
xNES	13(28)	9.5(10)	15(17)	17(20)	15(18)	13(16)	15/15
xNESas	**0.81**(0.7)	4.0(4)	4.4(4)	4.4(4)	4.0(3)	3.6(3)	15/15

Table 17: 02-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-3	1e-5	1e-7	#succ
f16	9.1	50	174	358	409	538	15/15
ACOR	**2.7**(4)	4.6(4)	5.1(5)	36(29)	43(26)	33(20)	15/15
BIPOPaCMA	**1.4**(2)	**2.6**(0.9)	**2.8**(3)	**2.8**(2)	**2.7**(2)	**2.2**(1)	15/15
BIPOPsaACM	3.2(2)	4.4(7)	5.1(3)	4.4(5)	4.7(4)	3.8(3)	15/15
CMA	5.1(8)	8.5(13)	4.2(4)	3.5(3)	3.3(3)	**2.6**(2)	15/15
CMAES	4.6(7)	7.4(11)	**3.6**(6)	**2.6**(3)	**2.4**(2)	**1.9**(2)	15/15
CMAa	4.6(4)	11(13)	6.3(8)	3.8(4)	4.0(4)	3.2(3)	15/15
CMAm	**2.4**(2)	5.8(9)	4.5(7)	3.4(4)	3.5(3)	**2.8**(3)	15/15
CMAma	8.8(9)	10(10)	4.4(3)	4.2(3)	4.1(3)	3.3(2)	15/15
CMAmah	3.9(4)	6.5(11)	5.6(8)	11(6)	10(5)	8.2(4)	15/15
CMAmh	10(4)	13(11)	6.9(6)	4.6(4)	4.6(4)	3.7(3)	15/15
DBRCGA	**2.3**(3)	**2.4**(3)	5.4(7)	6.2(6)	8.4(9)	6.7(7)	15/15
DE	4.0(4)	4.8(4)	5.4(7)	3.5(4)	3.5(3)	3.4(3)	15/15
DE-AUTO	3.2(3)	33(53)	31(39)	25(32)	38(33)	34(63)	15/15
DE-BFGS	**2.6**(1)	6.1(10)	4.5(4)	5.4(2)	6.5(1)	14(8)	14/15
DE-ROLL	3.2(3)	26(35)	32(45)	41(39)	47(49)	115(194)	12/15
DE-SIMPLEX	**1.3**(1)	5.4(7)	**2.8**(4)	**2.1**(2)	**2.2**(2)	**1.8**(2)	15/15
DEctpb	3.4(3)	3.8(3)	5.1(3)	13(8)	19(7)	16(6)	15/15
IPOPsaACM	3.8(6)	6.6(8)	4.3(4)	**3.0**(3)	3.1(2)	**2.9**(2)	15/15
JADEb	**2.1**(3)	4.3(4)	**2.7**(5)	**2.0**(2)	**2.0**(2)	**1.7**(2)	15/15
JADEctpb	**2.8**(2)	**3.8**(3)	3.8(2)	**2.8**(2)	3.2(2)	**2.8**(1)	15/15
MVDE	**2.4**(2)	**2.4**(2)	6.1(6)	207(4)	183(4)	141(3)	14/15
NBIPOPaCMA	3.3(3)	6.8(11)	4.0(6)	3.5(4)	3.3(4)	**2.6**(3)	15/15
NIPOPaCMA	3.3(4)	6.2(8)	4.0(5)	**2.5**(3)	**2.4**(3)	**2.0**(2)	15/15
PSO-BFGS	5.2(7)	9.4(12)	7.7(8)	14(13)	22(29)	106(131)	12/15
SNES	**1.8**(2)	5.1(5)	4.7(7)	6.7(8)	12(19)	12(20)	14/15
xNES	3.4(4)	13(23)	6.5(12)	5.4(6)	5.0(5)	3.9(4)	15/15
xNESas	3.1(4)	5.4(11)	3.8(4)	3.7(4)	4.4(6)	4.6(5)	15/15

Table 18: 02-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-3	1e-5	1e-7	#succ
f17	2.7	61	133	396	1086	1657	15/15
ACOR	**1.4**(1)	**0.94**(0.8)	**2.1**(0.7)	**1.8**(0.3)	**1.1**(0.2)	**0.98**(0.2)	15/15
BIPOPaCMA	19(14)	3.4(5)	**2.8**(3)	**1.6**(1)	**1.6**(1)	**1.4**(0.8)	15/15
BIPOPsaACM	3.2(4)	**1.2**(0.7)	**2.1**(2)	**2.2**(1)	**2.4**(1)	**1.7**(1)	15/15
CMA	3.4(3)	**1.8**(1)	**1.9**(3)	**2.1**(1)	**1.6**(1)	**1.3**(0.6)	15/15
CMAES	**2.4**(2)	**1.5**(1)	**2.3**(3)	**2.0**(4)	**2.9**(3)	**2.7**(3)	15/15
CMAa	**2.0**(3)	**0.78**(0.6)	**1.7**(2)	**1.7**(1)	**1.4**(0.6)	**1.1**(0.5)	15/15
CMAm	4.3(5)	**1.4**(1)	**3.0**(3)	**1.7**(1)	**1.3**(0.9)	**0.99**(0.7)	15/15
CMAma	**1.9**(2)	**1.3**(0.6)	**1.6**(2)	**1.3**(0.9)	**1.1**(0.9)	**0.82**(0.7)	15/15
CMAmah	**2.1**(2)	3.9(5)	**2.8**(4)	**2.0**(2)	**1.7**(1)	**1.3**(0.8)	15/15
CMAmh	3.6(3)	5.2(9)	3.1(4)	**2.3**(2)	**1.8**(1)	**1.6**(0.8)	15/15
DBRCGA	**1.7**(2)	**2.1**(1)	**2.6**(1)	3.2(4)	5.0(7)	3.5(4)	15/15
DE	3.0(4)	**1.5**(1)	3.1(0.9)	**2.5**(0.5)	**2.1**(2)	**1.6**(1)	15/15
DE-AUTO	**1.4**(1)	7.0(9)	9.0(11)	10(12)	7.6(5)	5.0(3)	15/15
DE-BFGS	**2.0**(2)	**2.2**(2)	3.9(2)	4.1(0.8)	**2.5**(0.5)	4.1(3)	15/15
DE-ROLL	**2.3**(2)	3.7(5)	6.2(4)	5.4(3)	4.4(1)	3.0(1)	15/15
DE-SIMPLEX	**1.8**(2)	6.5(6)	6.7(5)	3.9(3)	**2.1**(1)	337(423)	3/15
DEctpb	**1.8**(2)	**2.1**(1)	**2.6**(1.0)	**2.3**(0.6)	**1.6**(0.4)	**1.4**(0.4)	15/15
IPOPsaACM	4.2(8)	**1.5**(0.7)	**2.0**(2)	**2.1**(1)	**2.0**(0.9)	**1.7**(1)	15/15
JADEb	**1.7**(2)	**1.0**(0.7)	**1.0**(0.3)	19(1)	8.7(2)	5.8(2)	14/15
JADEctpb	**2.7**(2)	**1.2**(0.6)	**1.5**(0.5)	**1.3**(0.2)	**1.2**(0.8)	**0.95**(0.6)	15/15
MVDE	**1.5**(0.9)	**2.1**(2)	5.4(2)	5.7(1)	69(1.0)	47(0.9)	14/15
NBIPOPaCMA	4.2(4)	**1.7**(0.5)	**1.4**(0.4)	**1.2**(1)	**1.4**(1)	**1.1**(0.8)	15/15
NIPOPaCMA	**1.9**(2)	**1.7**(0.8)	**1.4**(0.5)	**1.4**(1)	**1.2**(0.6)	**1.1**(0.9)	15/15
PSO-BFGS	**1.7**(1)	10(8)	12(7)	9.0(3)	5.8(1)	16(18)	12/15
SNES	7.3(15)	3.6(2)	3.4(7)	**2.5**(3)	5.9(10)	6.4(8)	15/15
xNES	12(31)	8.0(17)	6.2(8)	6.7(8)	15(23)	13(14)	15/15
xNESas	4.2(6)	7.9(17)	4.3(8)	12(20)	26(17)	25(22)	15/15

Table 19: 02-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-3	1e-5	1e-7	#succ
f18	19	134	666	1708	2438	2858	15/15
ACOR	**1.6**(2)	**2.6**(2)	**1.5**(1)	**1.9**(1)	**2.4**(1)	**3.0**(2)	15/15
BIPOPaCMA	**2.1**(2)	4.4(6)	**2.2**(3)	**1.3**(0.8)	**1.1**(0.6)	**1.2**(1)	15/15
BIPOPsaACM	3.3(2)	**1.8**(2)	**0.84**(0.7)	**0.71**(0.7)	**1.4**(1)	**1.7**(2)	15/15
CMA	**1.4**(2)	3.8(4)	**1.6**(1)	**0.84**(0.6)	**0.91**(0.4)	**0.91**(0.4)	15/15
CMAES	**1.5**(1)	5.1(7)	**2.0**(2)	**1.5**(1)	9.1(12)	10(10)	14/15
CMAa	**1.3**(1)	**2.7**(3)	**1.4**(1)	**0.93**(0.6)	**0.92**(0.4)	**0.91**(0.3)	15/15
CMAm	3.2(1)	6.4(7)	**2.1**(1)	**1.3**(0.5)	**1.4**(0.9)	**1.3**(0.8)	15/15
CMAma	3.3(1)	5.3(7)	**1.6**(1)	**0.98**(0.5)	**1.0**(0.4)	**1.00**(0.4)	15/15
CMAmah	**1.3**(1)	5.3(5)	**1.9**(2)	**1.4**(0.4)	**1.2**(0.4)	**1.1**(0.3)	15/15
CMAmh	**1.2**(1)	7.7(8)	**2.6**(2)	**1.6**(0.6)	**1.3**(0.3)	**1.2**(0.3)	15/15
DBRCGA	**1.5**(2)	**1.8**(1)	**1.7**(2)	7.7(18)	18(20)	16(17)	15/15
DE	3.1(3)	3.1(2)	**1.4**(1)	**2.3**(2)	3.8(4)	3.5(4)	15/15
DE-AUTO	**1.8**(1)	12(23)	6.6(8)	5.6(4)	5.7(2)	4.9(2)	15/15
DE-BFGS	**2.5**(5)	5.8(4)	**1.9**(0.7)	**1.6**(0.5)	**1.8**(0.4)	8.6(11)	4/15
DE-ROLL	**2.3**(1)	4.6(5)	**2.7**(2)	**2.9**(1)	5.1(2)	24(36)	11/15
DE-SIMPLEX	3.2(5)	9.2(7)	**2.9**(1)	**1.9**(0.7)	**1.8**(0.8)	103(108)	1/15
DEctpb	**1.9**(2)	**1.7**(1.0)	**0.93**(0.2)	**0.85**(0.2)	**1.1**(0.2)	**1.2**(0.6)	15/15
IPOPsaACM	**2.0**(2)	**3.0**(3)	**1.4**(1)	**0.83**(0.6)	**1.1**(0.6)	**1.4**(1)	15/15
JADEb	**1.5**(1)	**1.4**(0.7)	11(0.7)	5.0(0.9)	18(23)	15(20)	11/15
JADEctpb	**2.1**(1)	**1.5**(0.4)	**0.63**(0.3)	**0.47**(0.1)	**0.68**(0.5)	**0.69**(0.4)	15/15
MVDE	3.3(3)	3.7(3)	**2.1**(0.6)	44(0.9)	32(1)	28(0.8)	14/15
NBIPOPaCMA	4.9(3)	4.6(3)	**2.6**(2)	**1.4**(1)	**1.3**(0.8)	**1.3**(0.7)	15/15
NIPOPaCMA	**1.8**(1)	**2.6**(3)	**0.72**(0.6)	**0.88**(0.7)	**0.84**(0.4)	**0.82**(0.3)	15/15
PSO-BFGS	6.8(11)	11(12)	4.5(3)	3.8(2)	5.0(1)	24(19)	2/15
SNES	**1.5**(2)	11(15)	18(24)	81(114)	181(216)	156(182)	5/15
xNES	**1.7**(1)	13(16)	4.9(4)	3.9(4)	12(13)	18(17)	14/15
xNESas	28(82)	13(15)	5.3(6)	7.0(5)	12(12)	17(14)	14/15

Table 20: 02-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-3	1e-5	1e-7	#succ
f19	1	1	26	227	252	276	15/15
ACOR	3.6(4)	38(28)	6.9(9)	72(246)	70(229)	68(210)	15/15
BIPOPaCMA	5.3(6)	**21**(23)	7.5(6)	21(22)	21(20)	20(19)	15/15
BIPOPsaACM	5.0(4)	**24**(16)	11(17)	16(22)	23(24)	22(22)	15/15
CMA	5.4(6)	58(41)	**5.1**(6)	12(13)	**11**(12)	**11**(12)	15/15
CMAES	5.6(6)	198(508)	25(22)	22(21)	20(19)	19(17)	15/15
CMAa	10(11)	42(31)	11(8)	**10**(15)	**11**(13)	**11**(12)	15/15
CMAm	4.5(4)	77(44)	14(21)	**12**(12)	15(14)	**14**(14)	15/15
CMAma	4.5(6)	137(380)	15(24)	25(35)	24(33)	24(30)	15/15
CMAmah	**3.5**(2)	48(46)	8.2(16)	22(28)	30(26)	29(24)	15/15
CMAmh	7.1(6)	78(48)	17(21)	**9.0**(11)	**8.5**(10)	**8.1**(9)	15/15
DBRCGA	3.9(2)	33(33)	**6.2**(5)	15(18)	15(17)	15(16)	15/15
DE	**3.4**(2)	55(38)	10(8)	120(224)	109(202)	100(185)	12/15
DE-AUTO	**3.3**(2)	86(34)	53(57)	81(102)	76(92)	70(74)	15/15
DE-BFGS	4.3(4)	61(80)	11(9)	24(50)	21(45)	31(41)	15/15
DE-ROLL	**2.9**(2)	76(127)	12(9)	65(117)	66(104)	160(174)	11/15
DE-SIMPLEX	4.3(4)	77(104)	17(18)	41(126)	37(114)	34(104)	15/15
DEctpb	4.0(4)	73(86)	9.2(9)	75(221)	69(198)	66(182)	13/15
IPOPsaACM	4.7(7)	33(34)	7.8(4)	**10**(9)	17(13)	16(13)	15/15
JADEb	4.3(4)	**25**(30)	**5.4**(4)	116(223)	105(201)	97(183)	12/15
JADEctpb	3.6(4)	34(26)	**6.6**(5)	115(221)	104(199)	96(182)	12/15
MVDE	8.6(11)	68(70)	12(14)	3432(4406)	3093(3968)	3188(3631)	8/15
NBIPOPaCMA	5.7(5)	32(43)	25(31)	31(43)	31(39)	28(36)	15/15
NIPOPaCMA	7.0(7)	93(45)	14(22)	34(26)	36(24)	34(22)	15/15
PSO-BFGS	7.2(8)	91(76)	21(27)	13(11)	**12**(10)	27(26)	15/15
SNES	5.7(8)	**24**(20)	7.4(6)	16(36)	51(101)	168(262)	14/15
xNES	4.1(4)	31(37)	11(9)	33(32)	40(59)	37(54)	15/15
xNESas	5.9(8)	38(40)	15(17)	65(81)	69(75)	64(67)	15/15

Table 21: 02-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-3	1e-5	1e-7	#succ
f20	3.7	61	365	366	370	375	15/15
ACOR	**1.1**(2)	**3.7**(3)	57(70)	58(70)	58(69)	57(69)	15/15
BIPOPaCMA	4.0(6)	6.9(6)	7.8(8)	13(15)	13(15)	13(15)	15/15
BIPOPsaACM	3.9(3)	7.1(8)	5.3(5)	5.9(6)	5.9(6)	6.0(6)	15/15
CMA	4.4(4)	11(14)	8.2(6)	11(19)	12(21)	12(21)	15/15
CMAES	**2.5**(2)	17(19)	21(24)	23(24)	23(24)	23(23)	15/15
CMAa	**2.6**(3)	10(7)	10(11)	13(23)	14(24)	14(24)	15/15
CMAm	**2.3**(2)	19(19)	16(17)	17(18)	18(19)	19(19)	15/15
CMAma	4.2(5)	14(18)	9.3(11)	12(12)	12(12)	13(12)	15/15
CMAmah	**2.5**(3)	14(13)	9.1(6)	14(11)	14(11)	15(11)	15/15
CMAmh	**2.4**(2)	12(18)	11(11)	13(12)	13(12)	13(12)	15/15
DBRCGA	**2.3**(3)	6.8(6)	**4.8**(5)	5.2(5)	5.5(5)	5.8(5)	15/15
DE	**2.4**(3)	5.1(3)	7.3(7)	7.6(7)	8.0(7)	8.2(7)	15/15
DE-AUTO	**1.8**(1)	14(26)	42(68)	42(67)	42(67)	41(66)	15/15
DE-BFGS	3.6(2)	**5.0**(3)	12(23)	12(23)	12(22)	12(22)	15/15
DE-ROLL	**1.7**(3)	13(19)	30(77)	30(76)	30(75)	30(75)	15/15
DE-SIMPLEX	3.1(2)	5.0(6)	21(15)	21(15)	21(15)	21(15)	15/15
DEctpb	**1.6**(3)	**2.7**(2)	**2.2**(3)	**3.1**(3)	**3.6**(3)	**4.1**(3)	15/15
IPOPsaACM	**2.6**(3)	8.2(11)	6.9(8)	13(15)	13(15)	13(15)	15/15
JADEb	**2.9**(4)	7.7(9)	**3.1**(3)	**3.3**(3)	**3.5**(3)	**3.7**(3)	15/15
JADEctpb	3.1(3)	**3.8**(2)	**2.6**(4)	**3.2**(4)	**3.6**(4)	**3.8**(4)	15/15
MVDE	3.7(5)	7.3(7)	916(1372)	998(1367)	988(1351)	976(1335)	11/15
NBIPOPaCMA	**2.8**(3)	8.2(13)	5.6(6)	7.5(9)	7.6(9)	7.7(9)	15/15
NIPOPaCMA	3.2(4)	12(15)	10(9)	11(10)	13(10)	14(10)	15/15
PSO-BFGS	6.5(8)	8.7(9)	4.9(7)	**4.9**(7)	**4.9**(7)	**4.8**(7)	15/15
SNES	5.7(5)	35(50)	18(19)	29(26)	29(26)	29(25)	15/15
xNES	6.5(4)	28(34)	22(24)	22(24)	22(23)	22(23)	15/15
xNESas	3.8(3)	27(32)	21(26)	23(26)	23(26)	23(25)	15/15

Table 22: 02-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-3	1e-5	1e-7	#succ
f21	1.7	51	174	290	324	330	15/15
ACOR	**1.6**(1)	**1.1**(1)	**0.93**(0.7)	**1.4**(0.6)	**1.6**(0.4)	**1.8**(0.5)	15/15
BIPOPaCMA	**2.0**(2)	5.5(6)	8.4(11)	21(7)	22(6)	27(6)	15/15
BIPOPsaACM	**1.7**(2)	3.9(4)	5.1(6)	3.6(4)	5.1(5)	5.1(5)	15/15
CMA	**1.2**(2)	6.1(7)	7.2(7)	4.8(5)	4.7(4)	4.9(4)	15/15
CMAES	**0.96**(0.6)	10(13)	8.3(12)	5.1(7)	4.8(6)	4.7(6)	15/15
CMAa	**0.92**(0.3)	5.1(7)	3.8(8)	**2.6**(5)	**2.5**(5)	**2.6**(5)	15/15
CMAm	**2.4**(2)	7.2(7)	5.8(9)	3.9(5)	3.7(5)	3.8(5)	15/15
CMAma	**1.5**(0.9)	8.6(15)	7.9(13)	7.7(16)	10(15)	21(16)	15/15
CMAmah	**2.1**(3)	7.2(8)	6.9(9)	4.4(5)	4.2(5)	4.2(5)	15/15
CMAmh	**1.4**(0.9)	6.0(10)	3.5(4)	**2.2**(2)	**2.1**(2)	**3.0**(2)	15/15
DBRCGA	**1.6**(2)	**1.3**(2)	**0.84**(0.8)	**0.97**(0.4)	**1.2**(0.3)	**1.5**(0.4)	15/15
DE	**1.1**(0.9)	3.9(2)	4.4(6)	**3.0**(4)	3.0(3)	3.2(3)	15/15
DE-AUTO	**1.2**(0.6)	19(41)	19(19)	12(11)	11(10)	11(10)	15/15
DE-BFGS	**1.3**(0.9)	**2.3**(4)	10(11)	5.9(7)	5.4(6)	5.9(6)	15/15
DE-ROLL	**1.3**(0.9)	15(26)	24(55)	15(33)	14(30)	18(30)	15/15
DE-SIMPLEX	**1.3**(0.9)	3.9(6)	19(41)	11(24)	10(22)	10(22)	15/15
DEctpb	**1.4**(1)	4.3(6)	**2.8**(5)	**2.3**(3)	**2.4**(3)	**2.8**(3)	15/15
IPOPsaACM	**1.3**(1)	6.8(9)	5.6(8)	10(6)	10(6)	11(6)	15/15
JADEb	**1.4**(0.9)	**2.4**(2)	3.6(5)	**2.3**(3)	**2.2**(3)	**2.3**(3)	15/15
JADEctpb	**1.1**(0.6)	**1.1**(1)	4.0(8)	**2.8**(5)	**2.9**(4)	3.1(4)	15/15
MVDE	**1.4**(1)	**1.8**(2)	383(2)	248(2)	224(2)	221(3)	14/15
NBIPOPaCMA	**1.2**(0.6)	22(39)	10(11)	8.6(11)	7.8(10)	7.8(10)	15/15
NIPOPaCMA	**0.76**(0.3)	13(13)	68(34)	43(21)	39(19)	38(20)	15/15
PSO-BFGS	**1.2**(0.9)	3.3(4)	**2.6**(4)	**1.6**(2)	**1.5**(2)	16(28)	15/15
SNES	**1.1**(0.6)	44(59)	23(40)	14(24)	13(22)	13(21)	15/15
xNES	**1.4**(1)	29(43)	21(28)	14(17)	14(15)	14(15)	15/15
xNESas	**1.4**(1)	19(37)	17(37)	10(23)	9.4(20)	9.4(20)	15/15

Table 23: 02-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-3	1e-5	1e-7	#succ
f22	5.1	27	168	249	289	306	15/15
ACOR	**1.3**(1)	**2.2**(2)	42(151)	30(105)	28(90)	28(89)	15/15
BIPOPaCMA	3.2(4)	16(12)	5.3(10)	5.7(7)	5.2(6)	5.1(6)	15/15
BIPOPsaACM	5.2(2)	10(15)	5.4(8)	6.3(6)	6.8(9)	6.5(8)	15/15
CMA	**1.8**(2)	6.4(12)	6.8(12)	14(22)	62(109)	108(228)	14/15
CMAES	**1.6**(2)	8.3(12)	4.9(4)	4.9(6)	4.4(5)	4.3(5)	15/15
CMAa	**1.4**(2)	11(12)	7.5(16)	7.9(17)	8.8(16)	11(17)	14/15
CMAm	**1.7**(2)	19(45)	11(8)	8.3(6)	8.9(9)	9.0(9)	15/15
CMAma	8.3(2)	14(21)	6.7(8)	7.9(12)	12(16)	12(17)	15/15
CMAmah	6.5(1)	8.7(17)	11(14)	7.9(10)	26(31)	129(346)	14/15
CMAmh	**1.6**(1)	14(17)	10(16)	40(27)	49(81)	104(211)	15/15
DBRCGA	**0.92**(0.8)	**2.3**(3)	**0.96**(0.9)	**1.3**(0.9)	**1.4**(0.9)	**1.9**(1)	15/15
DE	**1.1**(1)	6.4(5)	4.5(7)	3.7(4)	3.6(4)	3.8(4)	15/15
DE-AUTO	**1.3**(1)	8.7(20)	15(7)	10(5)	8.6(4)	9.3(4)	15/15
DE-BFGS	**1.4**(1)	**2.2**(2)	**0.63**(0.6)	**0.58**(0.3)	**0.53**(0.3)	**1.7**(2)	15/15
DE-ROLL	**0.88**(1)	8.2(15)	15(24)	14(18)	23(26)	55(56)	15/15
DE-SIMPLEX	**1.5**(1)	**2.4**(4)	**2.8**(2)	**2.1**(1)	**1.9**(1)	**1.8**(1)	15/15
DEctpb	**1.4**(1)	3.5(3)	**2.1**(5)	**2.1**(3)	**2.5**(3)	**2.8**(3)	15/15
IPOPsaACM	**1.5**(2)	10(16)	3.0(5)	3.4(4)	6.3(4)	16(3)	15/15
JADEb	**1.1**(1)	**2.0**(2)	5.7(6)	4.3(4)	3.9(3)	3.9(3)	15/15
JADEctpb	**1.2**(0.9)	**2.0**(2)	**1.7**(3)	**1.5**(2)	**1.6**(2)	**1.9**(2)	15/15
MVDE	**1.1**(1)	3.4(3)	**2.0**(1)	3.3(3)	5.0(3)	5.8(3)	15/15
NBIPOPaCMA	**1.3**(0.7)	10(11)	11(11)	9.1(8)	8.2(7)	8.0(6)	15/15
NIPOPaCMA	**2.3**(2)	55(123)	12(20)	13(29)	12(25)	11(24)	15/15
PSO-BFGS	**1.3**(1)	**2.5**(2)	**1.1**(1)	**0.85**(0.9)	**0.80**(0.8)	17(25)	15/15
SNES	**2.5**(3)	71(95)	40(79)	105(142)	107(132)	141(172)	15/15
xNES	**1.9**(2)	71(111)	27(32)	20(22)	23(27)	21(25)	15/15
xNESas	4.4(3)	45(87)	21(27)	21(21)	18(18)	17(17)	15/15

Table 24: 02-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ 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-3	1e-5	1e-7	#succ
f23	7.8	193	234	299	348	379	15/15
ACOR	**1.5**(2)	10(9)	1019(808)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	3.5(3)	5.6(4)	8.7(11)	7.4(9)	**6.8**(8)	**6.7**(7)	15/15
BIPOPsaACM	**2.4**(2)	7.9(12)	12(14)	10(11)	11(12)	10(11)	15/15
CMA	**1.5**(1)	4.1(4)	10(9)	8.8(7)	**8.2**(6)	**8.0**(6)	15/15
CMAES	4.0(4)	6.3(7)	14(10)	12(10)	11(8)	10(8)	15/15
CMAa	**1.5**(2)	5.5(7)	22(20)	20(15)	18(14)	17(13)	15/15
CMAm	**2.6**(2)	7.5(8)	60(23)	109(18)	94(16)	87(15)	14/15
CMAma	**2.5**(3)	5.0(6)	15(21)	12(17)	11(15)	11(14)	15/15
CMAmah	**2.5**(3)	5.9(7)	13(13)	11(10)	10(9)	10(8)	15/15
CMAmh	**2.5**(3)	5.6(6)	17(19)	14(16)	12(14)	12(13)	15/15
DBRCGA	**1.6**(2)	9.4(6)	58(68)	61(61)	53(53)	50(48)	15/15
DE	**2.9**(3)	9.5(12)	30(23)	26(18)	24(16)	24(22)	15/15
DE-AUTO	**2.1**(3)	**1.4**(1)	**3.1**(3)	**3.1**(2)	**2.9**(2)	**2.8**(1)	15/15
DE-BFGS	**1.9**(2)	**2.4**(2)	**4.0**(4)	**5.8**(5)	12(3)	348(411)	2/15
DE-ROLL	**1.6**(2)	5.2(4)	22(22)	34(25)	36(32)	265(317)	10/15
DE-SIMPLEX	**1.4**(1)	**0.84**(0.6)	**0.78**(0.5)	**0.72**(0.4)*	9.4(3)	500(623)	3/15
DEctpb	**2.2**(3)	18(23)	229(230)	1502(1534)	2019(2301)	1858(1882)	1/15
IPOPsaACM	**2.2**(3)	7.4(8)	9.0(9)	8.6(9)	**8.5**(8)	**8.0**(7)	15/15
JADEb	**2.1**(2)	4.9(5)	18(15)	23(11)	21(10)	20(9)	15/15
JADEctpb	**2.3**(2)	5.1(6)	48(79)	50(67)	43(58)	40(53)	15/15
MVDE	**0.99**(0.8)	6.3(4)	2167(4276)	6718(8353)	5794(7196)	5312(6594)	5/15
NBIPOPaCMA	**1.8**(2)	6.2(8)	12(9)	11(11)	10(9)	9.2(9)	15/15
NIPOPaCMA	**2.4**(2)	9.0(8)	16(10)	15(8)	14(7)	13(7)	15/15
PSO-BFGS	3.5(4)	**1.9**(2)	**3.3**(4)	**4.2**(4)	44(40)	∞ *2e5*	0/15
SNES	**2.1**(3)	11(12)	305(416)	460(635)	399(560)	476(543)	8/15
xNES	**1.4**(2)	18(19)	95(91)	79(69)	82(73)	79(67)	15/15
xNESas	**2.6**(4)	15(16)	95(128)	100(88)	87(76)	159(160)	0/15

Table 25: 02-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-3	1e-5	1e-7	#succ
f24	18	857	8515	24113	24721	24721	5/15
ACOR	**2.1**(2)	546(779)	59(79)	21(28)	21(27)	21(27)	15/15
BIPOPaCMA	**1.3**(2)	12(13)	28(44)	15(17)	18(17)	18(17)	15/15
BIPOPsaACM	**1.5**(1)	23(39)	10(12)	19(33)	34(35)	34(35)	14/15
CMA	4.2(1)	52(71)	130(165)	233(295)	227(276)	227(260)	1/15
CMAES	**1.9**(1)	6.9(9)	5.9(7)	8.4(9)	8.2(8)	8.2(8)	6/15
CMAa	**1.0**(1.0)	119(234)	132(141)	110(140)	107(128)	107(122)	2/15
CMAm	**1.7**(3)	106(234)	95(118)	46(58)	45(57)	45(57)	4/15
CMAma	**1.9**(2)	73(172)	307(353)	∞	∞	∞ *4e5*	0/15
CMAmah	**1.6**(1)	56(137)	130(165)	109(124)	106(122)	106(129)	2/15
CMAmh	**1.2**(0.8)	98(178)	133(167)	113(125)	110(122)	110(122)	2/15
DBRCGA	**1.2**(2)	**4.8**(5)	4.2(6)	5.0(5)	4.9(5)	4.9(5)	12/15
DE	**2.0**(2)	18(16)	**3.1**(3)	**2.4**(2)	**2.3**(3)	**2.3**(2)	13/15
DE-AUTO	**1.4**(2)	79(117)	10(12)	4.0(5)	3.9(4)	3.9(4)	11/15
DE-BFGS	**1.6**(2)	41(57)	4.2(6)	**1.5**(2)	**1.5**(2)	**1.5**(2)	15/15
DE-ROLL	8.5(1)	314(359)	33(36)	12(13)	12(12)	12(12)	7/15
DE-SIMPLEX	**1.1**(0.9)	79(64)	8.1(6)	**2.9**(2)	**2.8**(2)	**2.8**(2)	15/15
DEctpb	**1.5**(2)	124(137)	15(17)	5.3(5)	5.2(6)	5.2(6)	8/15
IPOPsaACM	**1.7**(2)	58(96)	258(329)	573(631)	559(648)	559(615)	2/15
JADEb	**2.2**(2)	5.7(4)	**2.9**(4)	**3.0**(2)	**2.9**(3)	**2.9**(3)	12/15
JADEctpb	**2.1**(2)	**5.3**(12)	**1.9**(2)	**0.80**(0.7)	**0.78**(0.7)	**0.79**(0.7)	15/15
MVDE	**1.7**(1)	4669(5836)	470(587)	270(311)	263(324)	263(303)	2/15
NBIPOPaCMA	4.8(2)	6.9(10)	14(28)	7.9(10)	7.8(9)	7.8(9)	15/15
NIPOPaCMA	**1.7**(1)	38(27)	23(28)	22(38)	22(37)	22(37)	14/15
PSO-BFGS	**1.4**(2)	**3.2**(2)	**0.97**(0.8)	**0.53**(0.5)	**0.52**(0.5)	**0.52**(0.5)	15/15
SNES	16(0.8)	**4.5**(7)	4.9(7)	13(14)	15(16)	15(18)	6/15
xNES	3.7(2)	5.8(7)	10(10)	20(21)	19(23)	19(23)	4/15
xNESas	**2.2**(1)	7.7(16)	13(12)	28(27)	27(30)	27(28)	4/15

Table 26: 03-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-3	1e-5	1e-7	#succ
f1	3.6	8.0	8.0	8.0	8.0	8.0	15/15
ACOR	**1.9**(2)	6.8(6)	17(6)	40(7)	59(7)	82(7)	15/15
BIPOPaCMA	4.1(5)	4.8(2)	11(3)	22(4)	32(4)	42(6)	15/15
BIPOPsaACM	3.1(3)	**4.0**(3)	7.9(2)	**12**(0.8)	15(1)	19(1)	15/15
CMA	**2.1**(3)	5.6(3)	10(3)	22(5)	33(6)	46(3)	15/15
CMAES	3.4(3)	5.4(4)	11(4)	25(5)	36(4)	46(6)	15/15
CMAa	**2.9**(3)	**4.2**(3)	9.0(4)	20(5)	30(7)	41(4)	15/15
CMAm	**2.4**(2)	4.4(4)	9.2(3)	17(3)	25(5)	34(4)	15/15
CMAma	3.2(4)	5.0(3)	9.5(3)	18(4)	26(5)	35(5)	15/15
CMAmah	**2.8**(3)	**3.8**(3)	**7.0**(4)	15(3)	22(3)	30(4)	15/15
CMAmh	**2.2**(2)	**3.6**(2)	**7.7**(2)	16(3)	24(5)	33(5)	15/15
DBRCGA	**1.8**(2)	15(12)	34(22)	79(27)	129(31)	171(34)	15/15
DE	**2.4**(2)	11(4)	21(14)	49(8)	77(11)	102(11)	15/15
DE-AUTO	**1.9**(2)	5.8(3)	8.1(0.1)	**8.1**(0.1)	**8.1**(0.1)	**8.1**(0.1)	15/15
DE-BFGS	**2.3**(3)	5.8(3)	**7.3**(0.2)	**7.3**(0.2)	**7.3**(0.2)	**7.3**(0.2)	15/15
DE-ROLL	**2.6**(2)	10(15)	13(12)	13(11)	**13**(11)	**13**(11)	15/15
DE-SIMPLEX	**2.8**(3)	8.6(4)	12(3)	15(3)	18(3)	21(3)	15/15
DEctpb	3.6(3)	13(6)	27(6)	58(10)	84(12)	116(10)	15/15
IPOPsaACM	3.2(3)	5.5(3)	9.3(1)	12(2)	16(2)	19(2)	15/15
JADEctpb	3.5(3)	8.4(6)	18(7)	42(8)	65(8)	87(11)	15/15
MVDE	**1.6**(2)	15(12)	49(17)	125(17)	197(26)	285(18)	15/15
NBIPOPaCMA	**2.7**(3)	5.0(4)	11(5)	21(4)	33(6)	42(8)	15/15
NIPOPaCMA	3.8(4)	5.7(5)	10(6)	22(7)	34(7)	44(7)	15/15
PSO-BFGS	**1.8**(2)	7.0(0.2)	**7.4**(0.2)	**7.4**(0.2)	**7.4**(0.2)	**7.4**(0.2)	15/15
SNES	3.9(5)	4.8(3)	9.2(2)	27(6)	44(6)	62(6)	15/15
xNES	3.9(4)	5.1(2)	12(4)	29(6)	49(7)	67(7)	15/15
xNESas	5.4(5)	5.7(3)	12(4)	28(4)	45(7)	57(7)	15/15

Table 27: 03-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-3	1e-5	1e-7	#succ
f2	38	42	43	45	47	48	15/15
ACOR	8.1(2)	9.4(1)	11(0.8)	14(1)	17(0.9)	20(1)	15/15
BIPOPaCMA	11(5)	13(4)	14(3)	16(3)	17(3)	18(3)	15/15
BIPOPsaACM	4.3(1)	4.5(1)	4.9(0.9)	5.3(0.9)	5.7(1)	6.2(1)	15/15
CMA	14(4)	16(6)	19(2)	20(2)	21(2)	23(2)	15/15
CMAES	12(5)	17(4)	18(3)	20(2)	21(2)	23(2)	15/15
CMAa	11(4)	13(2)	14(2)	16(2)	17(2)	18(2)	15/15
CMAm	14(6)	17(5)	18(3)	20(2)	20(2)	21(2)	15/15
CMAma	11(6)	13(5)	14(2)	16(2)	16(2)	18(2)	15/15
CMAmah	16(6)	19(2)	19(3)	20(3)	20(2)	21(2)	15/15
CMAmh	21(10)	25(6)	26(4)	27(4)	27(4)	28(4)	15/15
DBRCGA	15(4)	20(4)	23(6)	31(7)	38(7)	45(7)	15/15
DE	9.4(2)	11(2)	13(2)	18(3)	21(2)	28(4)	15/15
DE-AUTO	**2.1**(0.2)	**2.0**(0.1)	**2.1**(0.2)	**2.2**(0.2)	**2.4**(0.8)	**2.6**(0.8)	15/15
DE-BFGS	**2.1**(0.2)	**2.0**(0.3)	**2.1**(0.3)	**2.2**(0.3)	**2.3**(0.3)	**2.4**(0.3)	15/15
DE-ROLL	3.8(3)	3.7(3)	**3.7**(3)	**3.9**(3)	**4.1**(2)	**4.3**(2)	15/15
DE-SIMPLEX	**2.7**(0.9)	**3.3**(1)	3.7(0.8)	4.3(0.7)	4.6(0.7)	4.9(0.6)	15/15
DEctpb	9.5(3)	13(2)	14(2)	20(2)	23(1)	28(3)	15/15
IPOPsaACM	4.1(1)	4.3(0.8)	4.7(1.0)	5.1(1)	5.6(1)	6.1(1)	15/15
JADEb	6.2(2)	7.3(2)	8.4(2)	11(2)	14(2)	17(2)	15/15
JADEctpb	7.8(2)	10(2)	12(1)	16(1)	19(2)	23(2)	15/15
MVDE	22(4)	27(5)	33(4)	47(4)	58(5)	70(5)	15/15
NBIPOPaCMA	9.2(4)	12(4)	14(4)	16(2)	17(2)	18(2)	15/15
NIPOPaCMA	11(6)	13(3)	14(2)	16(3)	17(2)	18(2)	15/15
PSO-BFGS	**2.1**(0.2)	**2.0**(0.3)	**2.1**(0.3)	**2.3**(0.5)	**2.3**(0.5)	**2.5**(0.6)	15/15
SNES	6.7(2)	8.1(2)	9.3(2)	12(1)	15(2)	17(1)	15/15
xNES	10(3)	13(4)	14(4)	21(7)	25(6)	28(5)	15/15
xNESas	8.5(3)	10(3)	11(4)	14(3)	15(4)	17(3)	15/15

Table 28: 03-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	38	822	830	842	847	853	15/15
ACOR	5.0(2)	11(1)	113(122)	112(121)	112(120)	111(119)	15/15
BIPOPaCMA	**3.1**(1)	4.3(5)	12(17)	12(17)	12(17)	12(18)	15/15
BIPOPsaACM	**2.6**(1)	**2.1**(2)	13(17)	13(17)	13(17)	13(17)	15/15
CMA	10(16)	4.0(4)	21(23)	41(69)	42(70)	43(71)	15/15
CMAES	6.1(5)	5.3(6)	21(16)	21(15)	21(15)	21(15)	15/15
CMAa	7.8(12)	**2.8**(2)	23(43)	30(51)	31(53)	32(54)	15/15
CMAm	5.4(11)	**2.2**(2)	18(13)	21(15)	21(15)	22(15)	15/15
CMAma	**3.2**(2)	4.2(7)	11(12)	12(13)	12(13)	13(13)	15/15
CMAmah	7.2(11)	**2.7**(3)	27(28)	33(31)	34(32)	34(32)	15/15
CMAmh	4.4(4)	3.4(2)	30(44)	86(122)	89(126)	90(128)	15/15
DBRCGA	7.9(3)	**1.9**(0.8)	3.3(2)	3.8(2)	4.1(2)	4.5(2)	15/15
DE	4.8(3)	**0.65**(0.3)$\downarrow$4	**1.6**(2)	**1.8**(2)	**2.1**(2)	**2.3**(2)	15/15
DE-AUTO	7.6(12)	3.1(3)	6.8(6)	6.7(6)	6.7(6)	6.7(6)	15/15
DE-BFGS	8.2(9)	**1.4**(0.6)	**2.9**(3)	**2.9**(3)	**2.9**(2)	**2.9**(2)	15/15
DE-ROLL	5.9(6)	**1.4**(1)	3.6(2)	3.6(2)	3.6(2)	3.5(2)	15/15
DE-SIMPLEX	11(9)	3.1(2)	8.7(14)	8.6(14)	8.6(14)	8.6(14)	15/15
DEctpb	4.7(2)	**0.96**(0.5)	**1.3**(0.3)	**1.9**(0.4)	**2.3**(0.3)	**2.6**(0.3)	15/15
IPOPsaACM	5.2(3)	3.4(4)	17(21)	76(116)	76(117)	77(117)	15/15
JADEb	3.5(2)	**0.81**(1)	4.1(5)	4.2(5)	4.4(5)	4.5(5)	15/15
JADEctpb	3.4(2)	**0.78**(0.3)	**1.2**(0.4)	**1.5**(0.2)	**1.8**(0.3)	**2.1**(0.4)	15/15
MVDE	8.8(4)	**1.5**(0.3)	**1.8**(0.4)	**2.8**(0.4)	3.5(0.3)	4.2(0.3)	15/15
NBIPOPaCMA	3.8(2)	6.8(7)	37(37)	43(36)	43(36)	43(36)	15/15
NIPOPaCMA	5.0(3)	4.0(3)	13(13)	43(14)	43(15)	43(15)	15/15
PSO-BFGS	14(16)	4.8(4)	9.0(7)	8.9(7)	8.8(7)	8.8(7)	15/15
SNES	4.3(4)	10(9)	47(51)	46(50)	46(50)	46(50)	15/15
xNES	**3.0**(3)	11(11)	69(98)	69(97)	68(96)	68(96)	15/15
xNESas	11(23)	7.1(7)	66(59)	65(58)	65(58)	64(57)	15/15

Table 29: 03-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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	40	808	866	952	1015	1044	15/15
ACOR	7.1(4)	81(95)	218(147)	199(134)	187(126)	182(122)	15/15
BIPOPaCMA	**4.0**(3)	183(415)	2702(3463)	3633(4725)	3408(4330)	3315(4211)	8/15
BIPOPsaACM	5.9(4)	47(57)	3272(4131)	3097(3757)	2905(3551)	2826(3430)	9/15
CMA	7.1(5)	390(461)	∞	∞	∞	∞ *6e5*	0/15
CMAES	8.3(13)	19(17)	134(119)	122(108)	114(111)	111(108)	11/15
CMAa	9.1(14)	621(843)	∞	∞	∞	∞ *6e5*	0/15
CMAm	6.5(11)	538(559)	4727(4980)	∞	∞	∞ *6e5*	0/15
CMAma	6.6(12)	789(938)	∞	∞	∞	∞ *6e5*	0/15
CMAmah	10(13)	1039(1256)	8693(8872)	∞	∞	∞ *5e5*	0/15
CMAmh	15(11)	653(795)	∞	∞	∞	∞ *5e5*	0/15
DBRCGA	8.9(5)	3.1(1)	5.9(4)	5.7(3)	5.6(3)	5.7(3)	15/15
DE	5.8(2)	**1.5**(2)	**2.9**(2)	**2.9**(2)	**3.0**(2)	**3.1**(2)	15/15
DE-AUTO	18(19)	6.1(5)	16(19)	14(17)	13(16)	13(15)	15/15
DE-BFGS	13(10)	**1.6**(0.7)	**5.6**(9)	**5.1**(8)	**4.9**(8)	**4.8**(8)	15/15
DE-ROLL	5.7(4)	3.1(2)	6.1(5)	5.6(4)	5.3(4)	5.2(4)	15/15
DE-SIMPLEX	23(17)	5.3(7)	9.0(7)	8.2(7)	7.7(6)	7.6(6)	15/15
DEctpb	6.7(3)	**1.6**(0.6)	**2.0**(2)	**2.4**(2)	**2.6**(2)	**2.8**(2)	15/15
IPOPsaACM	8.5(7)	240(358)	1.6e4(2e4)	1.5e4(1e4)	1.4e4(1e4)	1.3e4(1e4)	3/15
JADEb	**4.0**(2)	**2.9**(3)	8.4(9)	7.8(8)	7.5(7)	7.5(7)	15/15
JADEctpb	**4.5**(2)	**1.7**(0.4)	**2.2**(2)	**2.3**(2)	**2.5**(2)	**2.6**(2)	15/15
MVDE	13(4)	**2.1**(0.4)	180(577)	165(525)	155(493)	151(479)	13/15
NBIPOPaCMA	10(17)	29(27)	243(391)	221(355)	208(333)	202(324)	15/15
NIPOPaCMA	**3.8**(2)	254(377)	1.1e4(1e4)	1.3e4(2e4)	1.3e4(1e4)	1.2e4(1e4)	3/15
PSO-BFGS	28(31)	11(11)	49(49)	44(45)	42(42)	41(41)	15/15
SNES	14(38)	28(32)	140(133)	128(121)	120(113)	117(110)	14/15
xNES	6.0(4)	37(50)	285(285)	259(258)	244(243)	237(240)	9/15
xNESas	4.9(3)	31(31)	136(208)	124(189)	116(178)	113(173)	14/15

Table 30: 03-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-3	1e-5	1e-7	#succ
f5	6.6	6.6	6.6	6.6	6.6	6.6	15/15
ACOR	7.3(3)	12(2)	13(2)	13(3)	13(3)	13(3)	15/15
BIPOPaCMA	3.4(2)	5.2(2)	5.3(2)	5.3(2)	5.3(2)	5.3(2)	15/15
BIPOPsaACM	4.2(3)	6.2(3)	6.4(3)	6.4(3)	6.4(3)	6.4(3)	15/15
CMA	**2.9**(2)	**4.5**(3)	**4.9**(3)	**5.0**(3)	**5.0**(3)	**5.0**(3)	15/15
CMAES	3.7(3)	6.0(4)	6.2(4)	6.2(4)	6.2(4)	6.2(4)	15/15
CMAa	4.9(2)	6.7(3)	6.9(3)	6.9(3)	6.9(3)	6.9(3)	15/15
CMAm	**3.0**(2)	5.3(2)	5.6(2)	5.6(2)	5.6(2)	5.6(2)	15/15
CMAma	3.3(1)	**4.5**(2)	**4.7**(2)	**4.8**(2)	**4.8**(2)	**4.8**(2)	15/15
CMAmah	**2.5**(1)	**4.1**(2)	**4.4**(2)	**4.4**(2)	**4.4**(2)	**4.4**(2)	15/15
CMAmh	**2.4**(1)	**3.8**(1)	**4.2**(1)	**4.3**(1)	**4.3**(1)	**4.3**(1)	15/15
DBRCGA	5.5(5)	17(9)	18(9)	19(9)	19(9)	19(9)	15/15
DE	4.2(2)	8.2(5)	9.1(4)	9.1(4)	9.1(4)	9.1(4)	15/15
DE-AUTO	5.7(3)	9.2(0.4)	9.2(0.4)	9.2(0.4)	9.2(0.4)	9.2(0.4)	15/15
DE-BFGS	5.1(2)	8.7(2)	8.9(2)	8.9(2)	8.9(2)	8.9(2)	15/15
DE-ROLL	5.1(3)	8.4(2)	8.8(0.6)	8.8(0.6)	8.8(0.6)	8.8(0.6)	15/15
DE-SIMPLEX	3.8(2)	17(7)	25(10)	45(22)	87(54)	96(53)	15/15
DEctpb	5.1(3)	12(5)	14(5)	14(5)	14(5)	14(5)	15/15
IPOPsaACM	4.0(1)	5.9(3)	6.2(3)	6.3(3)	6.3(3)	6.3(3)	15/15
JADEb	4.3(3)	8.9(6)	10(5)	10(7)	10(7)	10(7)	15/15
JADEctpb	6.1(3)	15(9)	16(10)	16(10)	16(10)	16(10)	15/15
MVDE	18(12)	51(13)	61(18)	63(18)	63(18)	63(18)	15/15
NBIPOPaCMA	3.5(2)	6.1(3)	6.5(3)	6.5(3)	6.5(3)	6.5(3)	15/15
NIPOPaCMA	3.9(2)	5.9(3)	6.3(3)	6.3(3)	6.3(3)	6.3(3)	15/15
PSO-BFGS	7.7(3)	10(0.6)	10(0.6)	10(0.6)	10(0.6)	10(0.6)	15/15
SNES	6.9(4)	12(5)	13(4)	13(4)	13(4)	13(4)	15/15
xNES	7.1(5)	12(6)	13(7)	13(8)	13(8)	13(8)	15/15
xNESas	5.7(3)	10(5)	11(5)	11(5)	11(5)	11(5)	15/15

Table 31: 03-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-3	1e-5	1e-7	#succ
f6	34	56	90	149	215	265	15/15
ACOR	**2.4**(2)	5.3(2)	5.7(1)	6.6(2)	6.6(1)	7.2(2)	15/15
BIPOPaCMA	**2.8**(2)	**2.8**(1)	**2.8**(1)	**2.7**(0.8)	**2.7**(0.4)	**2.8**(0.5)	15/15
BIPOPsaACM	**2.5**(1)	3.3(2)	**2.9**(2)	3.1(2)	3.1(1)	3.2(1)	15/15
CMA	**2.2**(2)	3.1(1)	3.0(1)	3.0(0.4)	**2.9**(0.4)	**2.9**(0.4)	15/15
CMAES	**2.3**(2)	3.1(2)	3.1(1)	3.3(0.6)	3.1(0.6)	3.2(0.5)	15/15
CMAa	**2.1**(2)	3.0(1.0)	**2.9**(0.5)	**3.0**(0.7)	**2.8**(0.7)	3.0(0.5)	15/15
CMAm	**2.1**(2)	3.1(2)	3.1(1)	3.0(1)	3.2(0.6)	3.3(0.7)	15/15
CMAma	**2.9**(2)	3.1(1.0)	**2.8**(0.9)	**2.9**(0.6)	**2.9**(0.6)	3.1(0.4)	15/15
CMAmah	**2.1**(2)	**2.8**(1)	**2.6**(2)	**2.4**(0.8)	**2.2**(0.6)	**2.3**(0.4)	15/15
CMAmh	**2.1**(2)	**2.6**(2)	**2.4**(0.9)	**2.6**(0.6)	**2.3**(0.5)	**2.4**(0.5)	15/15
DBRCGA	5.0(3)	9.5(4)	10(3)	11(3)	10(2)	10(3)	15/15
DE	3.8(3)	7.3(3)	7.7(2)	8.7(2)	8.9(3)	10(4)	15/15
DE-AUTO	**2.4**(1)	**2.2**(0.7)	**1.6**(0.4)	**1.3**(0.4)	**1.2**(0.5)	**1.5**(0.9)	15/15
DE-BFGS	**2.8**(2)	**2.7**(0.8)	**2.2**(0.8)	**1.7**(0.6)	**1.6**(0.8)	**2.1**(2)	15/15
DE-ROLL	27(30)	28(37)	25(24)	28(31)	35(59)	51(97)	15/15
DE-SIMPLEX	3.2(2)	**2.8**(2)	**2.4**(1)	**1.8**(0.9)	**1.6**(0.7)	**1.5**(0.6)	15/15
DEctpb	5.4(3)	7.8(3)	8.2(3)	8.8(3)	9.2(3)	10(3)	15/15
IPOPsaACM	**2.8**(2)	3.3(1)	**2.9**(1)	3.3(2)	3.2(2)	3.6(2)	15/15
JADEb	**2.3**(2)	3.6(1)	4.0(1)	4.6(0.9)	4.9(1)	5.1(1)	15/15
JADEctpb	**2.5**(1)	4.7(2)	5.0(1)	5.4(1)	5.5(0.9)	5.9(0.9)	15/15
MVDE	8.2(4)	14(5)	19(6)	27(8)	35(9)	40(10)	15/15
NBIPOPaCMA	**2.3**(2)	3.3(2)	3.0(0.9)	**2.9**(0.6)	**2.8**(0.4)	**2.9**(0.5)	15/15
NIPOPaCMA	**2.9**(2)	3.4(1)	**3.0**(0.7)	3.0(0.4)	**2.8**(0.4)	**2.9**(0.4)	15/15
PSO-BFGS	**2.8**(1)	**2.8**(0.7)	**2.0**(0.4)	**1.6**(0.5)	**1.5**(0.7)	**2.7**(1)	15/15
SNES	**1.3**(1)	**2.7**(1)	**3.0**(0.8)	3.6(1)	5.1(2)	24(3)	15/15
xNES	**2.6**(3)	3.3(2)	**2.9**(1.0)	4.1(1)	4.3(0.8)	4.4(0.6)	15/15
xNESas	**2.5**(1)	**2.9**(1)	3.1(1)	3.2(0.7)	3.6(0.7)	3.8(0.7)	15/15

Table 32: 03-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-3	1e-5	1e-7	#succ
f7	11	65	342	482	482	535	15/15
ACOR	3.8(3)	**2.6**(1)	5.6(2)	4.8(2)	4.8(2)	4.7(4)	15/15
BIPOPaCMA	3.2(2)	**1.7**(1)	**0.74**(0.4)	**0.85**(0.4)	**0.85**(0.4)	**0.89**(0.5)	15/15
BIPOPsaACM	3.1(2)	3.9(5)	**1.4**(1)	**1.5**(1)	**1.5**(1)	**1.4**(0.9)	15/15
CMA	**2.6**(2)	**1.8**(1)	**1.2**(0.7)	**1.0**(0.5)	**1.0**(0.5)	**1.0**(0.5)	15/15
CMAES	3.2(2)	**2.3**(1)	**1.0**(0.6)	**1.5**(2)	**1.5**(2)	**1.6**(1)	15/15
CMAa	**2.6**(1)	**1.6**(1)	**1.0**(0.5)	**1.00**(0.4)	**1.00**(0.4)	**1.00**(0.3)	15/15
CMAm	3.7(4)	**2.5**(2)	**1.4**(0.9)	**1.4**(0.7)	**1.4**(0.7)	**1.4**(0.7)	15/15
CMAma	3.8(4)	**1.7**(1)	**0.87**(0.7)	**0.82**(0.5)	**0.82**(0.5)	**0.79**(0.5)	15/15
CMAmah	7.5(3)	3.3(4)	**1.3**(2)	**1.4**(1)	**1.4**(1)	**1.3**(1.0)	15/15
CMAmh	**2.7**(3)	**2.9**(3)	**2.1**(1)	**1.8**(0.9)	**1.8**(0.9)	**1.7**(0.9)	15/15
DBRCGA	5.5(7)	4.1(3)	**2.0**(0.8)	3.6(3)	3.6(3)	3.8(3)	15/15
DE	3.5(4)	3.4(2)	**1.4**(0.9)	24(1)	24(1)	22(1)	14/15
DE-AUTO	3.1(3)	13(17)	6.0(4)	7.4(6)	7.4(6)	6.7(6)	15/15
DE-BFGS	5.3(8)	9.0(22)	**2.2**(4)	**2.2**(3)	**2.2**(3)	11(9)	15/15
DE-ROLL	4.5(3)	10(9)	4.6(3)	5.3(2)	5.3(2)	7.3(5)	15/15
DE-SIMPLEX	4.2(4)	4.3(3)	**2.2**(0.7)	**2.0**(0.6)	**2.0**(0.6)	**1.8**(0.5)	15/15
DEctpb	**2.8**(3)	3.4(3)	**1.6**(0.9)	**2.0**(1.0)	**2.0**(1.0)	**2.2**(1.0)	15/15
IPOPsaACM	**2.6**(2)	**2.3**(3)	**0.89**(0.9)	**1.1**(1.0)	**1.1**(1.0)	**1.1**(0.8)	15/15
JADEb	3.2(4)	**1.9**(0.8)	32(0.4)	79(156)	79(156)	71(140)	12/15
JADEctpb	**2.9**(2)	**2.0**(0.8)	**0.90**(0.3)	**1.3**(0.4)	**1.3**(0.4)	**1.3**(0.3)	15/15
MVDE	5.9(5)	5.2(3)	**2.6**(1)	4.6(2)	4.6(2)	5.0(1)	15/15
NBIPOPaCMA	3.7(5)	**2.9**(2)	**0.88**(0.7)	**0.92**(0.7)	**0.92**(0.7)	**1.0**(0.5)	15/15
NIPOPaCMA	**2.8**(2)	**1.9**(1)	**0.99**(1)	**0.87**(0.9)	**0.87**(0.9)	**1.0**(0.8)	15/15
PSO-BFGS	36(49)	110(151)	160(258)	147(192)	147(192)	319(399)	6/15
SNES	3.1(2)	18(24)	24(34)	42(38)	42(38)	46(66)	15/15
xNES	3.3(3)	14(24)	5.8(9)	4.4(6)	4.4(6)	4.0(6)	15/15
xNESas	**2.8**(2)	14(46)	8.1(9)	9.2(13)	9.2(13)	8.4(11)	15/15

Table 33: 03-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-3	1e-5	1e-7	#succ
f8	27	45	152	188	198	208	15/15
ACOR	5.8(3)	10(4)	18(4)	54(11)	95(16)	129(28)	15/15
BIPOPaCMA	**3.0**(2)	7.0(5)	3.7(1)	4.0(2)	4.3(1)	4.5(1)	15/15
BIPOPsaACM	4.1(1)	6.4(7)	**2.5**(2)	**2.4**(2)	**2.7**(2)	**2.7**(2)	15/15
CMA	3.4(2)	8.4(13)	4.7(4)	5.0(3)	5.3(3)	5.5(3)	15/15
CMAES	3.7(2)	6.4(5)	3.8(3)	4.5(2)	4.9(2)	5.2(1)	15/15
CMAa	**3.0**(2)	6.8(5)	3.6(2)	4.1(2)	4.4(1)	4.6(1)	15/15
CMAm	**2.9**(2)	6.1(5)	3.7(1)	4.2(1)	4.6(1)	4.8(1)	15/15
CMAma	3.0(2)	7.3(9)	3.5(3)	3.9(3)	4.2(2)	4.3(2)	15/15
CMAmah	3.5(3)	11(10)	5.5(3)	5.8(2)	6.0(2)	6.0(2)	15/15
CMAmh	5.3(10)	15(23)	6.8(7)	6.8(6)	7.0(6)	7.0(5)	15/15
DBRCGA	7.1(4)	12(8)	8.5(2)	16(9)	21(10)	25(10)	15/15
DE	7.8(5)	12(11)	7.6(4)	11(4)	14(4)	18(4)	15/15
DE-AUTO	**2.4**(0.2)	8.7(2)	**2.7**(0.7)	**2.4**(0.5)	**2.3**(0.5)	**2.2**(0.5)	15/15
DE-BFGS	3.0(0.7)	**3.3**(2)	**1.2**(0.6)	**1.1**(0.5)	**1.1**(0.4)	**1.1**(0.4)	15/15
DE-ROLL	3.7(0.8)	28(48)	46(46)	120(66)	174(57)	645(582)	8/15
DE-SIMPLEX	**2.1**(0.3)	**3.5**(3)	**1.4**(0.8)	**1.4**(0.6)	**1.4**(0.5)	**1.5**(0.5)	15/15
DEctpb	7.0(3)	12(6)	8.6(4)	13(5)	17(5)	21(5)	15/15
IPOPsaACM	3.3(2)	5.9(4)	**2.5**(1)	**2.4**(1)	**2.4**(1)	**2.4**(1)	15/15
JADEb	4.0(1)	13(18)	6.7(5)	7.0(4)	8.0(4)	8.8(3)	15/15
JADEctpb	5.5(2)	8.6(4)	6.9(3)	9.1(3)	10(3)	11(3)	15/15
MVDE	11(5)	24(7)	18(10)	43(14)	65(10)	87(16)	15/15
NBIPOPaCMA	3.7(3)	7.3(5)	3.8(2)	3.9(2)	4.3(1)	4.5(1)	15/15
NIPOPaCMA	3.1(2)	8.7(10)	4.4(3)	4.5(2)	4.8(2)	5.0(2)	15/15
PSO-BFGS	3.4(2)	**4.7**(2)	**1.6**(0.6)	**1.5**(0.5)	**1.4**(0.5)	**1.4**(0.4)	15/15
SNES	**2.8**(1)	211(450)	158(139)	517(118)	932(123)	1491(732)	2/15
xNES	**2.8**(2)	**5.1**(4)	5.8(7)	11(12)	12(16)	13(18)	15/15
xNESas	**2.5**(1)	7.7(8)	5.9(4)	6.9(6)	7.4(6)	7.7(6)	15/15

Table 34: 03-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-3	1e-5	1e-7	#succ
f9	21	65	127	159	169	178	15/15
ACOR	5.7(4)	6.1(4)	14(10)	60(39)	111(64)	154(97)	15/15
BIPOPaCMA	3.5(2)	3.3(2)	3.4(1)	3.9(1)	4.2(0.9)	4.6(0.9)	15/15
BIPOPsaACM	3.2(0.8)	4.3(3)	3.1(2)	3.0(2)	3.0(1)	3.0(1)	15/15
CMA	4.0(3)	6.0(6)	5.3(4)	5.6(3)	6.0(3)	6.3(3)	15/15
CMAES	3.4(2)	7.3(6)	6.0(4)	6.3(4)	6.7(3)	7.0(3)	15/15
CMAa	3.5(1)	4.0(2)	3.9(1)	4.1(1)	4.4(1)	4.8(1.0)	15/15
CMAm	4.0(1)	4.6(2)	4.8(1)	5.4(1)	5.7(1)	5.9(1)	15/15
CMAma	**2.9**(2)	4.6(3)	4.3(2)	4.7(1)	5.0(1)	5.2(1)	15/15
CMAmah	**2.6**(1)	3.6(4)	4.2(2)	4.7(2)	5.0(2)	5.2(2)	15/15
CMAmh	5.2(2)	7.3(10)	6.7(5)	6.8(5)	7.2(4)	7.2(4)	15/15
DBRCGA	10(4)	12(9)	16(17)	25(23)	34(23)	38(22)	15/15
DE	8.9(7)	9.2(9)	8.6(7)	11(5)	15(4)	20(4)	15/15
DE-AUTO	**3.0**(0.5)	**1.8**(1)	**1.2**(0.7)	**1.1**(0.5)	**1.1**(0.5)	**1.1**(0.5)	15/15
DE-BFGS	3.8(1)	**2.2**(1.0)	**1.4**(0.6)	**1.3**(0.4)	**1.3**(0.4)	**1.2**(0.4)	15/15
DE-ROLL	5.3(2)	41(34)	52(62)	143(70)	213(64)	1142(1147)	4/15
DE-SIMPLEX	3.2(0.4)	**2.2**(2)	**1.6**(0.8)	**1.5**(0.7)	**1.6**(0.6)	**1.7**(0.6)	15/15
DEctpb	8.6(5)	10(3)	11(7)	15(6)	19(7)	23(8)	15/15
IPOPsaACM	4.0(2)	3.1(2)	**2.6**(2)	**2.6**(1)	**2.6**(1)	**2.7**(1)	15/15
JADEb	5.1(2)	5.8(7)	5.6(4)	6.8(3)	7.8(2)	8.6(2)	15/15
JADEctpb	5.7(4)	6.8(2)	7.4(2)	9.3(2)	11(3)	12(2)	15/15
MVDE	15(11)	14(9)	22(15)	48(32)	71(28)	91(28)	15/15
NBIPOPaCMA	3.6(2)	4.9(5)	4.5(3)	4.7(2)	5.1(2)	5.3(2)	15/15
NIPOPaCMA	3.1(0.8)	3.3(2)	3.8(1)	4.2(0.9)	4.5(0.8)	4.7(0.8)	15/15
PSO-BFGS	4.9(1)	**2.5**(1)	**1.6**(0.6)	**1.4**(0.5)	**1.4**(0.4)	**1.4**(0.4)	15/15
SNES	**2.9**(1)	4.8(3)	112(70)	562(340)	1077(659)	2172(2022)	6/15
xNES	3.3(2)	4.7(2)	4.6(2)	5.6(2)	6.2(3)	6.6(3)	15/15
xNESas	3.7(2)	6.6(4)	8.7(9)	12(23)	13(22)	14(21)	15/15

Table 35: 03-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-3	1e-5	1e-7	#succ
f10	114	152	168	194	218	242	15/15
ACOR	94(148)	499(587)	1012(1207)	1797(2028)	2276(2339)	1.1e4(2e4)	9/15
BIPOPaCMA	3.4(2)	3.6(1)	3.6(0.8)	3.6(0.8)	3.6(0.7)	3.7(0.6)	15/15
BIPOPsaACM	**1.4**(0.3)	**1.3**(0.2)	**1.3**(0.3)	**1.3**(0.2)	**1.3**(0.2)	**1.3**(0.2)	15/15
CMA	5.3(2)	4.8(0.9)	4.7(0.4)	4.6(0.3)	4.5(0.3)	4.4(0.3)	15/15
CMAES	4.7(3)	4.7(2)	4.7(1)	4.7(0.7)	4.6(0.6)	4.6(0.5)	15/15
CMAa	3.5(2)	3.4(0.6)	3.3(0.7)	3.5(0.5)	3.5(0.6)	3.6(0.5)	15/15
CMAm	5.1(3)	4.9(2)	5.0(0.8)	4.8(0.7)	4.6(0.6)	4.5(0.5)	15/15
CMAma	3.7(2)	3.5(1)	3.6(0.5)	3.7(0.3)	3.5(0.3)	3.5(0.2)	15/15
CMAmah	4.3(2)	4.7(2)	4.8(0.7)	4.5(0.7)	4.3(0.5)	4.2(0.5)	15/15
CMAmh	6.2(3)	6.5(0.9)	6.5(0.6)	6.1(0.4)	5.7(0.4)	5.4(0.4)	15/15
DBRCGA	14(23)	67(81)	89(186)	152(177)	227(250)	258(230)	15/15
DE	9.4(4)	11(3)	13(3)	17(3)	20(3)	22(3)	15/15
DE-AUTO	**0.70**(0.1)	**0.54**(0.1)$_{\downarrow 4}$	**0.51**(0.1)$_{\downarrow 4}$	**0.49**(0.0)$_{\downarrow 4}$	**0.47**(0.0)$_{\downarrow 4}$	**0.47**(0.1)$_{\downarrow 4}$	15/15
DE-BFGS	**0.76**(0.1)	**0.60**(0.1)$_{\downarrow 2}$	**0.56**(0.1)$_{\downarrow 3}$	**0.56**(0.1)$_{\downarrow 3}$	**0.54**(0.1)$_{\downarrow 3}$	**0.53**(0.1)$_{\downarrow 3}$	15/15
DE-ROLL	59(59)	100(64)	158(67)	207(89)	263(74)	1347(1295)	4/15
DE-SIMPLEX	**1.4**(0.7)	**1.5**(1)	**1.4**(0.9)	**1.4**(0.7)	**1.4**(0.7)	**1.3**(0.6)	15/15
DEctpb	11(5)	12(3)	14(3)	18(3)	22(4)	25(3)	15/15
IPOPsaACM	**1.4**(0.3)	**1.3**(0.4)	**1.3**(0.4)	**1.3**(0.3)	**1.3**(0.3)	**1.3**(0.2)	15/15
JADEb	5.5(4)	5.4(3)	6.3(2)	6.7(2)	6.9(2)	7.1(2)	15/15
JADEctpb	5.2(2)	5.1(2)	5.5(1)	6.4(1)	7.0(0.9)	7.2(0.9)	15/15
MVDE	33(17)	51(20)	63(13)	86(17)	105(24)	122(18)	15/15
NBIPOPaCMA	3.6(1)	3.3(1)	3.4(1.0)	3.4(0.8)	3.5(0.6)	3.5(0.5)	15/15
NIPOPaCMA	3.7(2)	3.6(0.9)	3.7(0.4)	3.7(0.5)	3.7(0.4)	3.7(0.3)	15/15
PSO-BFGS	**0.70**(0.1)	**0.57**(0.1)$_{\downarrow 3}$	**0.54**(0.1)$_{\downarrow 4}$	**0.53**(0.1)$_{\downarrow 4}$	**0.53**(0.1)$_{\downarrow 4}$	**0.57**(0.1)$_{\downarrow 3}$	15/15
SNES	356(534)	653(682)	2453(2872)	6450(7067)	∞	∞ *3e5*	0/15
xNES	3.2(3)	4.7(3)	7.8(4)	12(6)	13(5)	13(5)	15/15
xNESas	3.8(2)	3.9(2)	4.3(2)	4.5(2)	4.5(2)	4.7(2)	15/15

Table 36: 03-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-3	1e-5	1e-7	#succ
f11	67	105	227	277	302	327	15/15
ACOR	114(112)	192(170)	180(143)	282(137)	381(167)	488(222)	15/15
BIPOPaCMA	5.2(3)	4.2(2)	**2.4**(0.6)	**2.4**(0.4)	**2.5**(0.4)	**2.5**(0.3)	15/15
BIPOPsaACM	**2.3**(0.6)	**1.8**(0.3)	**0.91**(0.2)	**0.84**(0.1)	**0.87**(0.1)	**0.90**(0.1)	15/15
CMA	8.6(4)	7.0(2)	3.8(0.4)	3.5(0.4)	3.6(0.4)	3.6(0.3)	15/15
CMAES	9.2(5)	7.4(2)	3.9(0.8)	3.6(0.6)	3.7(0.4)	3.6(0.5)	15/15
CMAa	5.9(3)	5.1(0.9)	**2.6**(0.3)	**2.5**(0.3)	**2.6**(0.3)	**2.7**(0.3)	15/15
CMAm	9.3(5)	9.0(1)	4.4(0.6)	3.9(0.4)	3.9(0.4)	3.8(0.4)	15/15
CMAma	6.2(3)	5.4(1)	**2.8**(0.5)	**2.6**(0.3)	**2.6**(0.3)	**2.6**(0.3)	15/15
CMAmah	10(3)	8.2(1)	4.2(0.3)	3.7(0.4)	3.6(0.3)	3.5(0.3)	15/15
CMAmh	13(7)	12(3)	5.8(1)	5.0(0.8)	4.8(0.7)	4.6(0.7)	15/15
DBRCGA	7.4(4)	39(60)	43(52)	93(128)	147(199)	256(372)	12/15
DE	11(6)	13(9)	8.1(5)	10(4)	13(4)	15(5)	15/15
DE-AUTO	**1.1**(0.1)	3.4(0.1)	**1.6**(0.0)	**1.4**(0.0)	**1.3**(0.0)	**1.6**(3)	15/15
DE-BFGS	**1.1**(0.1)	**0.72**(0.1)	**0.37**(0.0)$_{\downarrow 3}$	**0.34**(0.0)$_{\downarrow 4}$	**0.34**(0.0)$_{\downarrow 4}$	**0.44**(0.2)$_{\downarrow 3}$	15/15
DE-ROLL	73(78)	148(122)	116(39)	157(66)	218(67)	1746(1839)	2/15
DE-SIMPLEX	3.6(3)	3.1(2)	**1.8**(0.8)	**1.6**(0.6)	**1.5**(0.6)	**1.5**(0.6)	15/15
DEctpb	10(8)	13(6)	8.1(4)	11(4)	14(3)	16(4)	15/15
IPOPsaACM	**2.2**(0.8)	**1.8**(0.3)	**0.91**(0.1)	**0.85**(0.1)	**0.90**(0.1)	**0.91**(0.1)	15/15
JADEb	8.3(8)	8.2(8)	4.9(5)	4.8(4)	5.2(3)	5.5(3)	15/15
JADEctpb	7.0(3)	6.4(2)	4.0(1)	4.3(0.9)	5.0(1.0)	5.6(0.9)	15/15
MVDE	21(15)	34(17)	26(12)	48(13)	67(12)	79(15)	15/15
NBIPOPaCMA	6.2(3)	5.1(1)	**2.7**(0.5)	**2.6**(0.4)	**2.7**(0.3)	**2.8**(0.4)	15/15
NIPOPaCMA	5.6(3)	5.2(2)	**2.7**(0.8)	**2.5**(0.5)	**2.7**(0.6)	**2.8**(0.5)	15/15
PSO-BFGS	**1.2**(0.3)	**0.84**(0.2)	**0.42**(0.1)	**0.38**(0.1)$_{\downarrow 4}$	**0.38**(0.1)$_{\downarrow 4}$	**0.41**(0.1)$_{\downarrow 4}$	15/15
SNES	152(213)	2283(2544)	6036(6608)	∞	∞	∞ *3e5*	0/15
xNES	4.4(3)	4.6(4)	**2.5**(2)	**2.7**(2)	3.5(2)	4.6(1)	15/15
xNESas	4.8(3)	6.6(2)	6.9(2)	6.4(4)	6.2(4)	6.2(3)	15/15

Table 37: 03-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-3	1e-5	1e-7	#succ
f12	65	168	338	445	696	790	15/15
ACOR	151(98)	1639(3363)	1936(2490)	5413(5407)	1.0e4(1e4)	3.7e4(4e4)	2/15
BIPOPaCMA	7.3(6)	5.6(5)	3.8(3)	3.8(3)	3.0(2)	3.1(2)	15/15
BIPOPsaACM	**2.9**(2)	**2.5**(2)	**2.0**(2)	4.4(6)	5.2(9)	28(74)	15/15
CMA	11(18)	9.1(12)	6.5(7)	6.2(7)	4.8(5)	4.8(5)	15/15
CMAES	10(11)	7.2(6)	5.5(4)	5.4(4)	4.7(3)	4.8(3)	15/15
CMAa	10(11)	7.6(8)	5.1(5)	5.0(4)	4.2(3)	4.3(2)	15/15
CMAm	9.1(11)	9.3(8)	7.1(5)	6.9(5)	5.4(4)	5.5(4)	15/15
CMAma	7.9(8)	6.5(6)	4.7(4)	4.5(3)	3.6(3)	3.6(3)	15/15
CMAmah	10(12)	8.7(8)	6.0(3)	5.8(4)	4.5(3)	4.4(3)	15/15
CMAmh	16(19)	12(14)	9.0(8)	8.5(7)	6.6(5)	6.6(5)	15/15
DBRCGA	122(158)	182(196)	166(163)	191(177)	169(183)	204(173)	13/15
DE	42(72)	34(44)	26(26)	26(22)	21(16)	22(15)	15/15
DE-AUTO	4.6(8)	**2.4**(3)	**1.4**(1)	**1.5**(1)	**1.2**(0.8)	**1.2**(0.8)	15/15
DE-BFGS	**2.1**(2)	**1.1**(1)	**0.73**(0.6)	**0.75**(0.5)	**0.59**(0.4)	**0.59**(0.4)	15/15
DE-ROLL	80(31)	55(32)	53(45)	104(89)	136(87)	670(642)	2/15
DE-SIMPLEX	**2.5**(1)	**2.0**(2)	**1.4**(1)	**1.4**(1.0)	**1.1**(0.7)	**1.1**(0.7)	15/15
DEctpb	22(11)	18(10)	16(10)	21(15)	19(13)	20(12)	15/15
IPOPsaACM	4.4(4)	3.1(3)	**2.1**(3)	**2.2**(3)	**1.8**(2)	**1.8**(2)	15/15
JADEb	9.1(7)	10(8)	7.5(6)	7.4(5)	5.7(4)	5.7(3)	15/15
JADEctpb	11(4)	8.7(6)	6.1(4)	6.2(3)	5.0(2)	5.0(2)	15/15
MVDE	75(49)	101(92)	97(139)	118(111)	109(85)	116(86)	15/15
NBIPOPaCMA	6.0(3)	5.3(4)	4.2(4)	4.4(4)	3.3(3)	3.6(4)	15/15
NIPOPaCMA	8.5(7)	6.0(6)	4.4(3)	4.3(3)	3.4(2)	3.4(2)	15/15
PSO-BFGS	**1.8**(0.8)	**0.95**(0.6)	**0.57**(0.4)	**0.57**(0.3)	**0.53**(0.3)	**0.66**(0.6)	15/15
SNES	20(24)	82(65)	221(411)	2441(2377)	6448(6471)	∞ *3e5*	0/15
xNES	17(38)	19(22)	17(46)	23(43)	18(42)	17(38)	15/15
xNESas	17(19)	23(37)	33(66)	30(58)	26(40)	35(51)	15/15

Table 38: 03-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-3	1e-5	1e-7	#succ
f13	49	85	108	215	281	365	15/15
ACOR	11(7)	133(141)	1481(2814)	4701(4184)	8.5e4(1e5)	4.0e5(5e5)	1/15
BIPOPaCMA	3.1(1)	3.7(1)	3.8(1)	3.3(1)	3.5(0.7)	**3.4**(0.5)	15/15
BIPOPsaACM	**2.0**(0.4)	**1.8**(0.5)	**1.7**(0.5)	**1.3**(0.2)	**1.3**(0.3)	**1.2**(0.2)	15/15
CMA	3.1(1)	5.3(3)	5.2(2)	4.0(1.0)	4.1(0.9)	4.3(0.6)	15/15
CMAES	3.4(2)	5.3(3)	5.9(2)	4.3(0.6)	4.5(0.7)	4.5(1)	15/15
CMAa	3.0(2)	3.4(0.8)	4.0(0.6)	3.1(0.7)	3.5(0.9)	3.4(0.7)	15/15
CMAm	4.2(2)	4.9(3)	6.4(3)	4.5(2)	4.7(1)	5.0(2)	15/15
CMAma	3.4(2)	4.3(2)	4.8(2)	3.6(0.8)	3.8(0.7)	3.5(0.5)	15/15
CMAmah	4.4(6)	5.0(5)	6.6(4)	5.5(2)	6.6(2)	5.8(1)	15/15
CMAmh	7.7(9)	8.6(6)	9.0(5)	9.3(4)	8.0(2)	8.0(4)	15/15
DBRCGA	8.3(2)	14(9)	18(15)	46(49)	81(46)	572(603)	8/15
DE	9.3(2)	12(4)	14(5)	16(5)	19(5)	22(7)	15/15
DE-AUTO	**1.8**(0.2)	**1.2**(0.2)	**1.1**(0.1)	**0.73**(0.1)	**1.9**(2)	3.6(0.7)	15/15
DE-BFGS	**1.7**(0.3)	**1.2**(0.2)	**1.1**(0.1)	**0.72**(0.1)	5.9(5)	863(1217)	0/15
DE-ROLL	48(77)	51(77)	74(58)	53(33)	55(26)	148(146)	13/15
DE-SIMPLEX	**3.0**(1)	**2.9**(1)	**2.8**(1)	**1.7**(0.3)	**1.6**(0.4)	**1.9**(1)	15/15
DEctpb	9.1(4)	13(4)	17(6)	18(4)	21(5)	22(3)	15/15
IPOPsaACM	**2.4**(1)	**1.8**(0.6)	**1.9**(0.6)	**1.4**(0.5)	**1.4**(0.3)	**1.3**(0.2)	15/15
JADEb	4.8(2)	5.0(2)	6.1(2)	6.4(3)	7.1(2)	6.8(2)	15/15
JADEctpb	5.9(2)	7.2(2)	8.8(2)	7.4(1)	7.3(0.5)	6.7(0.5)	15/15
MVDE	18(11)	31(8)	55(23)	75(20)	98(19)	114(13)	15/15
NBIPOPaCMA	3.8(1)	3.7(1.0)	4.5(1)	3.3(0.7)	3.6(0.6)	3.4(0.4)	15/15
NIPOPaCMA	3.7(1)	3.8(1)	4.3(1)	3.4(1.0)	3.6(0.7)	3.4(0.5)	15/15
PSO-BFGS	**1.7**(0.1)	**1.2**(0.2)	**1.1**(0.1)	**0.72**(0.1)	95(58)	1.2e4(1e4)	0/15
SNES	25(34)	83(86)	228(314)	1779(2017)	1.6e4(2e4)	∞ *3e5*	0/15
xNES	4.7(3)	4.3(2)	4.5(1)	3.5(0.8)	3.7(0.5)	3.6(0.3)	15/15
xNESas	11(2)	8.0(0.9)	7.5(0.9)	4.9(0.9)	4.8(0.5)	4.5(0.4)	15/15

Table 39: 03-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-3	1e-5	1e-7	#succ
f14	2.2	17	28	71	110	194	15/15
ACOR	**1.9**(2)	3.7(2)	6.1(2)	7.3(2)	77(62)	1802(1766)	11/15
BIPOPaCMA	**2.9**(4)	**2.8**(2)	3.4(2)	4.0(1.0)	4.9(0.8)	4.1(0.4)	15/15
BIPOPsaACM	**1.8**(2)	**2.3**(2)	3.2(0.7)	**2.5**(0.4)	**2.5**(0.5)	**1.9**(0.3)	15/15
CMA	**2.8**(3)	3.1(2)	4.4(1)	4.1(1)	6.9(1)	5.8(0.8)	15/15
CMAES	**2.6**(3)	**2.8**(2)	3.7(2)	4.6(2)	6.6(0.4)	5.8(0.8)	15/15
CMAa	3.9(4)	**2.7**(3)	4.1(2)	4.2(0.7)	4.8(0.9)	4.2(0.5)	15/15
CMAm	**2.8**(4)	**2.5**(2)	3.4(2)	3.6(1)	6.1(2)	5.7(1)	15/15
CMAma	3.7(3)	3.1(2)	3.8(2)	4.1(1)	5.2(0.9)	4.4(0.9)	15/15
CMAmah	3.5(4)	**2.2**(2)	**2.8**(1)	3.6(2)	6.7(2)	6.1(0.7)	15/15
CMAmh	**2.3**(2)	**2.1**(2)	**2.4**(1)	4.3(1)	7.8(2)	7.6(2)	15/15
DBRCGA	**1.9**(2)	6.0(5)	13(6)	15(3)	45(51)	370(579)	14/15
DE	**2.0**(2)	4.1(3)	6.5(4)	9.1(2)	14(3)	16(4)	15/15
DE-AUTO	**2.3**(3)	3.2(2)	**2.8**(0.5)	**1.4**(0.2)	**1.2**(0.1)	4.9(5)	15/15
DE-BFGS	**1.9**(1)	**1.9**(2)	**2.4**(0.3)	**1.3**(0.2)	**1.1**(0.1)	**2.1**(2)	15/15
DE-ROLL	**2.2**(2)	6.3(2)	7.1(6)	20(18)	195(81)	845(914)	1/15
DE-SIMPLEX	**1.7**(2)	4.9(1)	3.9(1)	**2.3**(0.6)	**2.0**(0.5)	**1.4**(0.3)	15/15
DEctpb	**1.8**(2)	4.1(3)	8.6(2)	10(2)	17(5)	18(5)	15/15
IPOPsaACM	3.4(5)	**2.4**(2)	3.2(0.8)	**2.4**(0.6)	**2.4**(0.4)	**1.8**(0.3)	15/15
JADEb	**2.3**(2)	3.0(1)	4.6(2)	5.3(2)	7.1(2)	7.1(2)	15/15
JADEctpb	**2.1**(3)	4.3(3)	5.8(2)	7.1(2)	9.1(1)	7.9(1)	15/15
MVDE	**2.0**(2)	6.1(5)	17(8)	26(7)	56(26)	76(21)	15/15
NBIPOPaCMA	**2.5**(3)	**2.0**(2)	3.1(2)	3.7(0.7)	4.6(0.8)	4.0(0.4)	15/15
NIPOPaCMA	**2.5**(3)	**2.1**(2)	3.3(1)	4.1(0.9)	4.9(0.5)	4.2(0.5)	15/15
PSO-BFGS	**2.2**(2)	3.1(2)	**2.7**(0.4)	**1.4**(0.2)	**1.1**(0.1)	24(47)	10/15
SNES	6.8(6)	3.2(2)	3.6(2)	14(11)	4800(4494)	∞ *3e5*	0/15
xNES	3.7(5)	**2.8**(2)	3.7(2)	4.4(0.8)	5.0(0.8)	3.9(0.3)	15/15
xNESas	4.3(4)	**2.7**(3)	3.4(1)	4.3(1)	7.0(1)	5.3(0.9)	15/15

Table 40: 03-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-3	1e-5	1e-7	#succ
f15	121	1372	6285	8429	8787	9041	15/15
ACOR	**1.7**(0.6)	8.1(20)	10(13)	7.5(9)	7.2(9)	7.1(9)	15/15
BIPOPaCMA	**1.4**(0.7)	**1.5**(1)	**1.4**(1)	**1.2**(1)	**1.2**(1)	**1.2**(1)	15/15
BIPOPsaACM	**1.2**(0.8)	**1.2**(1)	**0.97**(0.7)	**0.76**(0.6)	**0.74**(0.6)	**0.73**(0.5)	15/15
CMA	**1.0**(0.6)	**1.7**(1)	**1.1**(1)	**0.92**(1)	**0.92**(1)	**0.92**(1)	15/15
CMAES	**0.96**(0.5)	**2.1**(2)	**1.6**(0.9)	**1.2**(0.7)	**1.2**(0.7)	**1.2**(0.6)	15/15
CMAa	**1.2**(1.0)	**1.3**(1)	**0.97**(0.8)	**0.76**(0.6)	**0.76**(0.6)	**0.77**(0.6)	15/15
CMAm	**0.91**(0.8)	**1.6**(1)	**1.2**(0.7)	**0.93**(0.6)	**0.92**(0.5)	**0.93**(0.5)	15/15
CMAma	**0.96**(0.4)	**1.5**(1.0)	**1.3**(2)	**1.0**(1)	**1.0**(1)	**1.1**(1)	15/15
CMAmah	**2.4**(4)	**2.0**(2)	**0.92**(0.5)	**0.78**(0.4)	**0.78**(0.4)	**0.78**(0.4)	15/15
CMAmh	**2.6**(4)	**1.3**(1)	**0.88**(0.9)	**0.70**(0.7)	**0.70**(0.7)	**0.71**(0.7)	15/15
DBRCGA	**2.8**(1)	3.8(3)	**2.1**(2)	**1.7**(2)	**1.6**(2)	**1.6**(2)	15/15
DE	**2.1**(1)	**2.5**(2)	**1.8**(2)	**1.4**(2)	**1.4**(1)	**1.3**(1)	15/15
DE-AUTO	8.2(12)	5.4(6)	4.0(4)	3.0(3)	**2.9**(3)	**2.8**(3)	15/15
DE-BFGS	**1.3**(0.9)	**1.0**(0.4)	**0.98**(0.9)	**0.73**(0.7)	**0.70**(0.7)	**0.68**(0.6)	15/15
DE-ROLL	6.8(10)	7.5(6)	5.1(6)	3.8(4)	3.6(4)	3.5(4)	15/15
DE-SIMPLEX	5.2(4)	**2.3**(1.0)	**1.8**(2)	**1.4**(1)	**1.3**(1)	**1.3**(1)	15/15
DEctpb	**1.9**(2)	**2.5**(2)	**1.4**(2)	**1.2**(1)	**1.2**(1)	**1.2**(1)	15/15
IPOPsaACM	**0.90**(0.5)	**1.2**(1)	**0.97**(0.8)	**0.79**(0.6)	**0.77**(0.6)	**0.76**(0.6)	15/15
JADEb	**1.4**(0.8)	3.1(5)	3.8(5)	**2.9**(3)	**2.8**(3)	**2.7**(3)	15/15
JADEctpb	**1.8**(0.5)	**1.6**(0.7)	**0.94**(1.0)	**0.80**(0.7)	**0.82**(0.7)	**0.82**(0.7)	15/15
MVDE	**2.8**(1)	56(3)	26(80)	20(59)	19(57)	19(55)	13/15
NBIPOPaCMA	**1.0**(0.5)	**1.8**(2)	**2.8**(2)	**2.2**(2)	**2.2**(2)	**2.3**(2)	15/15
NIPOPaCMA	**0.94**(0.5)	**1.8**(1)	**1.1**(0.7)	**0.91**(0.6)	**0.90**(0.6)	**0.92**(0.6)	15/15
PSO-BFGS	5.0(5)	3.4(3)	**1.9**(2)	**1.4**(1)	**1.4**(1)	**1.3**(1)	15/15
SNES	**1.3**(0.9)	5.5(5)	10(16)	7.8(12)	7.5(12)	7.3(11)	15/15
xNES	**2.8**(2)	10(11)	10(11)	7.6(8)	7.3(8)	7.1(7)	14/15
xNESas	**1.2**(0.6)	5.5(8)	5.1(5)	3.8(4)	3.7(4)	3.6(4)	15/15

Table 41: 03-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-3	1e-5	1e-7	#succ
f16	41	319	582	1864	3204	3361	15/15
ACOR	**1.7**(1)	10(8)	63(101)	31(39)	18(23)	17(22)	15/15
BIPOPaCMA	**1.5**(2)	**2.6**(3)	4.1(6)	**1.8**(3)	**1.1**(2)	**1.1**(2)	15/15
BIPOPsaACM	**1.1**(2)	**2.9**(4)	**2.4**(2)	**1.4**(1)	**0.92**(0.7)	**0.94**(0.7)	15/15
CMA	**1.4**(1)	**2.7**(3)	**2.3**(2)	**1.4**(1)	**0.95**(0.9)	**0.96**(0.8)	15/15
CMAES	**1.5**(1)	**2.9**(6)	4.9(5)	3.1(6)	**2.2**(3)	**2.1**(3)	15/15
CMAa	**1.7**(2)	**2.8**(3)	**2.7**(4)	**1.6**(1)	**1.1**(1)	**1.2**(1)	15/15
CMAm	**1.7**(2)	3.0(4)	3.1(3)	**1.3**(1)	**1.2**(0.6)	**1.2**(0.6)	15/15
CMAma	4.3(3)	3.6(4)	3.5(3)	**1.6**(2)	**1.1**(1)	**1.1**(1)	15/15
CMAmah	6.8(14)	3.5(3)	3.6(4)	**1.6**(0.7)	**0.98**(0.4)	**0.98**(0.4)	15/15
CMAmh	**1.6**(1)	3.7(3)	5.3(7)	**2.7**(3)	**1.8**(2)	**1.7**(2)	15/15
DBRCGA	**1.7**(2)	5.6(11)	8.3(9)	15(15)	15(18)	15(17)	15/15
DE	**2.2**(2)	4.8(3)	5.1(3)	3.2(4)	**2.1**(2)	**2.1**(2)	15/15
DE-AUTO	11(15)	26(38)	38(29)	37(21)	26(15)	35(34)	14/15
DE-BFGS	**1.5**(2)	3.6(4)	34(27)	13(15)	7.8(9)	54(73)	4/15
DE-ROLL	**0.91**(0.7)	23(31)	69(30)	58(83)	38(47)	74(74)	5/15
DE-SIMPLEX	**2.1**(3)	**2.6**(2)	3.2(3)	**1.7**(1)	**1.9**(0.7)	7.6(5)	15/15
DEctpb	**1.9**(2)	6.3(5)	8.9(4)	7.0(4)	8.8(4)	12(24)	13/15
IPOPsaACM	**2.7**(1)	3.9(7)	**2.8**(4)	**1.1**(1)	**0.81**(0.9)	**0.84**(0.9)	15/15
JADEb	**1.2**(1)	**2.1**(1)	**2.2**(0.5)	**1.8**(3)	**1.3**(1)	**1.4**(1)	15/15
JADEctpb	**1.2**(0.7)	3.5(3)	6.2(5)	4.4(3)	3.0(3)	4.8(3)	15/15
MVDE	**1.0**(0.8)	5.3(4)	15(7)	204(271)	120(158)	115(151)	11/15
NBIPOPaCMA	**1.6**(2)	**2.4**(3)	**2.2**(2)	**1.1**(1)	**0.74**(0.8)	**0.74**(0.7)	15/15
NIPOPaCMA	**1.5**(1)	**2.6**(2)	**2.8**(3)	**0.99**(0.9)	**0.71**(0.6)	**0.72**(0.5)	15/15
PSO-BFGS	3.4(4)	4.4(5)	9.2(7)	14(11)	11(11)	59(59)	6/15
SNES	**1.9**(2)	**3.0**(5)	5.0(5)	11(21)	15(19)	35(47)	12/15
xNES	**1.4**(2)	**2.6**(5)	4.3(4)	**1.8**(3)	**1.2**(2)	**1.1**(2)	15/15
xNESas	**0.92**(1)	**2.8**(4)	3.2(3)	**1.1**(1)	**0.71**(0.6)	**0.73**(0.6)	15/15

Table 42: 03-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-3	1e-5	1e-7	#succ
f17	3.6	78	282	1134	2347	3469	15/15
ACOR	**2.4**(2)	**2.0**(0.7)	**1.5**(0.3)	6.0(0.2)	3.2(0.1)	4.6(13)	15/15
BIPOPaCMA	4.2(7)	**1.8**(1)	**1.5**(2)	**0.89**(0.6)	**1.0**(0.8)	**0.81**(0.6)	15/15
BIPOPsaACM	3.4(5)	**1.3**(0.6)	**1.9**(3)	**1.3**(1)	**1.6**(1)	**1.4**(0.9)	15/15
CMA	**2.9**(5)	**2.1**(0.5)	**1.1**(0.3)	**1.00**(0.7)	**0.66**(0.4)	**0.72**(0.7)	15/15
CMAES	4.4(3)	**1.1**(0.5)	**1.6**(2)	**1.1**(0.8)	**2.6**(4)	3.3(4)	15/15
CMAa	4.4(5)	**2.4**(1)	**1.4**(2)	**0.94**(0.9)	**0.96**(0.8)	**0.84**(0.6)	15/15
CMAm	3.6(3)	3.4(7)	**1.3**(2)	**0.88**(0.6)	**1.0**(0.5)	**0.94**(0.5)	15/15
CMAma	4.9(6)	**1.7**(0.7)	**1.7**(2)	**0.98**(0.6)	**0.80**(0.8)	**0.78**(0.6)	15/15
CMAmah	3.7(5)	**2.4**(0.6)	4.0(4)	**2.0**(1)	**1.3**(0.3)	**1.2**(0.4)	15/15
CMAmh	5.3(4)	10(26)	4.7(7)	**2.5**(2)	**1.6**(0.9)	**1.3**(0.6)	15/15
DBRCGA	**2.0**(2)	3.7(1)	3.1(0.8)	3.2(5)	4.4(5)	8.1(13)	15/15
DE	**1.8**(2)	**2.7**(1)	**2.3**(0.8)	**1.4**(0.3)	**1.4**(0.4)	**1.8**(2)	15/15
DE-AUTO	**2.4**(2)	31(41)	22(13)	16(10)	13(6)	16(10)	15/15
DE-BFGS	3.1(2)	5.5(5)	4.0(3)	**2.7**(1)	**2.0**(0.5)	50(65)	3/15
DE-ROLL	19(3)	15(18)	24(16)	19(12)	15(10)	127(121)	5/15
DE-SIMPLEX	**2.7**(3)	8.9(6)	5.8(2)	3.7(0.8)	3.1(0.6)	242(304)	0/15
DEctpb	**1.9**(2)	3.1(2)	**2.5**(0.7)	**1.8**(0.4)	**1.6**(0.3)	**1.6**(0.5)	15/15
IPOPsaACM	**2.4**(3)	**1.2**(0.8)	**1.3**(2)	**1.3**(0.9)	**1.1**(0.9)	**0.97**(0.5)	15/15
JADEb	**2.0**(2)	**1.4**(0.9)	**1.2**(0.4)	**1.3**(2)	**1.4**(1)	3.6(6)	15/15
JADEctpb	**1.9**(2)	**1.7**(0.9)	**1.8**(0.5)	**1.2**(0.3)	**0.99**(0.2)	**0.92**(0.1)	15/15
MVDE	**1.8**(2)	4.7(2)	5.2(2)	4.9(1)	4.5(1)	4.4(1)	15/15
NBIPOPaCMA	3.1(4)	**2.2**(0.6)	**1.3**(2)	**0.99**(0.7)	**1.0**(0.2)	**1.3**(1.0)	15/15
NIPOPaCMA	3.3(4)	3.1(7)	**1.4**(2)	**0.87**(0.7)	**0.98**(0.5)	**0.92**(0.7)	15/15
PSO-BFGS	**2.1**(3)	11(13)	14(6)	6.6(2)	4.9(0.8)	63(71)	1/15
SNES	6.9(8)	3.9(1.0)	**2.9**(6)	**1.7**(2)	6.3(4)	8.0(9)	14/15
xNES	5.6(6)	**1.6**(1)	**2.4**(5)	**1.9**(3)	3.1(3)	3.0(3)	15/15
xNESas	5.3(5)	3.4(1)	**1.7**(1)	**1.3**(2)	3.3(3)	**2.8**(2)	15/15

Table 43: 03-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-3	1e-5	1e-7	#succ
f18	40	145	1289	3523	4738	5527	15/15
ACOR	**2.2**(1)	3.0(1)	23(60)	15(27)	29(38)	31(39)	15/15
BIPOPaCMA	**1.3**(1)	**2.3**(0.3)	**0.95**(2)	**0.69**(0.6)	**0.70**(0.5)	**0.75**(0.5)	15/15
BIPOPsaACM	**1.2**(0.8)	**2.2**(0.8)	**0.97**(0.8)	**0.62**(0.6)	**1.1**(0.4)	**1.0**(0.4)	15/15
CMA	3.6(1)	**2.0**(1)	**1.0**(1)	**0.83**(0.7)	**0.85**(0.4)	**0.86**(0.4)	15/15
CMAES	**1.3**(0.9)	3.1(5)	**2.5**(3)	3.4(3)	6.5(7)	11(14)	13/15
CMAa	**1.3**(1)	**2.5**(1)	**1.0**(1)	**0.93**(0.6)	**0.87**(0.3)	**0.90**(0.3)	15/15
CMAm	**1.5**(0.8)	**2.3**(0.4)	**1.2**(1)	**1.4**(1)	**1.3**(0.8)	**1.3**(0.8)	15/15
CMAma	**1.2**(0.9)	4.3(7)	**1.6**(2)	**0.90**(0.5)	**0.85**(0.4)	**0.83**(0.3)	15/15
CMAmah	6.1(10)	4.8(4)	**1.8**(2)	**1.3**(0.5)	**1.2**(0.4)	**1.2**(0.5)	15/15
CMAmh	**2.8**(1)	5.2(8)	**2.8**(4)	**1.6**(1.0)	**1.4**(0.6)	**1.3**(0.6)	15/15
DBRCGA	**2.7**(2)	3.6(1)	4.1(6)	22(21)	32(37)	60(64)	9/15
DE	**2.7**(2)	3.9(2)	**1.0**(0.5)	**1.2**(1)	**1.7**(1)	3.4(5)	15/15
DE-AUTO	22(24)	37(33)	10(11)	15(5)	16(5)	24(28)	13/15
DE-BFGS	**2.3**(2)	9.0(7)	**2.2**(1)	**2.2**(2)	**2.2**(2)	91(111)	0/15
DE-ROLL	16(36)	34(39)	14(10)	17(8)	23(19)	188(192)	0/15
DE-SIMPLEX	9.4(9)	27(33)	10(13)	5.1(5)	4.7(5)	170(190)	0/15
DEctpb	**2.6**(1)	4.1(2)	**1.2**(0.5)	**1.2**(0.3)	**1.9**(2)	5.8(6)	14/15
IPOPsaACM	**1.4**(1)	4.0(6)	**1.3**(0.9)	**0.91**(0.6)	**1.1**(0.4)	**1.3**(0.6)	15/15
JADEb	**1.3**(1.0)	**1.8**(2)	**1.8**(5)	**2.7**(6)	6.8(9)	13(14)	13/15
JADEctpb	**1.9**(0.7)	**2.8**(1.0)	**0.74**(0.2)	**0.57**(0.1)	**0.65**(0.1)	**0.76**(0.1)	15/15
MVDE	3.4(2)	8.0(2)	3.3(1)	3.9(1)	5.5(1)	6.4(2)	15/15
NBIPOPaCMA	**2.9**(2)	3.0(4)	**1.0**(0.7)	**0.89**(1.0)	**0.91**(0.6)	**1.1**(0.6)	15/15
NIPOPaCMA	**1.5**(1)	5.2(8)	**1.6**(2)	**1.1**(0.5)	**1.0**(0.4)	**0.95**(0.4)	15/15
PSO-BFGS	7.7(8)	24(20)	20(40)	10(15)	12(13)	243(275)	0/15
SNES	**1.7**(1)	3.6(3)	5.5(6)	71(85)	443(507)	390(435)	2/15
xNES	**1.7**(1)	5.9(11)	**1.5**(2)	**1.3**(2)	**2.8**(3)	3.8(3)	15/15
xNESas	**1.1**(0.9)	**2.4**(0.9)	**0.72**(0.8)	**0.61**(0.4)	**1.5**(2)	**2.4**(3)	15/15

Table 44: 03-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-3	1e-5	1e-7	#succ
f19	1	1	109	7367	7399	7441	15/15
ACOR	**4.3**(2)	170(119)	31(38)	13(18)	14(19)	15(20)	15/15
BIPOPaCMA	10(11)	**140**(118)	38(46)	3.9(4)	3.9(4)	3.9(4)	15/15
BIPOPsaACM	8.4(16)	424(684)	31(21)	**1.8**(2)	**1.8**(2)	**1.8**(2)	15/15
CMA	7.7(6)	203(364)	132(226)	8.4(9)	8.5(9)	8.5(9)	15/15
CMAES	10(9)	312(638)	50(38)	7.6(10)	7.6(10)	7.6(11)	13/15
CMAa	7.3(7)	**109**(98)	88(140)	4.4(4)	4.5(4)	4.5(4)	15/15
CMAm	10(8)	493(560)	153(289)	8.9(8)	8.9(8)	8.9(8)	15/15
CMAma	**5.7**(4)	382(911)	60(38)	5.6(8)	5.6(8)	5.6(8)	15/15
CMAmah	**5.3**(6)	168(185)	228(385)	6.1(7)	6.2(7)	6.2(7)	15/15
CMAmh	6.4(6)	325(178)	102(160)	4.5(5)	4.5(5)	4.5(5)	15/15
DBRCGA	12(15)	235(140)	38(33)	19(27)	19(25)	19(21)	12/15
DE	14(16)	276(230)	35(37)	5.1(7)	5.2(7)	5.2(7)	14/15
DE-AUTO	**4.1**(4)	1701(1930)	81(75)	15(21)	15(21)	19(22)	12/15
DE-BFGS	18(18)	310(238)	**19**(21)	11(18)	11(17)	18(19)	7/15
DE-ROLL	10(10)	879(1802)	72(83)	22(27)	22(25)	35(43)	6/15
DE-SIMPLEX	12(18)	685(1100)	32(33)	9.4(14)	9.4(14)	9.3(14)	14/15
DEctpb	10(8)	279(250)	**24**(12)	**1.6**(0.5)	**2.1**(1)	**2.2**(1)	15/15
IPOPsaACM	8.1(7)	268(375)	138(141)	5.3(8)	5.4(8)	5.4(8)	15/15
JADEb	12(14)	159(148)	**20**(19)	4.0(10)	4.7(10)	4.7(10)	13/15
JADEctpb	13(16)	166(172)	**27**(21)	**3.0**(2)	**3.2**(1)	**3.3**(1)	14/15
MVDE	10(9)	387(328)	30(28)	70(136)	71(135)	71(134)	10/15
NBIPOPaCMA	9.2(8)	174(152)	41(50)	3.4(4)	3.4(4)	**3.4**(4)	15/15
NIPOPaCMA	11(12)	**114**(86)	110(167)	13(17)	13(18)	13(18)	15/15
PSO-BFGS	8.4(8)	491(938)	41(31)	**2.9**(4)	**2.9**(4)	14(21)	9/15
SNES	9.1(8)	264(399)	27(28)	8.1(7)	16(10)	23(13)	11/15
xNES	7.5(9)	**137**(132)	41(46)	5.5(4)	5.8(5)	5.8(5)	15/15
xNESas	8.3(8)	526(250)	62(79)	10(9)	14(9)	14(9)	14/15

Table 45: 03-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-3	1e-5	1e-7	#succ
f20	8.3	385	2291	2481	2573	2776	15/15
ACOR	4.1(4)	**1.5**(0.9)	**2.3**(0.3)	**2.3**(0.4)	**2.3**(0.4)	**2.2**(0.3)	15/15
BIPOPaCMA	**1.4**(1)	5.6(8)	6.0(8)	6.2(7)	6.1(7)	5.8(7)	15/15
BIPOPsaACM	**2.9**(2)	**2.7**(3)	3.7(4)	3.6(4)	3.5(4)	3.3(4)	15/15
CMA	**2.8**(3)	5.5(7)	5.2(4)	5.5(4)	5.5(4)	5.3(4)	15/15
CMAES	**2.5**(3)	7.1(8)	17(19)	16(17)	16(17)	14(15)	15/15
CMAa	**3.0**(2)	6.5(7)	6.7(4)	6.7(4)	6.7(4)	6.4(4)	15/15
CMAm	3.1(4)	7.3(8)	6.0(4)	6.1(4)	6.1(4)	5.8(4)	15/15
CMAma	**1.9**(2)	7.3(6)	6.7(4)	7.1(4)	7.1(4)	6.8(3)	15/15
CMAmah	**1.9**(2)	5.9(7)	6.7(3)	7.0(3)	7.0(3)	6.7(3)	15/15
CMAmh	**2.2**(2)	6.0(7)	7.0(7)	7.2(8)	7.2(8)	6.8(8)	15/15
DBRCGA	5.4(8)	**2.2**(1)	4.5(5)	4.4(4)	4.4(4)	4.2(4)	15/15
DE	4.8(4)	**1.6**(0.7)	**1.5**(2)	**1.6**(2)	**1.6**(2)	**1.6**(2)	15/15
DE-AUTO	**2.8**(3)	6.1(7)	13(16)	12(15)	12(15)	11(14)	15/15
DE-BFGS	5.2(2)	**2.0**(2)	14(12)	12(11)	12(11)	11(10)	15/15
DE-ROLL	4.0(2)	4.3(5)	29(47)	27(28)	26(42)	24(39)	14/15
DE-SIMPLEX	3.4(4)	3.6(4)	41(50)	38(46)	36(45)	34(41)	15/15
DEctpb	**3.0**(5)	**1.7**(0.8)	**1.4**(1)	**1.5**(1)	**1.7**(1)	**1.7**(1)	15/15
IPOPsaACM	**2.2**(2)	3.0(4)	**2.4**(2)	**2.6**(2)	**2.5**(2)	**2.3**(2)	15/15
JADEb	**2.9**(2)	**1.7**(2)	**2.0**(2)	**1.9**(2)	**1.9**(2)	**1.8**(2)	15/15
JADEctpb	**3.0**(3)	**1.1**(0.6)	**1.2**(1)	**1.4**(1)	**1.4**(1)	**1.4**(1)	15/15
MVDE	5.4(5)	**2.2**(1)	110(219)	103(202)	99(195)	93(181)	12/15
NBIPOPaCMA	3.6(3)	3.2(2)	8.0(10)	8.0(10)	7.9(10)	7.6(9)	15/15
NIPOPaCMA	**2.9**(2)	3.4(4)	6.6(9)	6.7(9)	6.6(8)	6.4(8)	15/15
PSO-BFGS	6.0(4)	**2.5**(2)	7.9(11)	7.3(11)	7.1(10)	6.6(9)	15/15
SNES	**1.9**(2)	8.9(11)	10(11)	9.3(10)	9.0(10)	8.4(9)	15/15
xNES	**2.0**(2)	14(16)	19(20)	20(19)	20(18)	18(17)	15/15
xNESas	3.0(3)	7.6(8)	12(13)	14(19)	13(19)	12(17)	15/15

Table 46: 03-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-3	1e-5	1e-7	#succ
f21	5.9	184	425	458	469	482	14/15
ACOR	**1.5**(2)	112(143)	57(62)	54(57)	53(56)	52(54)	15/15
BIPOPaCMA	**1.3**(1)	7.9(12)	11(16)	16(21)	16(21)	16(20)	15/15
BIPOPsaACM	**2.3**(2)	3.4(4)	7.2(15)	7.5(17)	7.5(17)	7.4(17)	15/15
CMA	**1.3**(1)	7.3(12)	6.1(8)	6.6(8)	7.0(8)	7.0(8)	15/15
CMAES	**1.8**(3)	9.2(11)	11(13)	10(12)	10(12)	10(12)	15/15
CMAa	**2.4**(2)	4.0(6)	5.5(6)	15(26)	15(27)	15(28)	15/15
CMAm	**1.3**(1)	10(12)	48(14)	46(13)	46(14)	45(14)	14/15
CMAma	**1.2**(0.9)	8.3(19)	8.3(12)	12(13)	12(15)	12(15)	15/15
CMAmah	**0.97**(1)	6.0(11)	8.0(9)	7.9(8)	8.8(8)	8.8(8)	15/15
CMAmh	**1.5**(2)	4.7(6)	13(14)	13(15)	14(15)	14(15)	15/15
DBRCGA	**1.4**(0.9)	3.4(6)	4.4(6)	5.1(6)	5.7(6)	**6.1**(5)	15/15
DE	**1.8**(2)	3.5(4)	4.1(6)	**4.3**(5)	**4.7**(5)	**5.1**(5)	15/15
DE-AUTO	**1.8**(2)	30(46)	71(128)	66(119)	65(116)	63(113)	15/15
DE-BFGS	**1.2**(0.8)	**2.7**(3)	8.1(9)	7.6(8)	7.5(8)	17(33)	15/15
DE-ROLL	**1.7**(1)	28(44)	48(57)	45(53)	44(52)	43(51)	15/15
DE-SIMPLEX	**1.3**(1)	11(24)	9.1(20)	8.7(18)	8.5(18)	8.3(17)	15/15
DEctpb	**2.5**(2)	**1.9**(3)	**2.0**(2)	**2.9**(2)	**3.6**(2)	**4.2**(2)	15/15
IPOPsaACM	**1.4**(1)	**3.0**(4)	6.7(5)	38(12)	38(12)	37(12)	15/15
JADEb	**1.8**(2)	8.1(7)	10(16)	9.2(15)	9.2(14)	9.1(14)	15/15
JADEctpb	**1.3**(1)	4.5(9)	**2.7**(4)	**3.2**(3)	**3.6**(4)	**3.8**(3)	15/15
MVDE	**1.2**(1)	4.2(3)	**3.1**(2)	5.9(5)	10(5)	11(5)	15/15
NBIPOPaCMA	**2.1**(2)	11(13)	24(38)	23(35)	22(34)	22(33)	15/15
NIPOPaCMA	**1.8**(2)	21(31)	193(284)	185(264)	182(258)	179(251)	15/15
PSO-BFGS	**1.5**(2)	**2.5**(4)	**3.7**(5)	**3.5**(4)	**3.5**(4)	45(64)	14/15
SNES	**1.9**(2)	20(44)	18(26)	17(24)	16(23)	16(23)	15/15
xNES	**1.5**(2)	16(32)	36(50)	34(46)	33(45)	33(44)	15/15
xNESas	**1.5**(1)	43(84)	41(72)	38(67)	37(66)	36(64)	15/15

Table 47: 03-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-3	1e-5	1e-7	#succ
f22	18	170	354	384	401	414	15/15
ACOR	**2.1**(2)	141(297)	175(216)	165(198)	159(189)	156(183)	15/15
BIPOPaCMA	4.5(3)	4.3(3)	32(24)	30(22)	29(21)	28(20)	15/15
BIPOPsaACM	**2.3**(1)	4.1(6)	11(25)	11(23)	11(22)	11(21)	15/15
CMA	**1.6**(1)	**2.8**(3)	47(29)	335(537)	414(620)	481(644)	9/15
CMAES	**0.76**(0.7)	9.5(10)	14(14)	13(13)	13(12)	13(12)	15/15
CMAa	4.6(3)	14(19)	32(53)	315(468)	461(731)	447(626)	9/15
CMAm	4.1(3)	13(12)	60(53)	128(266)	335(380)	325(560)	10/15
CMAma	4.8(5)	12(19)	60(53)	198(303)	406(633)	395(631)	10/15
CMAmah	3.7(3)	11(12)	24(42)	234(340)	288(427)	282(497)	11/15
CMAmh	3.3(2)	3.9(4)	17(26)	57(76)	175(288)	246(374)	11/15
DBRCGA	**1.5**(2)	**1.8**(1)	**3.2**(5)	**4.3**(4)	**5.2**(4)	**6.1**(4)	15/15
DE	**2.0**(2)	**2.1**(1)	4.5(9)	5.2(8)	5.7(8)	**6.2**(8)	15/15
DE-AUTO	**1.2**(1)	16(15)	104(262)	96(242)	93(231)	91(224)	15/15
DE-BFGS	**1.0**(0.7)	3.2(6)	**2.7**(3)	**2.6**(3)	**2.6**(3)	19(29)	15/15
DE-ROLL	**1.5**(1)	11(17)	90(74)	85(68)	87(69)	123(126)	14/15
DE-SIMPLEX	**1.4**(1)	18(25)	20(21)	18(19)	18(18)	17(18)	15/15
DEctpb	**1.7**(2)	**2.2**(2)	6.8(10)	8.0(10)	9.1(9)	10(9)	15/15
IPOPsaACM	**1.4**(1)	5.3(6)	17(29)	101(237)	100(227)	98(222)	15/15
JADEb	15(42)	5.1(7)	5.6(5)	5.5(5)	5.5(5)	**5.7**(4)	15/15
JADEctpb	**1.5**(2)	4.5(9)	4.4(4)	**4.8**(5)	**5.3**(4)	**5.8**(5)	15/15
MVDE	**1.1**(0.9)	**2.0**(2)	**2.5**(3)	6.8(6)	11(5)	16(6)	15/15
NBIPOPaCMA	12(26)	21(35)	16(16)	18(25)	17(24)	17(23)	15/15
NIPOPaCMA	8.0(24)	19(19)	207(209)	210(198)	205(197)	202(198)	15/15
PSO-BFGS	4.5(7)	**2.2**(2)	**2.7**(4)	**2.5**(3)	**2.7**(3)	65(79)	12/15
SNES	13(3)	25(35)	39(45)	50(42)	69(55)	90(68)	15/15
xNES	18(2)	28(43)	36(63)	35(58)	33(56)	33(54)	15/15
xNESas	14(2)	29(31)	68(101)	70(93)	67(89)	65(87)	15/15

Table 48: 03-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ 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-3	1e-5	1e-7	#succ
f23	2.6	407	906	2214	2293	2393	15/15
ACOR	4.2(4)	19(15)	2.2e4(2e4)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	4.7(6)	4.4(7)	5.2(5)	**2.6**(2)	**2.6**(2)	**2.9**(2)	15/15
BIPOPsaACM	7.8(10)	5.9(6)	5.8(4)	4.9(6)	4.8(6)	5.1(5)	15/15
CMA	4.8(5)	8.0(8)	13(17)	5.8(7)	5.8(7)	5.7(7)	15/15
CMAES	**2.7**(2)	7.0(6)	14(14)	6.5(6)	6.8(9)	6.6(8)	15/15
CMAa	**2.4**(3)	8.5(9)	11(12)	4.9(5)	5.0(5)	5.0(5)	15/15
CMAm	4.9(8)	5.9(7)	113(334)	46(137)	45(132)	43(126)	13/15
CMAma	5.8(7)	5.3(7)	7.6(5)	3.3(2)	**3.4**(2)	**3.4**(2)	15/15
CMAmah	4.7(4)	5.0(6)	60(17)	25(7)	24(7)	23(7)	14/15
CMAmh	4.7(6)	13(15)	16(17)	6.9(7)	8.4(10)	8.3(10)	15/15
DBRCGA	4.1(3)	9.3(9)	102(104)	53(47)	52(46)	50(44)	14/15
DE	3.5(3)	20(16)	79(92)	35(38)	42(46)	40(44)	11/15
DE-AUTO	**2.6**(3)	**2.5**(3)	**4.4**(6)	**2.9**(4)	**2.8**(4)	**2.8**(4)	15/15
DE-BFGS	**2.2**(2)	**1.9**(2)	**3.4**(2)	3.1(4)	6.1(7)	280(316)	2/15
DE-ROLL	3.5(2)	3.2(6)	17(22)	32(30)	33(28)	126(127)	1/15
DE-SIMPLEX	**2.1**(2)	**0.66**(0.5)	**1.2**(2)	**0.66**(0.6)	5.9(4)	354(439)	1/15
DEctpb	3.7(4)	21(13)	353(343)	∞	∞	∞ *2e5*	0/15
IPOPsaACM	5.6(5)	7.5(7)	11(10)	4.5(4)	4.5(4)	4.4(4)	15/15
JADEb	3.2(3)	7.3(8)	25(22)	21(21)	21(20)	20(19)	14/15
JADEctpb	**2.8**(2)	10(6)	22(20)	10(9)	10(8)	10(8)	15/15
MVDE	4.1(5)	11(13)	1018(1650)	6370(6889)	6155(6759)	5901(7313)	1/15
NBIPOPaCMA	4.6(5)	4.2(3)	4.6(6)	**2.1**(2)	**2.4**(2)	**3.2**(3)	15/15
NIPOPaCMA	4.3(5)	11(8)	10(10)	4.8(4)	4.9(4)	4.9(4)	15/15
PSO-BFGS	3.6(4)	**1.4**(2)	**4.4**(4)	8.8(13)	88(107)	∞ *3e5*	0/15
SNES	3.7(3)	13(18)	80(159)	380(445)	525(614)	503(588)	3/15
xNES	4.1(5)	16(16)	280(367)	328(332)	318(369)	437(471)	3/15
xNESas	5.0(7)	16(19)	271(296)	186(207)	217(230)	256(223)	0/15

Table 49: 03-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-3	1e-5	1e-7	#succ
f24	97	10391	1.0e5	3.6e5	3.6e5	3.6e5	2/15
ACOR	**2.9**(2)	341(536)	37(54)	12(16)	12(15)	12(16)	13/15
BIPOPaCMA	**1.6**(2)	3.1(4)	11(9)	4.8(5)	4.8(5)	5.7(6)	12/15
BIPOPsaACM	**1.6**(1)	6.8(10)	7.2(9)	5.6(7)	5.7(7)	5.9(7)	11/15
CMA	**1.5**(1)	117(145)	∞	∞	∞	∞ *6e5*	0/15
CMAES	3.5(1)	3.5(4)	6.1(7)	**2.8**(3)	**2.8**(3)	**2.8**(3)	2/15
CMAa	**1.7**(1)	116(145)	∞	∞	∞	∞ *6e5*	0/15
CMAm	**2.6**(2)	67(88)	38(47)	11(14)	11(13)	11(13)	2/15
CMAma	**2.4**(2)	232(289)	∞	∞	∞	∞ *6e5*	0/15
CMAmah	**1.1**(0.7)	88(116)	38(44)	∞	∞	∞ *6e5*	0/15
CMAmh	**2.9**(5)	160(202)	∞	∞	∞	∞ *6e5*	0/15
DBRCGA	3.9(4)	4.6(5)	5.9(6)	∞	∞	∞ *3e5*	0/15
DE	3.2(3)	5.3(6)	6.6(8)	6.3(6)	6.3(7)	6.3(7)	1/15
DE-AUTO	26(42)	64(77)	6.8(8)	**2.0**(2)	**2.0**(2)	**2.0**(2)	5/15
DE-BFGS	**2.5**(2)	8.4(8)	**0.89**(0.8)	**0.26**(0.2)	**0.26**(0.2)	**0.26**(0.2)	14/15
DE-ROLL	33(56)	62(75)	6.9(8)	**2.0**(2)	**2.0**(2)	**2.6**(3)	4/15
DE-SIMPLEX	3.4(5)	21(29)	**2.2**(3)	**0.65**(0.8)	**0.65**(0.8)	**0.65**(0.8)	10/15
DEctpb	3.0(2)	21(23)	4.6(5)	**2.9**(3)	**3.0**(3)	**3.0**(3)	2/15
IPOPsaACM	**2.3**(2)	402(520)	433(439)	∞	∞	∞ *3e6*	0/15
JADEb	4.5(2)	**1.4**(1)	**2.3**(3)	**3.0**(3)	**3.0**(3)	**3.0**(3)	2/15
JADEctpb	**2.7**(2)	**2.2**(3)	**1.1**(1)	**0.66**(0.7)	**0.66**(0.8)	**0.66**(0.7)	7/15
MVDE	4.4(3)	1348(1540)	137(151)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.4**(0.7)	7.1(16)	5.9(7)	4.3(6)	4.3(5)	4.3(5)	12/15
NIPOPaCMA	3.9(4)	35(68)	5.6(7)	3.9(5)	3.9(5)	3.9(5)	12/15
PSO-BFGS	**1.4**(0.9)	**1.3**(2)	**0.44**(0.4)	**0.24**(0.2)	**0.24**(0.2)	**0.24**(0.2)	15/15
SNES	**1.9**(2)	4.0(4)	13(13)	∞	∞	∞ *3e5*	0/15
xNES	**2.6**(2)	**3.0**(3)	7.6(7)	∞	∞	∞ *2e5*	0/15
xNESas	**1.6**(1)	4.7(4)	29(35)	18(21)	18(21)	18(19)	1/15

Table 50: 05-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-3	1e-5	1e-7	#succ
f1	11	12	12	12	12	12	15/15
ACOR	4.7(5)	15(3)	26(4)	47(6)	67(4)	90(6)	15/15
BIPOPaCMA	3.1(2)	8.0(3)	15(3)	28(3)	40(5)	52(5)	15/15
BIPOPsaACM	**2.7**(2)	6.4(2)	8.8(0.7)	12(1)	16(1)	19(2)	15/15
CMA	**2.6**(3)	9.3(4)	15(4)	28(4)	40(5)	54(6)	15/15
CMAES	**2.3**(2)	8.6(3)	15(5)	27(5)	41(4)	53(6)	15/15
CMAa	**2.5**(2)	8.1(4)	15(4)	25(5)	38(4)	51(8)	15/15
CMAm	**2.8**(2)	7.6(2)	12(3)	22(4)	30(5)	41(5)	15/15
CMAma	**2.7**(3)	7.3(4)	11(4)	22(4)	31(5)	40(7)	15/15
CMAmah	**1.7**(1)	**4.9**(1)	**8.1**(2)	16(2)	23(2)	30(3)	15/15
CMAmh	**1.8**(1)	**5.1**(2)	9.2(3)	16(3)	24(4)	31(4)	15/15
DBRCGA	5.1(7)	49(33)	96(26)	197(20)	301(33)	416(43)	15/15
DE	5.0(4)	21(8)	39(8)	82(8)	122(9)	164(7)	15/15
DE-AUTO	3.3(2)	5.8(0.7)	**5.9**(0.3)	**6.0**(0.2)	**6.0**(0.2)	**6.0**(0.2)	15/15
DE-BFGS	3.3(2)	**4.9**(0.2)	**4.9**(0.2)	**4.9**(0.2)	**4.9**(0.2)	**4.9**(0.2)	15/15
DE-ROLL	3.3(2)	17(21)	18(21)	19(21)	19(21)	19(21)	15/15
DE-SIMPLEX	**2.8**(3)	6.7(2)	10(5)	15(3)	19(2)	23(3)	15/15
DEctpb	5.8(5)	26(9)	45(9)	92(10)	139(12)	183(13)	15/15
IPOPsaACM	3.0(2)	6.9(2)	8.7(0.9)	**12**(1)	**15**(2)	**18**(1)	15/15
JADEb	3.4(3)	14(6)	27(5)	50(6)	76(7)	104(9)	15/15
JADEctpb	4.1(3)	18(6)	36(7)	77(7)	115(10)	154(10)	15/15
MVDE	6.4(8)	45(20)	103(13)	220(20)	329(25)	451(21)	15/15
NBIPOPaCMA	**2.4**(2)	8.3(3)	14(2)	27(4)	39(3)	50(3)	15/15
NIPOPaCMA	**2.7**(2)	7.3(3)	14(3)	26(3)	37(2)	50(4)	15/15
PSO-BFGS	3.1(3)	**5.2**(0.2)	**5.2**(0.2)	**5.2**(0.2)	**5.2**(0.2)	**5.2**(0.2)	15/15
SNES	4.3(3)	7.9(3)	15(5)	33(5)	51(4)	68(5)	15/15
xNES	**3.0**(3)	6.3(4)	21(3)	50(6)	81(8)	110(7)	15/15
xNESas	**2.9**(2)	6.6(3)	16(5)	37(8)	60(12)	78(17)	15/15

Table 51: 05-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-3	1e-5	1e-7	#succ
f2	83	87	88	90	92	94	15/15
ACOR	6.0(0.6)	7.4(0.6)	8.7(0.8)	12(1)	14(0.8)	17(1)	15/15
BIPOPaCMA	10(4)	12(3)	14(1)	16(2)	17(2)	18(1)	14/15
BIPOPsaACM	**3.2**(0.7)	**3.4**(0.7)	**3.7**(0.5)	**4.2**(0.7)	**4.6**(0.6)	**4.9**(0.6)	15/15
CMA	14(4)	16(4)	17(4)	20(3)	22(3)	23(2)	15/15
CMAES	16(4)	17(3)	18(3)	20(2)	21(2)	22(2)	15/15
CMAa	10(3)	12(2)	13(2)	15(1)	16(2)	17(1)	15/15
CMAm	13(5)	16(4)	17(4)	19(2)	20(1)	21(1.0)	15/15
CMAma	11(3)	13(3)	14(2)	15(2)	16(2)	17(1)	15/15
CMAmah	13(3)	15(3)	15(2)	16(2)	17(2)	17(2)	15/15
CMAmh	16(5)	18(4)	21(3)	21(2)	22(2)	23(2)	15/15
DBRCGA	27(4)	33(4)	41(5)	54(6)	67(6)	81(6)	15/15
DE	11(1)	13(2)	16(2)	21(2)	27(2)	31(2)	15/15
DE-AUTO	**1.4**(0.2)	**1.4**(0.2)	**1.5**(0.4)	**1.8**(0.4)	**1.9**(0.5)	**2.1**(0.5)	15/15
DE-BFGS	**1.4**(0.3)	**1.4**(0.3)	**1.5**(0.3)	**1.7**(0.3)	**1.9**(0.3)	**2.0**(0.3)	15/15
DE-ROLL	5.1(6)	5.3(6)	5.4(6)	5.5(6)	5.8(6)	5.9(6)	15/15
DE-SIMPLEX	6.1(4)	10(7)	11(7)	12(7)	12(6)	12(6)	15/15
DEctpb	13(1.0)	16(1)	19(2)	24(2)	30(2)	35(2)	15/15
IPOPsaACM	3.5(1)	3.7(0.8)	4.1(0.8)	4.6(1.0)	5.0(0.9)	5.3(0.9)	15/15
JADEb	6.8(1)	8.5(2)	10(2)	14(2)	18(2)	22(3)	15/15
JADEctpb	10(1)	12(2)	15(2)	20(2)	26(2)	31(2)	15/15
MVDE	27(3)	33(4)	42(2)	56(4)	70(4)	83(3)	15/15
NBIPOPaCMA	11(3)	12(3)	14(2)	15(2)	17(2)	18(2)	15/15
NIPOPaCMA	10(3)	12(2)	13(2)	14(2)	16(2)	17(2)	15/15
PSO-BFGS	**1.7**(0.7)	**1.7**(0.7)	**1.8**(0.7)	**1.9**(0.7)	**2.1**(0.7)	**2.3**(0.8)	15/15
SNES	5.0(1)	5.9(0.9)	7.0(0.9)	9.3(0.6)	11(0.6)	13(0.6)	15/15
xNES	8.7(2)	10(2)	12(1)	16(1)	20(1)	23(1)	15/15
xNESas	11(5)	14(9)	19(18)	39(62)	43(63)	49(92)	15/15

Table 52: 05-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	716	1622	1637	1646	1650	1654	15/15
ACOR	**1.7**(0.8)	30(38)	241(167)	240(166)	239(165)	239(165)	15/15
BIPOPaCMA	**1.6**(2)	12(11)	190(397)	190(395)	190(394)	190(393)	15/15
BIPOPsaACM	**1.1**(1.0)	5.3(5)	264(474)	263(472)	262(470)	264(464)	15/15
CMA	**1.4**(2)	7.9(6)	718(956)	715(962)	713(950)	712(961)	6/15
CMAES	**1.7**(2)	23(26)	293(324)	292(311)	291(319)	290(321)	6/15
CMAa	**0.91**(0.6)	30(7)	1333(1513)	1326(1690)	1323(1681)	1321(1661)	4/15
CMAm	**1.1**(1)	7.0(10)	959(1381)	955(1217)	953(1283)	951(1152)	5/15
CMAma	**0.74**(1)	39(10)	556(738)	554(802)	553(718)	552(724)	7/15
CMAmah	**2.4**(2)	5.9(6)	3145(3852)	3129(3643)	3121(3740)	3114(3705)	2/15
CMAmh	**1.7**(2)	100(222)	1004(1261)	999(1333)	997(1257)	995(1431)	5/15
DBRCGA	**2.4**(1.0)	8.0(4)	11(6)	11(6)	12(6)	12(6)	15/15
DE	**1.1**(0.4)	**1.4**(0.2)	**2.5**(2)	**2.8**(2)	**3.1**(2)	**3.4**(2)	15/15
DE-AUTO	**1.3**(1)	11(5)	21(9)	20(9)	20(9)	20(9)	15/15
DE-BFGS	**2.0**(1)	3.7(3)	7.7(5)	7.6(5)	7.6(5)	7.6(5)	15/15
DE-ROLL	**2.2**(1)	4.4(2)	6.6(4)	6.6(4)	6.6(4)	6.6(4)	15/15
DE-SIMPLEX	4.1(3)	10(8)	19(13)	19(14)	19(14)	19(13)	15/15
DEctpb	**1.3**(0.5)	**2.1**(0.7)	**2.5**(0.5)	**3.2**(0.5)	**3.6**(0.5)	**3.9**(0.4)	15/15
IPOPsaACM	**1.1**(1)	30(90)	1790(2125)	1781(2319)	1776(2101)	1772(1934)	12/15
JADEb	**0.80**(0.2)	**1.9**(2)	6.6(7)	6.8(7)	7.1(7)	7.3(7)	15/15
JADEctpb	**1.1**(0.5)	**1.6**(0.3)	**2.2**(0.4)	**2.7**(0.3)	**3.0**(0.3)	**3.4**(0.3)	15/15
MVDE	**2.2**(0.6)	**2.4**(0.3)	**2.9**(0.2)	**3.8**(0.2)	**4.6**(0.2)	**5.5**(0.2)	15/15
NBIPOPaCMA	**0.87**(0.3)	13(18)	473(727)	471(723)	470(721)	470(720)	15/15
NIPOPaCMA	**1.4**(1)	29(12)	799(1357)	795(1349)	793(1345)	792(1342)	15/15
PSO-BFGS	9.4(10)	26(38)	121(155)	120(154)	120(155)	120(153)	13/15
SNES	4.4(7)	91(146)	785(889)	781(784)	779(752)	778(783)	8/15
xNES	3.0(1)	92(114)	414(447)	412(445)	412(441)	411(442)	9/15
xNESas	**1.5**(0.7)	69(80)	454(380)	452(373)	451(374)	450(430)	13/15

Table 53: 05-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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	809	1633	1688	1817	1886	1903	15/15
ACOR	**2.0**(1)	783(1075)	2.5e4(3e4)	2.3e4(3e4)	2.2e4(3e4)	2.2e4(3e4)	3/15
BIPOPaCMA	**1.6**(1)	1.4e4(2e4)	∞	∞	∞	∞ *5e6*	0/15
BIPOPsaACM	**1.3**(0.9)	6335(6377)	∞	∞	∞	∞ *5e6*	0/15
CMA	**2.7**(3)	∞	∞	∞	∞	∞ *9e5*	0/15
CMAES	**2.2**(1)	216(211)	∞	∞	∞	∞ *3e5*	0/15
CMAa	**1.7**(2)	∞	∞	∞	∞	∞ *9e5*	0/15
CMAm	**2.9**(3)	∞	∞	∞	∞	∞ *9e5*	0/15
CMAma	**1.7**(2)	∞	∞	∞	∞	∞ *9e5*	0/15
CMAmah	**2.5**(2)	∞	∞	∞	∞	∞ *9e5*	0/15
CMAmh	**1.8**(2)	∞	∞	∞	∞	∞ *9e5*	0/15
DBRCGA	**2.6**(1)	11(7)	17(10)	16(10)	16(9)	16(9)	15/15
DE	**1.2**(0.3)	**1.7**(0.3)	**9.4**(14)	**9.0**(13)	**9.0**(13)	**9.2**(13)	15/15
DE-AUTO	**1.8**(2)	16(9)	28(22)	26(21)	25(20)	25(20)	15/15
DE-BFGS	3.8(2)	9.0(6)	20(17)	19(15)	18(15)	18(15)	15/15
DE-ROLL	**1.6**(2)	4.7(3)	**11**(10)	**10**(9)	**10**(9)	**10**(8)	15/15
DE-SIMPLEX	6.8(3)	14(7)	24(16)	23(14)	22(14)	22(14)	15/15
DEctpb	**1.4**(0.4)	**2.6**(0.4)	**4.9**(3)	**5.2**(3)	**5.4**(3)	**5.7**(3)	15/15
IPOPsaACM	**1.0**(0.8)	4.3e4(5e4)	∞	∞	∞	∞ *5e6*	0/15
JADEb	**0.80**(0.4)	4.7(5)	25(28)	24(26)	23(25)	23(25)	15/15
JADEctpb	**1.4**(0.4)	**2.0**(0.5)	**3.9**(3)	**4.1**(3)	**4.4**(3)	**4.7**(3)	15/15
MVDE	**2.4**(0.4)	**3.0**(0.6)	95(296)	89(275)	86(265)	86(263)	13/15
NBIPOPaCMA	**1.7**(1)	738(708)	3819(3753)	3547(3233)	3418(3359)	3387(2721)	9/15
NIPOPaCMA	**2.8**(3)	2.2e4(2e4)	∞	∞	∞	∞ *5e6*	0/15
PSO-BFGS	14(12)	120(118)	410(479)	381(372)	367(414)	364(355)	7/15
SNES	3.2(6)	443(390)	3934(4054)	3654(4481)	3521(3838)	3489(3640)	2/15
xNES	4.5(6)	599(526)	5871(6210)	5453(6133)	5255(5742)	5208(5323)	1/15
xNESas	3.8(5)	381(428)	9998(1e4)	9287(1e4)	8949(9466)	8868(9618)	1/15

Table 54: 05-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-3	1e-5	1e-7	#succ
f5	10	10	10	10	10	10	15/15
ACOR	8.5(1)	12(2)	13(3)	13(3)	13(3)	13(3)	15/15
BIPOPaCMA	5.7(3)	6.9(3)	6.9(3)	6.9(3)	6.9(3)	6.9(3)	15/15
BIPOPsaACM	4.7(2)	5.8(2)	6.2(3)	6.2(3)	6.2(3)	6.2(3)	15/15
CMA	4.4(2)	6.5(2)	6.7(2)	6.7(2)	6.7(2)	6.7(2)	15/15
CMAES	4.3(2)	5.8(2)	5.8(2)	5.9(2)	5.9(2)	5.9(2)	15/15
CMAa	4.2(2)	6.0(2)	6.3(2)	6.4(2)	6.4(2)	6.4(2)	15/15
CMAm	**3.9**(2)	**5.1**(2)	**5.3**(1)	**5.4**(1)	**5.4**(1)	**5.4**(1)	15/15
CMAma	**3.4**(0.8)	**4.7**(1)	**4.8**(2)	**4.8**(2)	**4.8**(2)	**4.8**(2)	15/15
CMAmah	**3.3**(2)	**4.2**(2)	**4.7**(2)	**4.8**(2)	**4.8**(2)	**4.8**(2)	15/15
CMAmh	**2.9**(1)	**3.9**(0.9)	**4.0**(1)	**4.1**(1)	**4.1**(1)	**4.1**(1)	15/15
DBRCGA	31(33)	50(38)	54(40)	54(40)	54(40)	54(40)	15/15
DE	8.3(3)	12(4)	12(3)	13(3)	13(3)	13(3)	15/15
DE-AUTO	5.8(0.4)	6.3(0.4)	6.4(0.3)	6.4(0.3)	6.4(0.3)	6.4(0.3)	15/15
DE-BFGS	6.5(2)	8.8(3)	9.0(2)	9.0(2)	9.0(2)	9.0(2)	15/15
DE-ROLL	5.9(0.3)	6.4(0.4)	6.5(0.4)	6.7(0.5)	6.9(0.5)	7.1(0.5)	15/15
DE-SIMPLEX	29(13)	122(119)	266(171)	324(99)	336(123)	369(138)	15/15
DEctpb	11(5)	16(4)	17(4)	18(2)	18(2)	18(2)	15/15
IPOPsaACM	4.3(3)	6.1(3)	6.2(3)	6.3(2)	6.3(2)	6.3(2)	15/15
JADEb	8.4(4)	14(4)	15(4)	15(4)	15(4)	15(4)	15/15
JADEctpb	11(6)	20(8)	21(7)	21(7)	21(7)	21(7)	15/15
MVDE	48(10)	90(16)	99(20)	101(20)	101(20)	101(20)	15/15
NBIPOPaCMA	4.2(2)	5.6(2)	5.9(2)	5.9(2)	5.9(2)	5.9(2)	15/15
NIPOPaCMA	4.1(2)	5.9(3)	6.1(3)	6.1(3)	6.1(3)	6.1(3)	15/15
PSO-BFGS	6.8(0.3)	8.8(0.3)	8.8(0.6)	8.9(0.6)	8.9(0.6)	8.9(0.6)	15/15
SNES	7.8(3)	12(4)	12(4)	12(4)	12(4)	12(4)	15/15
xNES	9.5(4)	15(6)	15(6)	16(6)	16(6)	16(6)	15/15
xNESas	10(4)	15(9)	16(9)	16(8)	16(8)	16(8)	15/15

Table 55: 05-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-3	1e-5	1e-7	#succ
f6	114	214	281	580	1038	1332	15/15
ACOR	3.4(1)	3.6(0.8)	4.1(0.9)	3.4(0.4)	**2.6**(0.4)	**2.7**(0.3)	15/15
BIPOPaCMA	**2.0**(1)	**1.9**(0.8)	**2.2**(0.5)	**1.6**(0.3)	**1.2**(0.2)	**1.2**(0.1)	15/15
BIPOPsaACM	**1.9**(0.7)	**1.8**(0.6)	**2.1**(0.9)	**1.8**(0.9)	**1.3**(0.5)	**1.4**(0.5)	15/15
CMA	**2.5**(0.9)	**2.2**(0.4)	**2.2**(0.3)	**1.7**(0.2)	**1.3**(0.1)	**1.2**(0.1)	15/15
CMAES	**2.4**(0.7)	**2.0**(0.5)	**2.2**(0.5)	**1.7**(0.4)	**1.3**(0.3)	**1.3**(0.2)	15/15
CMAa	**2.0**(0.6)	**1.9**(0.4)	**2.0**(0.3)	**1.5**(0.2)	**1.2**(0.1)	**1.1**(0.1)	15/15
CMAm	**2.2**(1)	**2.0**(0.8)	**2.1**(0.6)	**1.7**(0.5)	**1.3**(0.2)	**1.3**(0.2)	15/15
CMAma	**2.4**(1)	**2.1**(0.9)	**2.2**(0.9)	**1.6**(0.4)	**1.2**(0.2)	**1.2**(0.2)	15/15
CMAmah	**1.7**(1.0)	**1.5**(0.5)	**1.7**(0.5)	**1.3**(0.4)	**0.94**(0.3)	**0.92**(0.2)	15/15
CMAmh	**1.8**(0.9)	**1.7**(0.8)	**1.8**(0.9)	**1.5**(0.4)	**1.1**(0.2)	**1.1**(0.2)	15/15
DBRCGA	7.4(3)	10(3)	12(4)	10(2)	8.0(2)	8.2(1)	15/15
DE	5.4(1)	6.6(2)	8.4(2)	8.0(2)	6.3(1)	6.7(2)	15/15
DE-AUTO	**1.3**(0.7)	**1.0**(0.4)	**1.00**(0.3)	**0.79**(0.4)	**0.73**(0.4)	**0.79**(0.2)	15/15
DE-BFGS	5.1(2)	3.1(1)	**2.5**(0.9)	**1.5**(0.6)	**1.3**(2)	**2.8**(3)	15/15
DE-ROLL	13(19)	13(19)	19(27)	18(23)	13(20)	53(66)	14/15
DE-SIMPLEX	5.5(9)	5.6(5)	6.2(4)	5.6(5)	5.9(6)	12(12)	15/15
DEctpb	6.0(3)	6.6(1)	8.2(2)	6.9(1)	5.6(1)	5.8(1.0)	15/15
IPOPsaACM	**2.3**(1)	**2.1**(0.9)	**2.6**(1)	**1.9**(0.8)	**1.5**(0.5)	**1.7**(0.7)	15/15
JADEb	**2.6**(1)	3.4(1)	4.5(1)	4.4(0.9)	3.7(0.9)	4.0(2)	15/15
JADEctpb	4.1(2)	4.5(1.0)	5.4(0.9)	4.4(0.5)	3.6(0.4)	3.7(0.5)	15/15
MVDE	6.5(3)	13(4)	18(4)	21(4)	21(8)	25(9)	15/15
NBIPOPaCMA	**2.1**(1)	**1.9**(0.6)	**2.0**(0.6)	**1.5**(0.3)	**1.1**(0.2)	**1.1**(0.2)	15/15
NIPOPaCMA	**2.0**(0.8)	**1.7**(0.5)	**1.9**(0.3)	**1.5**(0.2)	**1.2**(0.1)	**1.2**(0.1)	15/15
PSO-BFGS	6.4(9)	3.8(5)	3.1(4)	**1.9**(2)	**1.5**(2)	54(98)	11/15
SNES	**1.5**(1)	**1.7**(0.6)	**2.2**(0.5)	**2.0**(0.6)	10(15)	23(51)	15/15
xNES	**1.6**(1)	**2.0**(0.5)	**2.5**(0.3)	**2.2**(0.3)	**1.8**(0.1)	**1.8**(0.1)	15/15
xNESas	**1.5**(1)	**2.1**(0.6)	**2.4**(0.6)	**2.0**(0.2)	**1.5**(0.2)	**1.6**(0.2)	15/15

Table 56: 05-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-3	1e-5	1e-7	#succ
f7	24	324	1171	1572	1572	1597	15/15
ACOR	6.5(3)	**2.1**(1)	32(25)	25(18)	25(18)	25(18)	15/15
BIPOPaCMA	6.9(4)	**1.3**(1)	**1.0**(0.9)	**0.93**(0.7)	**0.93**(0.7)	**0.95**(0.7)	15/15
BIPOPsaACM	4.5(3)	**1.4**(1)	**0.83**(0.5)	**0.91**(0.7)	**0.91**(0.7)	**0.93**(0.7)	15/15
CMA	4.7(3)	**1.5**(1)	**0.88**(0.4)	**0.92**(0.7)	**0.92**(0.7)	**0.94**(0.7)	15/15
CMAES	5.1(3)	**1.1**(0.9)	**2.0**(2)	**2.6**(3)	**2.6**(3)	**2.6**(3)	15/15
CMAa	7.3(3)	**1.1**(1)	**0.88**(0.6)	**0.77**(0.5)	**0.77**(0.5)	**0.79**(0.5)	15/15
CMAm	**3.9**(2)	**1.1**(1.0)	**1.3**(1)	**1.3**(1)	**1.3**(1)	**1.4**(1)	15/15
CMAma	5.1(3)	**1.4**(1)	**0.84**(0.6)	**0.76**(0.5)	**0.76**(0.5)	**0.82**(0.5)	15/15
CMAmah	**3.9**(3)	**1.6**(1)	**1.4**(0.7)	**1.2**(0.6)	**1.2**(0.6)	**1.2**(0.6)	15/15
CMAmh	4.5(5)	**2.1**(2)	**1.4**(0.9)	**1.4**(0.6)	**1.4**(0.6)	**1.4**(0.7)	15/15
DBRCGA	16(14)	4.1(2)	4.9(6)	7.9(7)	7.9(7)	8.0(8)	15/15
DE	13(11)	3.4(2)	**1.9**(0.6)	**2.5**(0.7)	**2.5**(0.7)	**2.7**(0.8)	15/15
DE-AUTO	40(64)	13(10)	6.9(3)	9.1(3)	9.1(3)	14(9)	15/15
DE-BFGS	8.9(6)	3.4(5)	10(22)	9.2(17)	9.2(17)	41(64)	10/15
DE-ROLL	29(39)	11(11)	8.4(7)	8.3(5)	8.3(5)	8.5(5)	15/15
DE-SIMPLEX	11(11)	8.0(7)	5.1(7)	4.7(5)	4.7(5)	4.9(5)	15/15
DEctpb	10(8)	3.3(1)	**2.1**(0.9)	**2.7**(0.8)	**2.7**(0.8)	3.0(0.9)	15/15
IPOPsaACM	**3.7**(2)	**1.2**(1)	**0.68**(0.5)	**0.77**(0.9)	**0.77**(0.9)	**0.90**(0.9)	15/15
JADEb	6.1(3)	57(0.7)	54(107)	81(159)	81(159)	80(157)	10/15
JADEctpb	8.4(5)	**2.0**(0.7)	**1.3**(0.4)	**1.4**(0.3)	**1.4**(0.3)	**1.6**(0.3)	15/15
MVDE	18(7)	7.0(4)	5.0(2)	8.7(4)	8.7(4)	9.4(4)	15/15
NBIPOPaCMA	4.8(2)	**1.3**(1)	**0.86**(0.9)	**0.86**(0.6)	**0.86**(0.6)	**0.88**(0.6)	15/15
NIPOPaCMA	6.0(3)	**1.3**(1)	**0.93**(0.9)	**0.99**(0.7)	**0.99**(0.7)	**1.1**(0.7)	15/15
PSO-BFGS	589(940)	458(446)	930(922)	2363(2591)	2363(2429)	2326(2392)	1/15
SNES	**3.5**(3)	37(76)	51(56)	212(256)	212(256)	237(253)	14/15
xNES	4.5(2)	**2.9**(0.5)	**2.7**(4)	3.0(6)	3.0(6)	3.0(6)	15/15
xNESas	4.4(3)	**0.81**(0.3)	3.2(4)	**2.6**(3)	**2.6**(3)	**2.6**(3)	15/15

Table 57: 05-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-3	1e-5	1e-7	#succ
f8	73	273	336	391	410	422	15/15
ACOR	5.5(0.9)	11(2)	43(4)	120(11)	199(10)	278(10)	15/15
BIPOPaCMA	**3.0**(1)	5.9(5)	6.2(4)	6.2(4)	6.4(4)	6.7(4)	15/15
BIPOPsaACM	**2.2**(0.6)	**2.5**(2)	**2.5**(2)	**2.5**(2)	**2.5**(1)	**2.5**(1)	15/15
CMA	3.4(1.0)	5.1(5)	5.7(4)	5.8(4)	6.0(4)	6.3(4)	15/15
CMAES	4.3(4)	3.6(1)	4.4(1)	4.7(1)	5.0(1)	5.2(1)	15/15
CMAa	**2.7**(1.0)	4.5(5)	4.9(5)	5.1(4)	5.3(4)	5.5(4)	15/15
CMAm	**2.6**(0.8)	4.2(5)	4.9(4)	5.2(3)	5.4(3)	5.6(3)	15/15
CMAma	**2.7**(1)	3.2(2)	3.7(2)	4.0(1)	4.2(1)	4.4(1)	15/15
CMAmah	**1.8**(0.6)	3.5(3)	4.0(3)	4.3(2)	4.4(2)	4.5(2)	15/15
CMAmh	**2.5**(1)	4.5(4)	5.1(4)	5.3(3)	5.5(3)	5.6(3)	15/15
DBRCGA	18(5)	16(7)	24(16)	43(16)	56(22)	75(30)	15/15
DE	9.3(4)	14(5)	21(8)	30(8)	40(7)	49(8)	15/15
DE-AUTO	**1.6**(0.4)	**2.4**(4)	**2.1**(4)	**1.9**(3)	**1.9**(3)	**1.8**(3)	15/15
DE-BFGS	**2.8**(2)	**1.2**(0.6)	**1.1**(0.5)	**1.1**(0.4)	**1.1**(0.4)	**1.1**(0.4)	15/15
DE-ROLL	4.6(6)	13(10)	40(33)	83(51)	120(38)	1134(1188)	5/15
DE-SIMPLEX	**1.9**(0.8)	**2.2**(3)	**2.2**(2)	**2.1**(2)	**2.2**(2)	**2.2**(2)	15/15
DEctpb	11(2)	10(4)	22(9)	32(8)	43(7)	54(8)	15/15
IPOPsaACM	**2.3**(1)	**1.9**(0.7)	**2.0**(0.6)	**2.0**(0.5)	**2.0**(0.5)	**2.1**(0.5)	15/15
JADEb	5.0(1)	11(12)	12(10)	12(9)	13(8)	14(8)	15/15
JADEctpb	7.5(3)	7.3(3)	10(3)	12(2)	13(1)	14(1)	15/15
MVDE	21(8)	20(16)	64(69)	196(117)	388(152)	589(194)	15/15
NBIPOPaCMA	**2.9**(0.9)	4.1(4)	4.6(4)	4.8(3)	5.1(3)	5.3(3)	15/15
NIPOPaCMA	4.1(3)	4.4(5)	4.8(4)	5.0(4)	5.2(4)	5.5(4)	15/15
PSO-BFGS	**3.0**(2)	**1.8**(1)	**1.6**(0.8)	**1.5**(0.7)	**1.5**(0.7)	**1.4**(0.7)	15/15
SNES	3.7(1)	87(92)	219(164)	667(328)	1770(1554)	4064(3841)	4/15
xNES	4.1(2)	3.9(1)	5.8(3)	7.3(4)	7.7(4)	8.3(4)	15/15
xNESas	3.4(2)	6.8(3)	8.7(4)	16(13)	16(13)	16(12)	15/15

Table 58: 05-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-3	1e-5	1e-7	#succ
f9	35	127	214	300	335	369	15/15
ACOR	12(3)	21(8)	59(26)	251(139)	467(266)	655(376)	15/15
BIPOPaCMA	7.9(4)	10(10)	7.7(6)	6.6(5)	6.4(4)	6.3(4)	15/15
BIPOPsaACM	**4.2**(1)	**4.1**(4)	**3.1**(2)	**2.6**(2)	**2.5**(2)	**2.3**(1)	15/15
CMA	7.0(3)	9.0(11)	7.7(7)	6.7(5)	6.7(5)	6.5(4)	15/15
CMAES	5.5(1)	7.1(3)	6.5(2)	5.8(1)	5.8(1.0)	5.7(0.9)	15/15
CMAa	6.1(2)	6.5(2)	5.9(1)	5.2(1)	5.2(1.0)	5.2(0.9)	15/15
CMAm	5.4(4)	6.5(2)	6.2(1)	5.6(1.0)	5.5(0.8)	5.3(0.8)	15/15
CMAma	5.9(2)	6.9(4)	6.0(2)	5.4(2)	5.3(1)	5.1(1)	15/15
CMAmah	4.4(1)	9.4(8)	7.5(5)	6.3(3)	6.1(3)	5.8(3)	15/15
CMAmh	5.0(2)	11(9)	9.0(5)	7.6(4)	7.4(3)	7.0(3)	15/15
DBRCGA	34(10)	37(26)	42(30)	72(51)	109(77)	129(74)	15/15
DE	22(8)	37(7)	36(10)	40(11)	50(14)	58(17)	15/15
DE-AUTO	**3.7**(1)	7.1(6)	4.5(4)	3.3(2)	3.0(2)	**2.8**(2)	15/15
DE-BFGS	**4.2**(0.7)	**2.7**(2)	**1.9**(0.9)	**1.5**(0.7)	**1.3**(0.6)	**1.2**(0.5)	15/15
DE-ROLL	8.1(6)	17(10)	71(43)	124(58)	165(67)	361(334)	13/15
DE-SIMPLEX	5.8(4)	4.4(4)	3.2(2)	**2.6**(2)	**2.5**(1)	**2.4**(1)	15/15
DEctpb	23(11)	29(7)	37(9)	43(11)	53(16)	62(19)	15/15
IPOPsaACM	5.0(2)	**3.1**(1)	**2.5**(0.6)	**2.1**(0.5)	**2.0**(0.5)	**2.0**(0.4)	15/15
JADEb	12(2)	20(33)	16(20)	15(13)	15(12)	15(11)	15/15
JADEctpb	14(2)	24(7)	22(5)	19(5)	19(4)	18(4)	15/15
MVDE	49(13)	79(49)	197(94)	304(85)	453(164)	614(232)	15/15
NBIPOPaCMA	5.2(1)	6.2(3)	5.6(2)	5.0(0.9)	5.0(1.0)	5.0(0.9)	15/15
NIPOPaCMA	5.6(1)	5.4(2)	5.0(1)	4.6(0.8)	4.6(0.8)	4.6(0.8)	15/15
PSO-BFGS	**4.1**(1)	**2.2**(1)	**1.6**(0.9)	**1.3**(0.6)	**1.2**(0.5)	**1.1**(0.5)	15/15
SNES	5.3(2)	69(48)	211(80)	1480(1829)	2065(1866)	5488(6053)	4/15
xNES	7.1(2)	8.2(3)	8.7(4)	8.4(5)	8.3(4)	8.4(4)	15/15
xNESas	6.4(2)	13(4)	12(3)	11(6)	11(6)	11(6)	15/15

Table 59: 05-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-3	1e-5	1e-7	#succ
f10	349	500	574	626	829	880	15/15
ACOR	662(773)	1848(1729)	3067(1662)	5253(2231)	5798(2317)	9645(7046)	1/15
BIPOPaCMA	**2.6**(0.9)	**2.2**(0.6)	**2.1**(0.3)	**2.2**(0.3)	**1.9**(0.1)	**2.0**(0.1)	15/15
BIPOPsaACM	**0.76**(0.1)	**0.59**(0.1)	**0.58**(0.1)$_{\downarrow 3}$	**0.60**(0.1)$_{\downarrow 3}$	**0.51**(0.1)$_{\downarrow 3}$	**0.53**(0.1)$_{\downarrow 4}$	15/15
CMA	**2.8**(1)	**2.7**(0.8)	**2.6**(0.6)	**2.8**(0.4)	**2.3**(0.3)	**2.3**(0.3)	15/15
CMAES	3.5(0.7)	**2.9**(0.5)	**2.7**(0.4)	**2.8**(0.3)	**2.3**(0.2)	**2.3**(0.2)	15/15
CMAa	**2.6**(0.8)	**2.2**(0.4)	**2.1**(0.2)	**2.2**(0.2)	**1.8**(0.2)	**1.9**(0.2)	15/15
CMAm	3.9(0.9)	3.2(0.7)	3.0(0.3)	3.0(0.3)	**2.4**(0.2)	**2.4**(0.2)	15/15
CMAma	**2.5**(0.8)	**2.2**(0.5)	**2.1**(0.3)	**2.2**(0.2)	**1.8**(0.2)	**1.8**(0.2)	15/15
CMAmah	**2.9**(1)	**2.5**(0.5)	**2.4**(0.3)	**2.3**(0.3)	**1.9**(0.2)	**1.9**(0.2)	15/15
CMAmh	4.1(1)	3.4(0.9)	3.3(0.3)	3.2(0.3)	**2.5**(0.2)	**2.5**(0.2)	15/15
DBRCGA	59(45)	194(275)	407(299)	1184(1040)	1630(1560)	4070(4546)	2/15
DE	27(8)	28(6)	32(6)	43(8)	42(6)	49(7)	15/15
DE-AUTO	**2.6**(4)	**1.9**(3)	**1.6**(3)	**1.5**(2)	**1.2**(2)	**1.1**(2)	15/15
DE-BFGS	**0.75**(0.7)	**0.54**(0.4)	**0.49**(0.4)	**0.48**(0.4)	**0.39**(0.3)	**0.50**(0.9)	15/15
DE-ROLL	93(102)	121(86)	129(82)	176(66)	178(43)	1865(1957)	1/15
DE-SIMPLEX	**2.9**(3)	**2.7**(2)	**2.5**(1)	**2.4**(1)	**1.9**(1.0)	**2.0**(2)	15/15
DEctpb	32(7)	32(6)	37(8)	52(6)	51(5)	61(6)	15/15
IPOPsaACM	**0.77**(0.2)	**0.61**(0.1)	**0.57**(0.1)$_{\downarrow 3}$	**0.60**(0.1)$_{\downarrow 3}$	**0.51**(0.1)$_{\downarrow 3}$	**0.53**(0.1)$_{\downarrow 3}$	15/15
JADEb	6.7(2)	5.7(2)	6.0(1)	6.7(2)	5.8(2)	6.1(1)	15/15
JADEctpb	6.1(1)	5.1(0.8)	5.0(0.8)	5.4(0.7)	4.8(0.5)	5.1(0.5)	15/15
MVDE	137(86)	198(73)	331(134)	780(257)	996(230)	2756(2274)	1/15
NBIPOPaCMA	**2.8**(0.8)	**2.2**(0.5)	**2.1**(0.2)	**2.2**(0.2)	**1.8**(0.2)	**1.9**(0.2)	15/15
NIPOPaCMA	**2.7**(0.7)	**2.3**(0.3)	**2.1**(0.3)	**2.2**(0.3)	**1.8**(0.2)	**1.9**(0.2)	15/15
PSO-BFGS	**1.3**(1)	**0.94**(1)	**0.84**(0.9)	**0.79**(0.8)	**0.62**(0.6)	**1.7**(0.6)	15/15
SNES	3419(3283)	5375(5422)	∞	∞	∞	∞ *1e6*	0/15
xNES	**2.1**(0.6)	**1.9**(0.3)	**1.9**(0.2)	**2.3**(0.2)	**2.2**(0.2)	**2.5**(0.2)	15/15
xNESas	**2.0**(0.8)	**1.8**(0.7)	**1.8**(0.6)	**2.0**(0.5)	**1.9**(0.4)	**2.0**(0.3)	15/15

Table 60: 05-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-3	1e-5	1e-7	#succ
f11	143	202	763	1177	1467	1673	15/15
ACOR	130(102)	258(72)	118(34)	130(26)	153(30)	177(34)	15/15
BIPOPaCMA	5.1(2)	4.6(1)	**1.4**(0.2)	**1.1**(0.2)	**0.94**(0.1)	**0.91**(0.1)	15/15
BIPOPsaACM	**2.1**(0.3)	**1.6**(0.2)	**0.47**(0.1)$_{\downarrow 4}$	**0.34**(0.0)$_{\downarrow 4}$	**0.30**(0.0)$_{\downarrow 4}$	**0.29**(0.0)$_{\downarrow 4}$	15/15
CMA	8.7(2)	7.6(1)	**2.2**(0.4)	**1.6**(0.2)	**1.4**(0.2)	**1.3**(0.2)	15/15
CMAES	9.1(1)	7.7(1)	**2.3**(0.3)	**1.6**(0.2)	**1.4**(0.2)	**1.3**(0.1)	15/15
CMAa	5.2(1.0)	4.6(0.7)	**1.4**(0.2)	**1.1**(0.1)	**0.95**(0.1)	**0.93**(0.1)	15/15
CMAm	8.4(3)	7.8(1)	**2.3**(0.3)	**1.7**(0.2)	**1.4**(0.2)	**1.3**(0.1)	15/15
CMAma	5.1(1)	4.4(0.8)	**1.3**(0.2)	**1.0**(0.1)	**0.89**(0.1)	**0.84**(0.1)	15/15
CMAmah	6.5(2)	6.2(1)	**1.8**(0.3)	**1.3**(0.2)	**1.1**(0.1)	**1.0**(0.1)	15/15
CMAmh	12(4)	10(2)	**3.0**(0.3)	**2.1**(0.2)	**1.7**(0.1)	**1.6**(0.1)	15/15
DBRCGA	18(9)	106(111)	77(75)	100(79)	140(85)	177(152)	11/15
DE	32(23)	42(19)	16(5)	17(4)	19(4)	23(4)	15/15
DE-AUTO	**2.6**(0.1)	**1.9**(0.1)	**0.51**(0.0)	**0.35**(0.0)	**0.29**(0.0)	**0.61**(1)	15/15
DE-BFGS	**0.70**(0.2)$_{\downarrow 2}$	**0.53**(0.1)$_{\downarrow 3}$	**0.15**(0.0)$_{\downarrow 4}$	**0.11**(0.0)$_{\downarrow 4}$	**0.11**(0.0)$_{\downarrow 4}$	**0.12**(0.1)$_{\downarrow 4}$	15/15
DE-ROLL	76(76)	163(111)	63(26)	81(14)	92(14)	2107(2398)	0/15
DE-SIMPLEX	4.5(4)	5.3(3)	**1.7**(0.5)	**1.3**(0.6)	**1.1**(0.5)	**0.97**(0.4)	15/15
DEctpb	26(18)	44(17)	18(5)	21(5)	24(6)	27(6)	15/15
IPOPsaACM	**2.0**(0.4)	**1.6**(0.3)	**0.46**(0.1)$_{\downarrow 4}$	**0.34**(0.1)$_{\downarrow 4}$	**0.30**(0.1)$_{\downarrow 4}$	**0.29**(0.0)$_{\downarrow 4}$	15/15
JADEb	9.0(4)	12(6)	4.0(1)	3.0(0.9)	**2.8**(0.8)	**2.7**(0.7)	15/15
JADEctpb	8.1(3)	9.0(1)	**2.8**(0.4)	**2.3**(0.3)	**2.2**(0.2)	**2.3**(0.2)	15/15
MVDE	43(32)	195(125)	123(53)	267(143)	383(201)	795(741)	6/15
NBIPOPaCMA	6.1(1)	5.0(0.8)	**1.5**(0.2)	**1.1**(0.1)	**0.97**(0.1)	**0.94**(0.1)	15/15
NIPOPaCMA	5.2(1)	4.4(0.7)	**1.3**(0.1)	**1.0**(0.1)	**0.93**(0.1)	**0.90**(0.1)	15/15
PSO-BFGS	**0.60**(0.1)$_{\downarrow 4}$	**0.45**(0.1)$_{\downarrow 4}$	**0.13**(0.0)$_{\downarrow 4}$	**0.10**(0.0)$_{\downarrow 4}$	**0.09**(0.0)$_{\downarrow 4}$	**0.11**(0.0)$_{\downarrow 4}$	15/15
SNES	3907(2964)	∞	∞	∞	∞	∞ *1e6*	0/15
xNES	4.4(1)	3.9(1)	**1.2**(0.3)	**1.1**(0.2)	**1.1**(0.1)	**1.2**(0.1)	15/15
xNESas	4.2(3)	4.3(1)	**1.3**(0.3)	**1.1**(0.2)	**1.0**(0.1)	**1.1**(0.1)	15/15

Table 61: 05-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-3	1e-5	1e-7	#succ
f12	108	268	371	461	1303	1494	15/15
ACOR	4129(7120)	3.3e4(6e4)	7.8e4(1e5)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	12(9)	8.4(6)	7.7(6)	7.3(6)	3.0(3)	3.2(3)	15/15
BIPOPsaACM	**2.6**(0.8)	**2.1**(2)	**2.1**(2)	**2.5**(3)	**1.4**(1)	**1.7**(2)	15/15
CMA	10(8)	8.3(5)	8.4(5)	8.6(5)	3.7(2)	3.7(3)	15/15
CMAES	8.4(9)	5.9(7)	7.1(7)	7.9(5)	3.5(2)	3.8(2)	15/15
CMAa	8.7(6)	7.2(6)	7.9(6)	8.5(6)	3.7(2)	3.7(2)	15/15
CMAm	7.4(8)	7.5(6)	8.2(6)	8.7(6)	3.9(3)	3.9(3)	15/15
CMAma	6.1(3)	4.9(5)	5.4(5)	5.9(4)	**2.6**(2)	**2.6**(2)	15/15
CMAmah	6.5(8)	7.3(7)	8.1(6)	8.8(5)	3.9(2)	3.8(2)	15/15
CMAmh	8.3(10)	8.9(10)	10(9)	10(9)	4.5(4)	4.5(4)	15/15
DBRCGA	615(1690)	1328(1871)	9445(1e4)	∞	∞	∞ *5e5*	0/15
DE	103(94)	107(85)	117(116)	135(129)	63(51)	66(52)	15/15
DE-AUTO	**2.8**(3)	**2.2**(2)	**2.2**(2)	**2.2**(2)	**0.93**(0.8)	**1.2**(1)	15/15
DE-BFGS	**2.8**(1)	**2.0**(1)	**1.9**(1)	**1.9**(1)	**0.80**(0.5)	**1.1**(0.7)	15/15
DE-ROLL	21(19)	112(37)	148(105)	211(256)	118(148)	485(546)	1/15
DE-SIMPLEX	4.1(4)	3.1(2)	3.4(2)	3.4(2)	**1.6**(1)	**2.0**(2)	15/15
DEctpb	89(41)	77(46)	104(117)	138(134)	70(57)	80(56)	14/15
IPOPsaACM	3.8(3)	**2.9**(2)	**2.8**(2)	**2.8**(2)	**1.2**(0.9)	**1.2**(0.9)	15/15
JADEb	18(13)	15(8)	15(10)	15(11)	6.7(4)	6.7(4)	15/15
JADEctpb	24(3)	13(4)	12(7)	14(7)	6.1(3)	6.2(4)	15/15
MVDE	207(116)	342(277)	715(673)	1416(755)	1221(1148)	3256(3348)	2/15
NBIPOPaCMA	10(6)	6.9(6)	6.5(6)	6.5(5)	**2.7**(2)	**2.8**(2)	15/15
NIPOPaCMA	11(16)	8.2(11)	8.0(9)	7.9(8)	3.4(3)	3.4(3)	15/15
PSO-BFGS	**2.8**(2)	**1.7**(1)	**1.5**(1)	**1.7**(1)	**0.73**(0.5)	**0.86**(0.9)	15/15
SNES	43(92)	220(274)	296(610)	5016(4651)	∞	∞ *1e6*	0/15
xNES	11(3)	24(38)	32(42)	50(106)	22(39)	25(35)	15/15
xNESas	16(28)	36(66)	36(58)	51(97)	21(35)	31(34)	15/15

Table 62: 05-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-3	1e-5	1e-7	#succ
f13	132	195	250	1310	1752	2255	15/15
ACOR	99(221)	475(603)	2137(2399)	5448(7733)	8.1e4(9e4)	∞ *1e7*	0/15
BIPOPaCMA	3.2(2)	3.8(1)	4.3(0.9)	**1.2**(0.1)	**1.2**(0.1)	**1.1**(0.2)	15/15
BIPOPsaACM	**1.2**(0.3)	**1.3**(0.4)	**1.3**(0.4)	**0.37**(0.1)$_{\downarrow 4}$	**0.34**(0.1)$_{\downarrow 4}$	**0.32**(0.1)$_{\downarrow 4}$	15/15
CMA	3.3(2)	5.3(2)	5.5(2)	**1.4**(0.3)	**1.6**(0.3)	**1.5**(0.3)	15/15
CMAES	4.5(3)	4.8(3)	5.1(2)	**1.5**(0.4)	**1.5**(0.4)	**1.4**(0.4)	15/15
CMAa	**2.9**(0.7)	4.1(2)	4.5(1)	**1.2**(0.2)	**1.2**(0.1)	**1.2**(0.1)	15/15
CMAm	4.0(3)	5.0(2)	4.7(2)	**1.7**(0.7)	**1.8**(0.8)	**2.0**(0.8)	15/15
CMAma	3.1(2)	4.5(3)	4.6(2)	**1.2**(0.3)	**1.3**(0.2)	**1.2**(0.2)	15/15
CMAmah	4.0(4)	5.6(4)	5.6(3)	**1.7**(0.8)	**1.7**(0.6)	**1.6**(0.5)	15/15
CMAmh	4.7(5)	10(3)	8.9(2)	**2.2**(0.8)	**2.5**(1)	**2.8**(0.9)	15/15
DBRCGA	22(8)	138(161)	603(907)	1034(1035)	2061(2364)	∞ *5e5*	0/15
DE	14(4)	26(11)	39(11)	19(7)	28(9)	45(23)	6/15
DE-AUTO	**0.99**(0.1)	**0.87**(0.1)$_{\downarrow 2}$	**0.83**(0.1)$_{\downarrow 4}$	**0.22**(0.0)$_{\downarrow 4}$	**1.1**(0.5)	**0.96**(0.1)	15/15
DE-BFGS	**1.0**(0.2)	**0.91**(0.1)	**0.87**(0.1)	**0.23**(0.0)$_{\downarrow 4}$	**2.6**(1.0)	529(621)	0/15
DE-ROLL	20(18)	43(39)	53(29)	16(7)	16(4)	79(115)	12/15
DE-SIMPLEX	4.8(4)	6.2(5)	8.4(6)	**2.3**(1)	**2.2**(1)	**2.7**(2)	15/15
DEctpb	17(8)	30(10)	49(16)	23(6)	30(6)	34(4)	12/15
IPOPsaACM	**1.2**(0.4)	**1.1**(0.3)	**1.2**(0.3)	**0.33**(0.1)$_{\downarrow 4}$	**0.35**(0.1)$_{\downarrow 4}$	**0.33**(0.1)$_{\downarrow 4}$	15/15
JADEb	5.4(2)	8.9(3)	11(4)	3.5(1)	3.5(1)	3.3(0.8)	15/15
JADEctpb	8.2(1)	12(2)	12(2)	3.1(0.3)	**2.9**(0.2)	**2.6**(0.2)	15/15
MVDE	29(12)	92(44)	240(114)	280(188)	2645(2759)	∞ *1e6*	0/15
NBIPOPaCMA	**2.7**(1)	3.3(2)	3.9(1)	**1.1**(0.2)	**1.2**(0.2)	**1.2**(0.1)	15/15
NIPOPaCMA	**2.9**(2)	4.4(2)	4.7(1)	**1.2**(0.2)	**1.3**(0.3)	**1.2**(0.2)	15/15
PSO-BFGS	**0.99**(0.1)	**0.87**(0.1)$_{\downarrow 2}$	**0.84**(0.1)$_{\downarrow 4}$	**0.22**(0.0)$_{\downarrow 4}$	181(286)	∞ *5e5*	0/15
SNES	44(76)	157(175)	335(295)	860(764)	2575(2827)	6385(7295)	0/15
xNES	3.6(0.8)	4.3(0.3)	4.7(0.3)	**1.4**(0.1)	**1.5**(0.1)	**1.5**(0.1)	15/15
xNESas	3.3(0.6)	3.7(0.5)	4.0(0.5)	**1.3**(0.2)	**1.4**(0.2)	**1.5**(0.2)	15/15

Table 63: 05-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-3	1e-5	1e-7	#succ
f14	10	41	58	139	251	476	15/15
ACOR	**1.7**(2)	4.7(2)	6.3(1)	9.3(3)	123(85)	4.8e4(6e4)	0/15
BIPOPaCMA	**2.3**(3)	**2.6**(1)	3.3(0.8)	3.9(0.7)	3.9(0.7)	3.2(0.3)	15/15
BIPOPsaACM	**1.5**(2)	**2.3**(0.6)	**2.4**(0.5)	**2.2**(0.3)	**1.8**(0.2)	**1.3**(0.1)	15/15
CMA	**2.3**(3)	**2.8**(0.9)	3.5(1)	4.2(1)	5.4(0.5)	4.4(0.6)	15/15
CMAES	**1.5**(1)	**2.9**(1)	3.8(0.8)	4.2(1)	5.4(1)	4.4(0.5)	15/15
CMAa	**2.5**(3)	**2.7**(1)	3.5(1)	4.0(0.7)	3.9(0.4)	3.1(0.4)	15/15
CMAm	**1.6**(2)	**2.8**(1)	3.2(2)	4.1(1.0)	5.4(1)	4.4(0.6)	15/15
CMAma	**1.8**(3)	**2.8**(0.9)	3.3(0.6)	3.7(0.7)	4.0(0.8)	**3.0**(0.4)	15/15
CMAmah	**1.4**(1)	**2.1**(0.8)	**2.4**(0.6)	3.4(0.9)	4.1(1)	3.5(0.4)	15/15
CMAmh	**1.4**(2)	**2.1**(1)	**2.5**(0.9)	4.1(2)	6.4(0.8)	5.1(0.6)	15/15
DBRCGA	**1.5**(1)	15(7)	25(3)	26(9)	110(97)	1315(1232)	1/15
DE	**1.8**(3)	7.2(3)	12(2)	15(4)	37(8)	47(12)	15/15
DE-AUTO	**1.7**(1)	**2.0**(0.3)	**1.7**(0.2)	**0.99**(0.1)	**0.73**(0.1)	5.1(5)	15/15
DE-BFGS	**1.0**(1)	**1.8**(0.2)	**1.5**(0.3)	**0.95**(0.1)	**0.71**(0.1)	6.4(10)	13/15
DE-ROLL	**1.4**(2)	4.7(6)	4.9(4)	10(10)	112(33)	1824(2231)	0/15
DE-SIMPLEX	**0.95**(2)	5.3(4)	4.9(3)	3.1(0.9)	**2.2**(0.5)	**1.5**(0.3)	15/15
DEctpb	**1.1**(1)	6.3(4)	12(2)	16(3)	40(12)	52(10)	15/15
IPOPsaACM	**2.8**(2)	**2.5**(0.6)	**2.5**(0.6)	**2.1**(0.3)	**1.8**(0.2)	**1.3**(0.1)	15/15
JADEb	**1.3**(1)	4.0(1.0)	6.1(1)	7.8(1)	10(2)	8.2(3)	15/15
JADEctpb	**0.95**(0.8)	5.3(2)	8.9(1)	10(2)	12(1)	8.2(0.5)	15/15
MVDE	**0.91**(1.0)	15(6)	26(7)	38(9)	173(39)	591(272)	15/15
NBIPOPaCMA	**1.7**(2)	**2.5**(1)	3.6(0.8)	4.1(0.5)	4.2(0.5)	3.2(0.4)	15/15
NIPOPaCMA	**2.1**(2)	3.1(1)	3.9(1)	4.3(0.7)	4.0(0.5)	3.2(0.4)	15/15
PSO-BFGS	**2.3**(3)	**1.9**(0.3)	**1.6**(0.2)	**0.98**(0.1)	**0.76**(0.1)	134(203)	4/15
SNES	**2.6**(3)	**2.4**(1)	3.3(1)	8.3(10)	1.2e4(1e4)	∞ *1e6*	0/15
xNES	**2.3**(2)	**2.1**(1)	4.2(1)	5.5(0.7)	5.1(0.7)	3.9(0.2)	15/15
xNESas	**2.0**(2)	**1.9**(0.9)	3.9(1)	4.9(1)	4.6(0.5)	3.3(0.3)	15/15

Table 64: 05-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-3	1e-5	1e-7	#succ
f15	511	9310	19369	20073	20769	21359	14/15
ACOR	5.3(4)	7.7(11)	17(27)	16(26)	16(25)	15(25)	15/15
BIPOPaCMA	**1.5**(2)	**1.1**(0.8)	**1.4**(1)	**1.3**(1)	**1.3**(1)	**1.3**(1)	15/15
BIPOPsaACM	**1.4**(1)	**0.59**(0.5)	**0.65**(0.5)	**0.64**(0.5)	**0.62**(0.5)	**0.61**(0.4)	15/15
CMA	**1.6**(2)	**0.74**(0.5)	**0.86**(0.6)	**0.86**(0.6)	**0.86**(0.6)	**0.87**(0.6)	15/15
CMAES	**2.1**(2)	5.0(5)	15(13)	15(14)	14(13)	14(14)	9/15
CMAa	**1.5**(2)	**1.1**(0.7)	**1.2**(0.6)	**1.2**(0.7)	**1.2**(0.6)	**1.2**(0.6)	15/15
CMAm	**1.8**(2)	**0.74**(0.6)	**0.66**(0.4)	**0.67**(0.4)	**0.67**(0.3)	**0.68**(0.3)	15/15
CMAma	**1.0**(0.5)	**0.86**(0.6)	**1.1**(0.8)	**1.1**(0.8)	**1.1**(0.8)	**1.1**(0.8)	15/15
CMAmah	**2.0**(2)	**0.98**(0.5)	**1.1**(0.7)	**1.1**(0.7)	**1.1**(0.7)	**1.1**(0.7)	15/15
CMAmh	3.2(3)	**0.95**(0.5)	**1.1**(0.6)	**1.1**(0.6)	**1.1**(0.6)	**1.1**(0.6)	15/15
DBRCGA	3.7(2)	26(24)	84(90)	81(96)	79(80)	77(93)	4/15
DE	6.1(5)	4.3(4)	6.0(7)	5.9(6)	5.7(6)	5.6(6)	13/15
DE-AUTO	15(9)	6.1(7)	11(14)	11(13)	11(13)	10(13)	13/15
DE-BFGS	3.8(3)	**1.1**(1)	**1.6**(1)	**1.6**(1)	**1.5**(1)	**1.5**(1)	15/15
DE-ROLL	24(14)	7.0(6)	12(13)	12(14)	12(14)	11(13)	13/15
DE-SIMPLEX	10(5)	3.1(3)	3.2(3)	3.0(3)	**2.9**(3)	**2.9**(3)	15/15
DEctpb	6.0(4)	4.9(4)	7.1(8)	7.2(7)	7.1(8)	7.1(8)	12/15
IPOPsaACM	**1.6**(1)	**0.42**(0.4)$_\downarrow$	**0.72**(0.6)	**0.71**(0.6)	**0.70**(0.6)	**0.69**(0.6)	15/15
JADEb	3.0(2)	14(15)	32(33)	39(44)	38(42)	37(41)	4/15
JADEctpb	3.7(1)	7.5(13)	39(51)	39(44)	59(60)	175(199)	1/15
MVDE	5.1(2)	12(12)	26(31)	31(30)	32(28)	32(29)	11/15
NBIPOPaCMA	**1.7**(2)	**0.99**(1)	**1.6**(0.9)	**1.6**(0.9)	**1.5**(0.9)	**1.5**(0.8)	15/15
NIPOPaCMA	**1.4**(2)	**1.1**(0.9)	**1.2**(0.7)	**1.2**(0.7)	**1.2**(0.7)	**1.2**(0.7)	15/15
PSO-BFGS	10(7)	6.6(5)	39(40)	37(38)	36(39)	35(36)	8/15
SNES	5.0(10)	14(14)	23(20)	22(19)	22(18)	21(18)	14/15
xNES	**1.8**(1)	5.3(6)	25(33)	24(32)	24(24)	23(24)	11/15
xNESas	3.6(6)	4.3(4)	18(20)	18(19)	17(19)	16(18)	14/15

Table 65: 05-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-3	1e-5	1e-7	#succ
f16	120	612	2662	10449	11644	12095	15/15
ACOR	7.0(9)	325(232)	154(187)	66(77)	70(66)	75(83)	15/15
BIPOPaCMA	3.6(2)	3.5(3)	**1.8**(2)	**0.74**(1.0)	**0.71**(0.8)	**0.71**(0.8)	15/15
BIPOPsaACM	3.2(4)	4.3(2)	**1.6**(1)	**0.82**(0.7)	**0.77**(0.7)	**0.79**(0.7)	15/15
CMA	**2.3**(2)	**3.1**(3)	**1.9**(2)	**1.1**(1)	**1.00**(1)	**1.00**(1)	15/15
CMAES	**2.0**(2)	3.6(4)	**2.7**(4)	4.5(8)	5.8(7)	5.7(7)	15/15
CMAa	**1.7**(1)	**2.8**(3)	**2.2**(2)	**0.84**(0.6)	**0.80**(0.5)	**0.80**(0.5)	15/15
CMAm	**2.9**(4)	5.0(6)	**3.0**(2)	**1.0**(0.6)	**1.1**(0.7)	**1.1**(0.7)	15/15
CMAma	**2.3**(2)	3.3(5)	**1.7**(0.8)	**0.88**(0.6)	**0.83**(0.5)	**0.83**(0.5)	15/15
CMAmah	**2.3**(1)	3.8(4)	**2.4**(2)	**0.94**(0.7)	**0.90**(0.6)	**0.90**(0.6)	15/15
CMAmh	**2.9**(1)	3.8(3)	**2.5**(1)	**1.2**(1)	**1.1**(1.0)	**1.1**(1.0)	15/15
DBRCGA	**2.2**(1)	27(41)	38(51)	50(58)	86(96)	101(117)	5/15
DE	5.1(6)	31(13)	17(16)	11(10)	10(9)	10(8)	14/15
DE-AUTO	6.6(15)	115(105)	99(103)	93(97)	86(90)	605(644)	1/15
DE-BFGS	8.0(8)	17(12)	21(9)	33(48)	30(43)	585(643)	0/15
DE-ROLL	8.3(9)	69(41)	62(96)	73(81)	110(116)	616(632)	0/15
DE-SIMPLEX	**2.4**(2)	7.6(7)	19(25)	10(9)	10(8)	37(47)	7/15
DEctpb	3.9(5)	54(30)	52(30)	165(191)	149(161)	144(155)	2/15
IPOPsaACM	3.1(4)	**2.4**(2)	**1.0**(1)	**0.52**(0.6)$\downarrow$	**0.55**(0.6)$\downarrow$	**0.55**(0.5)$\downarrow$	15/15
JADEb	3.1(3)	4.5(2)	6.8(8)	7.6(12)	8.4(12)	8.7(12)	12/15
JADEctpb	**2.9**(5)	10(5)	36(48)	∞	∞	∞ *2e5*	0/15
MVDE	**1.8**(2)	24(11)	90(163)	1411(1627)	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.6**(2)	4.6(6)	**2.4**(2)	**0.99**(1)	**0.94**(1.0)	**0.93**(1.0)	15/15
NIPOPaCMA	**1.8**(2)	**2.7**(5)	**1.0**(1)	**0.56**(0.6)	**0.55**(0.5)	**0.57**(0.5)	15/15
PSO-BFGS	6.9(8)	41(37)	75(97)	111(141)	298(345)	593(643)	1/15
SNES	**3.0**(3)	7.8(16)	13(24)	11(22)	41(45)	61(83)	9/15
xNES	**2.0**(2)	3.6(2)	4.4(8)	**2.5**(3)	**2.3**(3)	**2.2**(3)	15/15
xNESas	**2.3**(2)	5.3(8)	**1.7**(3)	**1.8**(2)	**1.6**(2)	**1.6**(2)	15/15

Table 66: 05-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-3	1e-5	1e-7	#succ
f17	5.2	215	899	3669	6351	7934	15/15
ACOR	3.1(3)	**1.8**(0.4)	**0.95**(0.2)	**2.8**(8)	7.5(9)	11(14)	15/15
BIPOPaCMA	3.8(5)	**0.86**(0.3)	**1.1**(2)	**0.83**(0.5)	**0.94**(0.7)	**1.4**(0.4)	15/15
BIPOPsaACM	3.8(6)	**1.0**(1)	**1.2**(2)	**0.92**(0.5)	**1.1**(0.4)	**1.4**(1)	15/15
CMA	**1.8**(2)	**0.82**(0.3)	**0.93**(2)	**0.89**(0.6)	**1.1**(0.7)	**1.2**(0.4)	15/15
CMAES	4.1(4)	**0.96**(0.4)	**0.74**(0.2)	**1.2**(2)	8.5(11)	30(30)	9/15
CMAa	**2.6**(2)	**1.3**(0.4)	**0.77**(1.0)	**0.89**(0.5)	**0.81**(0.3)	**1.0**(0.4)	15/15
CMAm	3.4(3)	**0.85**(0.5)	**0.58**(0.1)	**0.73**(0.4)	**0.77**(0.5)	**0.91**(0.3)	15/15
CMAma	3.3(2)	**1.5**(0.4)	**1.1**(1)	**0.84**(0.9)	**0.82**(0.5)	**0.96**(0.4)	15/15
CMAmah	3.1(2)	**1.5**(3)	**2.1**(2)	**1.3**(0.8)	**1.1**(0.5)	**1.0**(0.4)	15/15
CMAmh	**2.5**(2)	**1.2**(0.6)	**2.6**(3)	**1.5**(1.0)	**1.4**(0.6)	**1.5**(0.6)	15/15
DBRCGA	3.7(5)	5.4(0.8)	7.7(1)	16(14)	38(37)	88(92)	4/15
DE	4.1(6)	3.2(1.0)	**2.2**(0.5)	**2.1**(0.5)	**2.8**(2)	3.3(3)	15/15
DE-AUTO	3.8(3)	163(53)	120(212)	47(57)	35(32)	41(36)	10/15
DE-BFGS	3.0(3)	7.1(7)	35(110)	10(27)	6.9(16)	145(164)	0/15
DE-ROLL	**2.7**(3)	47(41)	125(261)	54(71)	45(42)	898(979)	1/15
DE-SIMPLEX	**2.5**(2)	23(16)	55(35)	24(34)	15(20)	887(915)	0/15
DEctpb	4.1(5)	3.4(1)	**2.6**(0.9)	**2.1**(0.5)	**2.1**(0.5)	3.7(2)	15/15
IPOPsaACM	4.9(4)	**1.8**(0.4)	**1.1**(1)	**0.85**(0.5)	**1.2**(0.5)	**1.4**(0.8)	15/15
JADEb	3.1(2)	**1.4**(0.6)	3.3(7)	3.4(7)	5.3(5)	9.0(7)	13/15
JADEctpb	3.3(4)	**2.5**(0.7)	**1.9**(0.3)	**1.2**(0.2)	**1.2**(0.3)	**1.2**(0.2)	15/15
MVDE	**2.9**(4)	5.8(2)	5.8(2)	6.8(3)	10(6)	32(63)	13/15
NBIPOPaCMA	6.5(6)	5.7(7)	**2.1**(2)	**1.1**(1)	**1.0**(0.6)	**1.3**(0.7)	15/15
NIPOPaCMA	5.5(4)	**1.00**(0.4)	**0.88**(2)	**0.98**(0.9)	**0.90**(0.4)	**1.0**(0.4)	15/15
PSO-BFGS	**1.5**(1.0)	26(15)	21(19)	13(21)	9.2(12)	907(947)	0/15
SNES	5.3(4)	4.2(0.9)	3.6(6)	**2.7**(3)	8.1(9)	19(20)	14/15
xNES	4.5(6)	**1.1**(0.4)	**0.79**(0.2)	**0.47**(0.1)	**1.3**(1)	6.1(9)	15/15
xNESas	6.8(7)	**1.0**(0.7)	**1.1**(0.7)	**0.81**(0.7)	**1.4**(1)	**2.0**(3)	15/15

Table 67: 05-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-3	1e-5	1e-7	#succ
f18	103	378	3968	9280	10905	12469	15/15
ACOR	**1.9**(1)	**2.4**(1)	5.8(14)	36(38)	82(70)	80(60)	15/15
BIPOPaCMA	**1.2**(0.3)	**2.0**(3)	**0.62**(0.5)	**0.76**(0.3)	**0.86**(0.3)	**0.98**(0.3)	15/15
BIPOPsaACM	**2.5**(1)	3.1(4)	**0.82**(1.0)	**0.76**(0.7)	**1.2**(0.7)	**1.4**(0.7)	15/15
CMA	**1.2**(0.9)	**1.6**(0.8)	**1.6**(2)	**0.97**(0.8)	**1.0**(0.7)	**1.1**(0.5)	15/15
CMAES	**1.2**(0.7)	**2.2**(4)	**1.5**(2)	11(11)	76(80)	92(100)	3/15
CMAa	**0.82**(0.3)	**1.7**(0.3)	**0.44**(0.5)	**0.66**(0.3)$\downarrow$	**0.76**(0.3)	**0.94**(0.6)	15/15
CMAm	**0.94**(0.7)	**0.77**(0.3)	**0.53**(0.6)	**0.79**(0.4)	**0.82**(0.3)	**0.85**(0.3)	15/15
CMAma	**0.89**(0.7)	**1.2**(0.8)	**0.63**(0.5)	**0.69**(0.6)	**0.67**(0.6)	**0.71**(0.5)	15/15
CMAmah	6.2(2)	7.2(11)	**1.5**(1)	**1.2**(0.6)	**1.1**(0.7)	**1.1**(0.6)	15/15
CMAmh	**0.51**(0.3)	**2.6**(3)	**1.1**(1)	**1.3**(0.6)	**1.3**(0.6)	**1.3**(0.6)	15/15
DBRCGA	5.0(3)	12(2)	5.4(9)	100(116)	∞	∞ *5e5*	0/15
DE	**2.4**(2)	4.4(2)	**1.4**(0.7)	**2.8**(3)	7.7(9)	40(43)	5/15
DE-AUTO	48(107)	162(60)	60(71)	54(56)	60(60)	84(83)	2/15
DE-BFGS	5.7(7)	18(10)	28(63)	19(27)	20(23)	587(685)	0/15
DE-ROLL	49(69)	112(57)	65(69)	88(91)	∞	∞ *5e5*	0/15
DE-SIMPLEX	23(23)	155(285)	62(77)	65(71)	74(83)	575(613)	0/15
DEctpb	**2.9**(2)	4.9(2)	**1.5**(0.7)	**2.3**(1.0)	6.7(7)	290(331)	1/15
IPOPsaACM	**2.8**(0.8)	**1.5**(0.5)	**0.64**(0.7)	**0.85**(0.7)	**1.0**(0.4)	**1.1**(0.4)	15/15
JADEb	**1.8**(1)	4.0(1)	**2.5**(3)	12(16)	72(83)	∞ *2e5*	0/15
JADEctpb	**1.9**(1)	3.3(0.7)	**0.72**(0.1)	**0.60**(0.1)$\downarrow_2$	**1.1**(0.2)	**1.1**(0.2)	15/15
MVDE	4.2(1)	10(4)	4.3(2)	18(10)	39(24)	50(28)	12/15
NBIPOPaCMA	**1.0**(0.6)	3.1(7)	**0.68**(0.9)	**0.99**(0.4)	**1.0**(0.4)	**1.1**(0.4)	15/15
NIPOPaCMA	**1.1**(0.7)	**1.5**(1)	**0.49**(0.6)	**0.99**(0.7)	**1.1**(0.7)	**1.1**(0.4)	15/15
PSO-BFGS	24(18)	37(11)	16(10)	38(38)	53(55)	∞ *5e5*	0/15
SNES	**1.1**(0.9)	6.3(13)	**1.9**(3)	20(22)	647(734)	∞ *1e6*	0/15
xNES	**1.2**(1)	**1.4**(0.5)	**0.43**(0.1)	**0.51**(0.6)	**2.0**(2)	3.6(4)	15/15
xNESas	**0.80**(0.5)	**1.4**(0.3)	**0.25**(0.1)	**0.43**(0.5)	**1.4**(0.9)	**2.0**(3)	15/15

Table 68: 05-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-3	1e-5	1e-7	#succ
f19	1	1	242	1.2e5	1.2e5	1.2e5	15/15
ACOR	28(28)	3135(4608)	626(611)	17(38)	17(38)	17(38)	14/15
BIPOPaCMA	22(14)	**1466**(1186)	186(177)	**2.0**(1)	**2.0**(1)	**2.0**(1)	15/15
BIPOPsaACM	16(14)	1834(1246)	**92**(142)	**0.85**(0.6)	**0.85**(0.6)	**0.85**(0.6)	15/15
CMA	**15**(14)	1796(1570)	572(827)	**2.1**(2)	**2.1**(2)	**2.1**(2)	15/15
CMAES	21(13)	2230(1651)	327(335)	∞	∞	∞ *3e5*	0/15
CMAa	24(10)	6888(1525)	462(416)	**3.0**(3)	**3.0**(3)	**3.0**(3)	14/15
CMAm	20(16)	**1379**(1430)	551(660)	**2.3**(2)	**2.3**(2)	**2.3**(2)	15/15
CMAma	18(13)	**1297**(924)	259(255)	**1.9**(2)	**1.9**(2)	**1.9**(2)	15/15
CMAmah	17(12)	**1167**(656)	518(491)	**2.4**(2)	**2.4**(2)	**2.3**(2)	15/15
CMAmh	**12**(15)	3.1e4(8e4)	421(494)	**2.5**(2)	**2.5**(2)	**2.5**(2)	15/15
DBRCGA	28(26)	3184(1818)	859(1122)	∞	∞	∞ *5e5*	0/15
DE	32(28)	4210(2571)	1106(1032)	15(17)	15(16)	15(16)	2/15
DE-AUTO	323(28)	1.3e4(1e4)	361(226)	19(21)	19(21)	19(19)	3/15
DE-BFGS	40(38)	2166(1133)	**71**(65)	4.3(4)	4.3(4)	11(11)	2/15
DE-ROLL	38(26)	5195(8159)	502(489)	61(62)	61(70)	∞ *5e5*	0/15
DE-SIMPLEX	62(16)	2807(2948)	**68**(95)	4.7(6)	4.7(5)	4.7(5)	9/15
DEctpb	34(41)	3526(3425)	1050(1038)	∞	∞	∞ *2e5*	0/15
IPOPsaACM	19(16)	1931(1477)	250(254)	**1.4**(1)	**1.4**(1)	**1.4**(1)	15/15
JADEb	30(24)	3020(2620)	586(682)	9.5(9)	9.4(10)	9.4(10)	3/15
JADEctpb	35(26)	2139(2314)	276(160)	∞	∞	∞ *2e5*	0/15
MVDE	34(26)	4483(4878)	756(722)	56(62)	120(124)	120(123)	1/15
NBIPOPaCMA	20(20)	2026(1762)	156(138)	**2.6**(4)	**2.6**(4)	**2.6**(4)	15/15
NIPOPaCMA	16(16)	1813(1877)	324(473)	**2.7**(3)	**2.7**(3)	**2.7**(3)	15/15
PSO-BFGS	69(94)	2559(2762)	**60**(51)	3.6(3)	3.6(3)	19(21)	1/15
SNES	**14**(12)	3327(5308)	1668(2065)	36(41)	36(41)	36(38)	3/15
xNES	**15**(16)	2009(1734)	386(502)	5.3(5)	5.3(5)	5.6(5)	10/15
xNESas	17(18)	3280(5087)	542(792)	11(10)	20(21)	21(22)	6/15

Table 69: 05-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-3	1e-5	1e-7	#succ
f20	16	851	38111	54470	54861	55313	14/15
ACOR	6.0(2)	3.2(4)	3.3(4)	**2.3**(3)	**2.3**(3)	**2.3**(3)	15/15
BIPOPaCMA	3.4(3)	10(11)	**2.4**(1)	**1.7**(0.9)	**1.8**(0.9)	**1.8**(0.9)	15/15
BIPOPsaACM	3.1(2)	3.9(4)	**1.7**(1)	**1.2**(1.0)	**1.2**(1.0)	**1.2**(1.0)	15/15
CMA	3.7(2)	8.3(6)	**1.7**(0.8)	**1.3**(0.6)	**1.3**(0.6)	**1.3**(0.6)	15/15
CMAES	3.7(3)	27(28)	∞	∞	∞	∞ *3e5*	0/15
CMAa	**2.5**(2)	9.1(3)	**1.7**(1)	**1.4**(1)	**1.4**(1)	**1.4**(1)	15/15
CMAm	**3.0**(3)	9.0(4)	**1.7**(0.8)	**1.3**(0.6)	**1.3**(0.6)	**1.3**(0.6)	15/15
CMAma	**2.4**(2)	9.4(6)	**1.7**(2)	**1.3**(1)	**1.3**(1)	**1.4**(1)	15/15
CMAmah	**2.3**(2)	11(4)	**1.6**(2)	**1.2**(1)	**1.2**(1)	**1.2**(1)	15/15
CMAmh	**2.6**(1)	14(12)	**1.7**(2)	**1.3**(1)	**1.3**(1)	**1.3**(1)	15/15
DBRCGA	18(15)	4.4(6)	**2.4**(2)	**1.7**(1)	**1.7**(1)	**1.7**(1)	14/15
DE	8.8(6)	**1.9**(0.7)	**0.57**(0.8)	**0.41**(0.6)	**0.42**(0.6)	**0.42**(0.5)	15/15
DE-AUTO	4.0(1)	7.2(6)	14(16)	10(12)	10(12)	10(12)	9/15
DE-BFGS	4.1(2)	**2.8**(1)	10(14)	7.1(10)	7.0(8)	7.0(7)	10/15
DE-ROLL	15(19)	3.1(3)	4.0(6)	**2.8**(4)	**2.8**(4)	**2.8**(4)	14/15
DE-SIMPLEX	6.4(2)	4.7(5)	19(22)	13(15)	13(18)	13(15)	7/15
DEctpb	7.7(6)	**2.1**(1)	**0.14**(0.0)$_{\downarrow 4}$	**0.14**(0.0)	**0.16**(0.0)	**0.17**(0.0)	15/15
IPOPsaACM	**2.4**(2)	3.5(3)	**1.6**(1)	**1.2**(1)	**1.2**(1)	**1.2**(1)	15/15
JADEb	5.8(4)	**0.91**(0.3)	**1.7**(2)	**1.2**(2)	**1.2**(2)	**1.2**(2)	14/15
JADEctpb	4.9(3)	**2.3**(2)	**0.25**(0.2)$_{\downarrow 3}$	**0.25**(0.2)	**0.29**(0.2)	**0.33**(0.2)	15/15
MVDE	14(8)	**2.7**(2)	**0.23**(0.1)$_{\downarrow 4}$	**0.26**(0.1)	**0.32**(0.1)	**0.35**(0.1)	15/15
NBIPOPaCMA	3.6(3)	11(12)	**2.4**(1)	**1.8**(1)	**1.8**(1)	**1.8**(1)	15/15
NIPOPaCMA	3.2(2)	10(5)	**2.1**(2)	**1.6**(1)	**1.6**(1)	**1.7**(1)	15/15
PSO-BFGS	4.9(0.9)	5.4(7)	3.5(3)	**2.4**(2)	**2.4**(2)	**2.4**(2)	14/15
SNES	**2.3**(2)	29(29)	23(21)	16(13)	16(14)	16(13)	11/15
xNES	**2.3**(2)	10(12)	11(9)	8.0(6)	8.0(8)	7.9(8)	13/15
xNESas	3.2(3)	12(22)	21(25)	15(19)	15(17)	14(16)	12/15

Table 70: 05-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-3	1e-5	1e-7	#succ
f21	41	1157	1674	1705	1729	1757	14/15
ACOR	3.8(4)	118(196)	299(212)	294(209)	290(206)	285(202)	15/15
BIPOPaCMA	**1.8**(0.9)	7.4(8)	49(23)	50(22)	50(22)	49(22)	15/15
BIPOPsaACM	**1.9**(1)	3.4(4)	4.9(8)	5.0(8)	4.9(8)	4.9(8)	15/15
CMA	6.6(16)	7.3(14)	43(108)	43(105)	43(103)	42(101)	13/15
CMAES	**1.8**(1)	3.1(3)	3.9(5)	3.9(5)	**3.9**(5)	**3.9**(5)	15/15
CMAa	**1.9**(1)	28(14)	23(20)	23(21)	23(21)	22(22)	14/15
CMAm	**1.4**(1)	26(8)	21(20)	21(21)	21(21)	21(21)	14/15
CMAma	**2.0**(2)	5.0(5)	22(18)	39(110)	39(107)	39(106)	13/15
CMAmah	3.6(4)	**2.7**(3)	5.7(10)	5.9(11)	6.0(11)	6.1(11)	15/15
CMAmh	3.3(1)	5.7(6)	40(62)	41(63)	42(70)	42(69)	14/15
DBRCGA	3.2(3)	**2.2**(5)	**2.1**(4)	**2.7**(3)	**3.3**(3)	**3.8**(3)	15/15
DE	**2.7**(3)	3.9(6)	3.7(4)	4.0(4)	4.3(4)	**4.5**(4)	15/15
DE-AUTO	10(24)	26(47)	36(72)	36(71)	35(70)	35(69)	15/15
DE-BFGS	**2.2**(2)	**1.6**(2)	**2.7**(3)	**2.7**(3)	**2.7**(3)	16(15)	12/15
DE-ROLL	10(21)	33(51)	31(39)	31(39)	30(38)	30(38)	15/15
DE-SIMPLEX	3.2(2)	19(23)	19(17)	19(17)	18(17)	18(17)	15/15
DEctpb	3.2(3)	5.5(5)	4.5(4)	5.3(4)	5.8(4)	6.2(4)	15/15
IPOPsaACM	**2.9**(2)	**1.6**(2)	28(23)	28(26)	28(26)	27(26)	15/15
JADEb	**2.3**(2)	4.4(5)	4.4(4)	4.4(4)	4.5(4)	**4.6**(4)	15/15
JADEctpb	**1.7**(2)	**1.1**(1)	**1.2**(1)	**2.8**(4)	5.0(9)	8.2(13)	15/15
MVDE	4.3(3)	**1.5**(0.8)	**2.8**(2)	5.9(3)	10(4)	13(4)	15/15
NBIPOPaCMA	**2.1**(2)	11(10)	31(62)	30(61)	30(60)	29(59)	15/15
NIPOPaCMA	4.1(1)	76(145)	272(620)	269(609)	266(601)	263(591)	15/15
PSO-BFGS	**1.8**(2)	**0.88**(1)	**1.6**(2)	**1.6**(2)	**1.6**(2)	29(55)	13/15
SNES	51(123)	46(74)	53(65)	52(63)	52(62)	51(62)	15/15
xNES	34(123)	29(37)	32(44)	32(44)	31(43)	31(42)	15/15
xNESas	12(1)	23(25)	36(57)	35(56)	35(55)	35(54)	15/15

Table 71: 05-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-3	1e-5	1e-7	#succ
f22	71	386	938	1008	1040	1068	14/15
ACOR	**2.9**(3)	143(261)	855(1544)	797(1437)	774(1394)	756(1359)	15/15
BIPOPaCMA	14(13)	16(22)	38(92)	36(86)	35(84)	34(82)	15/15
BIPOPsaACM	**2.2**(4)	**3.2**(4)	14(27)	**13**(25)	**13**(24)	**13**(23)	15/15
CMA	10(11)	87(40)	292(414)	554(747)	537(710)	524(658)	6/15
CMAES	9.3(10)	21(28)	18(31)	17(28)	16(28)	**16**(27)	15/15
CMAa	15(24)	87(30)	379(552)	433(594)	421(637)	411(517)	7/15
CMAm	12(23)	17(26)	144(219)	444(563)	431(595)	421(541)	7/15
CMAma	**2.0**(0.8)	94(71)	250(367)	465(573)	452(570)	442(555)	7/15
CMAmah	6.3(14)	130(262)	289(387)	346(452)	336(397)	329(412)	8/15
CMAmh	5.3(8)	38(29)	288(406)	436(559)	424(547)	414(526)	7/15
DBRCGA	**2.6**(3)	6.7(5)	**11**(11)	**12**(10)	**15**(11)	**16**(11)	15/15
DE	5.0(4)	13(16)	17(25)	17(22)	18(22)	19(21)	15/15
DE-AUTO	8.1(15)	84(101)	102(128)	95(119)	92(115)	96(103)	15/15
DE-BFGS	6.7(15)	13(27)	23(24)	21(22)	21(22)	131(241)	8/15
DE-ROLL	16(24)	144(290)	150(233)	143(217)	144(215)	208(240)	8/15
DE-SIMPLEX	6.5(8)	29(74)	44(47)	41(44)	40(42)	39(41)	15/15
DEctpb	5.1(5)	7.9(13)	**11**(15)	13(14)	16(13)	17(13)	15/15
IPOPsaACM	3.4(5)	12(13)	85(258)	116(267)	113(258)	110(252)	15/15
JADEb	12(30)	16(19)	14(10)	14(10)	**14**(9)	**14**(9)	15/15
JADEctpb	**2.1**(1)	**3.4**(3)	**8.0**(11)	**12**(18)	16(27)	17(30)	15/15
MVDE	4.4(3)	**5.4**(3)	85(14)	98(52)	113(58)	124(58)	14/15
NBIPOPaCMA	8.9(11)	14(18)	18(19)	17(18)	17(18)	17(17)	15/15
NIPOPaCMA	4.0(10)	258(468)	338(715)	316(665)	307(644)	300(628)	15/15
PSO-BFGS	**1.6**(2)	**4.2**(6)	**3.4**(4)	**3.2**(4)	**3.3**(4)	170(238)	5/15
SNES	91(152)	191(260)	134(155)	129(144)	149(188)	161(189)	15/15
xNES	66(209)	100(193)	104(119)	97(110)	95(107)	92(104)	15/15
xNESas	46(61)	44(57)	39(42)	37(39)	36(37)	35(37)	15/15

Table 72: 05-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-3	1e-5	1e-7	#succ
f23	3.0	518	14249	31654	33030	34256	15/15
ACOR	**2.6**(3)	86(79)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	3.2(3)	11(9)	**1.6**(1)	**0.86**(0.6)	**0.85**(0.6)	**0.84**(0.6)	15/15
BIPOPsaACM	4.2(4)	14(8)	**1.1**(1)	**0.91**(0.9)	**0.88**(0.8)	**0.97**(0.8)	15/15
CMA	**2.7**(3)	20(18)	107(141)	49(64)	47(61)	45(59)	6/15
CMAES	**2.9**(5)	13(15)	6.9(9)	4.9(5)	4.7(5)	4.5(4)	12/15
CMAa	**2.4**(3)	29(17)	39(71)	18(32)	17(30)	17(29)	10/15
CMAm	**2.2**(2)	16(17)	63(105)	37(48)	36(46)	35(44)	7/15
CMAma	**2.5**(2)	21(38)	37(70)	22(32)	21(31)	20(29)	9/15
CMAmah	**1.9**(2)	17(29)	52(73)	23(32)	22(30)	22(30)	9/15
CMAmh	4.5(10)	10(13)	38(70)	23(32)	22(31)	21(30)	9/15
DBRCGA	**0.91**(0.8)	19(19)	43(40)	222(237)	212(220)	205(223)	1/15
DE	**2.9**(4)	48(59)	57(62)	35(39)	53(60)	105(124)	1/15
DE-AUTO	**2.9**(3)	4.6(4)	3.5(2)	4.4(2)	4.8(2)	6.1(3)	14/15
DE-BFGS	**2.2**(2)	**2.5**(3)	**2.0**(2)	**1.3**(0.9)	**1.4**(0.9)	96(109)	0/15
DE-ROLL	**2.4**(2)	**4.4**(5)	18(21)	14(14)	16(13)	104(117)	0/15
DE-SIMPLEX	**2.3**(2)	**0.92**(0.9)	**0.88**(0.7)	**0.91**(0.8)	**1.1**(0.8)	99(110)	0/15
DEctpb	3.5(4)	57(60)	∞	∞	∞	∞ *2e5*	0/15
IPOPsaACM	**2.1**(2)	13(17)	8.8(2)	6.6(20)	6.4(19)	6.2(18)	15/15
JADEb	**2.3**(3)	35(40)	32(28)	17(17)	17(16)	16(15)	6/15
JADEctpb	**2.4**(3)	37(32)	8.3(6)	7.6(8)	7.3(7)	7.1(7)	10/15
MVDE	**1.8**(2)	32(40)	190(182)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.6**(2)	8.2(8)	**1.4**(2)	**0.97**(1)	**0.95**(1)	**1.1**(0.9)	15/15
NIPOPaCMA	3.2(2)	15(21)	**1.8**(1)	**0.86**(0.7)	**0.86**(0.7)	**0.87**(0.7)	15/15
PSO-BFGS	**1.4**(1)	**3.5**(5)	3.3(4)	30(34)	∞	∞ *5e5*	0/15
SNES	**2.8**(2)	35(38)	46(54)	416(461)	399(470)	384(460)	1/15
xNES	3.4(3)	66(68)	755(795)	∞	∞	∞ *8e5*	0/15
xNESas	**2.2**(2)	97(97)	∞	∞	∞	∞ *1e6*	0/15

Table 73: 05-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-3	1e-5	1e-7	#succ
f24	1622	2.2e5	6.4e6	9.6e6	1.3e7	1.3e7	3/15
ACOR	8.2(6)	155(162)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.3**(1)	**1.0**(1)	**1.1**(1)	**1.3**(1)	**0.96**(1.0)	**0.96**(1)	5/15
BIPOPsaACM	**1.8**(1)	**1.0**(1)	**0.69**(0.8)	**0.97**(1)	**0.73**(0.8)	**0.73**(0.8)	6/15
CMA	**1.9**(1)	9.4(12)	∞	∞	∞	∞ *1e6*	0/15
CMAES	**1.6**(2)	3.1(3)	∞	∞	∞	∞ *3e5*	0/15
CMAa	**1.5**(2)	13(16)	∞	∞	∞	∞ *1e6*	0/15
CMAm	**2.2**(2)	19(23)	∞	∞	∞	∞ *1e6*	0/15
CMAma	**1.3**(1)	65(72)	∞	∞	∞	∞ *1e6*	0/15
CMAmah	**1.6**(1)	19(21)	∞	∞	∞	∞ *1e6*	0/15
CMAmh	**1.4**(1)	13(18)	**2.2**(3)	**1.5**(2)	**1.1**(1)	**1.1**(1)	1/15
DBRCGA	11(12)	5.6(6)	∞	∞	∞	∞ *5e5*	0/15
DE	10(8)	5.4(6)	∞	∞	∞	∞ *2e5*	0/15
DE-AUTO	10(11)	10(12)	∞	∞	∞	∞ *5e5*	0/15
DE-BFGS	**1.3**(1)	4.3(5)	**0.19**(0.2)	**0.24**(0.3)	**0.18**(0.2)	**0.18**(0.2)	3/15
DE-ROLL	13(11)	16(17)	∞	∞	∞	∞ *5e5*	0/15
DE-SIMPLEX	3.5(3)	10(11)	**0.56**(0.6)	**0.76**(0.8)	**0.57**(0.6)	**0.57**(0.7)	1/15
DEctpb	12(8)	17(18)	∞	∞	∞	∞ *2e5*	0/15
IPOPsaACM	**1.9**(1)	42(52)	11(13)	∞	∞	∞ *5e6*	0/15
JADEb	4.2(4)	7.8(9)	∞	∞	∞	∞ *2e5*	0/15
JADEctpb	6.5(5)	∞	∞	∞	∞	∞ *2e5*	0/15
MVDE	13(10)	69(74)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.0**(1)	**0.64**(0.5)	**0.92**(1)	**0.81**(0.9)	**0.71**(0.8)	**0.88**(1)	5/15
NIPOPaCMA	**1.8**(1)	**2.1**(4)	**0.61**(0.7)	**0.46**(0.4)	**0.35**(0.3)	**0.35**(0.3)	11/15
PSO-BFGS	3.2(2)	**0.69**(1)	**0.20**(0.2)	**0.23**(0.3)	**0.18**(0.2)	**0.18**(0.2)	3/15
SNES	**1.6**(2)	3.2(4)	∞	∞	∞	∞ *1e6*	0/15
xNES	7.5(10)	12(13)	∞	∞	∞	∞ *8e5*	0/15
xNESas	6.2(8)	26(27)	∞	∞	∞	∞ *1e6*	0/15

Table 74: 10-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-3	1e-5	1e-7	#succ
f1	22	23	23	23	23	23	15/15
ACOR	11(2)	25(4)	37(5)	63(5)	88(6)	113(7)	15/15
BIPOPaCMA	5.0(2)	13(3)	18(3)	31(2)	44(4)	57(5)	15/15
BIPOPsaACM	4.8(1)	6.3(0.5)	7.6(1.0)	11(0.8)	14(1)	17(1)	15/15
CMA	5.3(3)	12(3)	19(3)	31(4)	44(5)	57(5)	15/15
CMAES	5.8(2)	12(2)	18(2)	31(3)	44(4)	57(6)	15/15
CMAa	5.2(2)	11(3)	18(2)	30(3)	44(5)	57(6)	15/15
CMAm	4.4(2)	9.1(2)	14(2)	23(3)	32(2)	42(3)	15/15
CMAma	4.5(0.8)	8.7(2)	13(2)	23(3)	31(4)	41(4)	15/15
CMAmah	**3.2**(1)	6.5(2)	9.4(2)	16(3)	22(2)	29(3)	15/15
CMAmh	**3.4**(1)	6.6(1)	9.4(2)	16(2)	22(3)	29(3)	15/15
DBRCGA	77(18)	197(55)	336(58)	612(97)	910(116)	1201(85)	15/15
DE	28(10)	67(12)	107(19)	179(14)	252(17)	328(27)	15/15
DE-AUTO	3.7(0.4)	**4.1**(0.2)	**4.1**(0.2)	**4.1**(0.2)	**4.1**(0.2)	**4.1**(0.2)	15/15
DE-BFGS	**3.2**(0.2)	**3.3**(0)	**3.2**(0)	**3.2**(0)	**3.2**(0)	**3.2**(0)	15/15
DE-ROLL	7.6(8)	18(16)	19(20)	20(20)	20(21)	20(21)	15/15
DE-SIMPLEX	8.5(7)	22(12)	35(14)	46(15)	55(14)	67(11)	15/15
DEctpb	28(8)	69(10)	115(10)	201(15)	287(11)	368(17)	15/15
IPOPsaACM	4.6(1)	**6.2**(0.4)	**7.4**(0.7)	**11**(1)	**14**(0.8)	**17**(0.7)	15/15
JADEb	13(4)	32(5)	52(8)	98(9)	147(12)	201(13)	15/15
JADEctpb	18(4)	45(5)	78(8)	141(7)	211(7)	282(6)	15/15
MVDE	47(15)	139(13)	227(15)	409(17)	594(24)	781(21)	15/15
NBIPOPaCMA	4.6(3)	11(2)	18(3)	31(4)	43(4)	55(4)	15/15
NIPOPaCMA	5.9(2)	12(3)	19(3)	31(4)	44(4)	57(5)	15/15
PSO-BFGS	**3.1**(0.2)	**3.3**(0)	**3.2**(0)	**3.2**(0)	**3.2**(0)	**3.2**(0)	15/15
SNES	4.3(2)	10(3)	19(4)	39(3)	57(4)	76(5)	15/15
xNES	3.8(1)	18(6)	52(3)	111(7)	176(6)	239(6)	15/15
xNESas	4.0(2)	16(4)	37(5)	64(15)	85(19)	103(31)	15/15

Table 75: 10-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-3	1e-5	1e-7	#succ
f2	187	190	191	193	194	195	15/15
ACOR	7.0(1)	8.2(0.8)	10(0.9)	12(1)	16(1)	18(2)	15/15
BIPOPaCMA	14(3)	17(2)	18(2)	20(1)	21(1)	22(2)	14/14
BIPOPsaACM	**3.9**(0.9)	**4.4**(0.8)	4.8(0.7)	5.4(0.6)	5.8(0.5)	6.2(0.6)	15/15
CMA	22(6)	24(3)	26(2)	28(2)	29(2)	30(2)	15/15
CMAES	21(4)	24(4)	26(2)	28(2)	29(2)	31(2)	15/15
CMAa	16(2)	17(2)	18(1)	20(1)	21(1)	23(1)	15/15
CMAm	21(5)	24(3)	25(3)	28(1)	29(1)	29(1)	15/15
CMAma	15(3)	17(2)	18(1)	19(1)	20(1)	21(1)	15/15
CMAmah	16(3)	18(3)	19(2)	21(2)	21(2)	22(2)	15/15
CMAmh	19(3)	24(3)	25(3)	27(1)	28(1)	28(1)	15/15
DBRCGA	61(8)	78(9)	96(9)	130(12)	161(12)	191(10)	15/15
DE	20(2)	24(3)	29(2)	38(2)	47(3)	56(3)	15/15
DE-AUTO	**1.7**(0.6)	**1.9**(0.7)	**2.0**(0.8)	**2.2**(0.9)	**2.4**(1.0)	**2.7**(1)	15/15
DE-BFGS	**2.0**(0.8)	**2.2**(0.9)	**2.4**(1)	**2.7**(1)	**2.9**(1)	**3.1**(1)	15/15
DE-ROLL	7.4(10)	7.5(10)	7.6(10)	7.8(9)	8.1(9)	8.3(9)	15/15
DE-SIMPLEX	91(33)	109(39)	119(41)	138(31)	144(27)	176(120)	15/15
DEctpb	22(2)	27(1)	32(2)	42(2)	52(2)	61(3)	15/15
IPOPsaACM	4.1(0.7)	4.4(0.7)	**4.7**(0.8)	**5.3**(0.7)	**5.7**(0.8)	**6.1**(0.7)	15/15
JADEb	11(1)	14(1)	17(1)	24(1)	31(2)	38(3)	15/15
JADEctpb	17(1)	21(2)	25(2)	34(1)	43(2)	51(3)	15/15
MVDE	44(2)	54(2)	65(3)	87(4)	109(1)	130(2)	15/15
NBIPOPaCMA	14(3)	17(2)	18(2)	20(1)	21(1)	23(1.0)	15/15
NIPOPaCMA	14(3)	16(3)	18(2)	19(2)	21(2)	23(2)	15/15
PSO-BFGS	**2.6**(1)	**2.6**(1)	**2.7**(1)	**3.0**(1)	**3.2**(1)	**3.6**(2)	15/15
SNES	4.8(0.9)	5.6(0.7)	6.7(0.5)	8.9(0.6)	11(0.7)	13(0.7)	15/15
xNES	15(1)	17(1.0)	21(0.9)	28(1)	35(0.8)	43(1)	15/15
xNESas	13(2)	16(2)	18(2)	22(2)	25(3)	27(4)	15/15

Table 76: 10-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	1739	3600	3609	3642	3646	3651	15/15
ACOR	15(16)	2427(2749)	9807(1e4)	9718(9610)	9706(9599)	9693(1e4)	4/15
BIPOPaCMA	4.0(3)	307(440)	4151(4441)	4114(4399)	4110(4394)	4105(5310)	7/15
BIPOPsaACM	**2.2**(2)	231(319)	1682(2031)	1667(1737)	1665(2010)	1663(1981)	12/15
CMA	3.7(3)	632(823)	2700(3062)	2676(3274)	2674(3056)	2671(3034)	2/15
CMAES	8.4(11)	2030(2153)	∞	∞	∞	∞ *5e5*	0/15
CMAa	4.4(3)	818(998)	∞	∞	∞	∞ *1e6*	0/15
CMAm	3.0(3)	494(630)	5720(6455)	5670(6222)	5664(5865)	5657(6017)	1/15
CMAma	**2.0**(3)	366(512)	2640(3182)	2617(3003)	2614(2993)	2611(3036)	2/15
CMAmah	3.0(2)	358(586)	5586(6687)	5537(6174)	5531(6010)	5525(6498)	1/15
CMAmh	4.2(3)	608(794)	5512(6145)	5462(6555)	5456(6195)	5449(6121)	1/15
DBRCGA	13(5)	38(23)	56(38)	56(38)	57(39)	59(39)	15/15
DE	5.5(1)	**5.5**(4)	**16**(15)	**16**(15)	**17**(15)	17(15)	15/15
DE-AUTO	9.1(9)	24(7)	45(24)	45(24)	45(24)	45(24)	15/15
DE-BFGS	9.4(6)	16(7)	24(11)	24(11)	24(11)	24(11)	15/15
DE-ROLL	3.6(3)	13(6)	17(8)	17(8)	17(8)	**17**(8)	15/15
DE-SIMPLEX	37(20)	56(16)	80(37)	80(37)	80(37)	80(37)	15/15
DEctpb	7.6(2)	9.0(1)	**10**(1)	**11**(1)	**11**(1)	**12**(1)	15/15
IPOPsaACM	**2.3**(0.6)	174(325)	7895(9699)	7823(9037)	7814(9026)	7803(8219)	4/14
JADEb	3.5(0.8)	**6.3**(6)	19(24)	19(24)	20(24)	20(24)	15/15
JADEctpb	3.9(0.4)	**3.1**(0.2)	**3.5**(0.3)	**4.3**(0.2)	**5.0**(0.2)	**5.7**(0.2)	15/15
MVDE	5.8(1)	**5.6**(0.3)	**6.3**(0.4)	**7.4**(0.4)	**8.7**(0.4)	**10**(0.3)	15/15
NBIPOPaCMA	3.7(4)	1586(2779)	7793(9848)	7722(9612)	7714(9600)	7703(1e4)	4/15
NIPOPaCMA	**2.3**(1)	1021(1394)	6292(6934)	6235(7895)	6228(6864)	6220(7875)	5/15
PSO-BFGS	69(74)	1999(2191)	∞	∞	∞	∞ *1e6*	0/15
SNES	18(17)	5463(5262)	∞	∞	∞	∞ *3e6*	0/15
xNES	15(17)	4196(4767)	∞	∞	∞	∞ *2e6*	0/15
xNESas	16(17)	8179(8537)	1.7e4(2e4)	1.7e4(2e4)	1.7e4(2e4)	1.7e4(2e4)	1/15

Table 77: 10-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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	2234	3626	3660	3707	3744	28767	12/15
ACOR	31(60)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	5.6(5)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPsaACM	5.3(4)	∞	∞	∞	∞	∞ *1e7*	0/5
CMA	6.6(4)	∞	∞	∞	∞	∞ *2e6*	0/15
CMAES	24(29)	∞	∞	∞	∞	∞ *5e5*	0/15
CMAa	7.5(4)	∞	∞	∞	∞	∞ *2e6*	0/15
CMAm	5.5(4)	∞	∞	∞	∞	∞ *2e6*	0/15
CMAma	5.6(4)	∞	∞	∞	∞	∞ *2e6*	0/15
CMAmah	8.6(8)	∞	∞	∞	∞	∞ *1e6*	0/15
CMAmh	8.6(3)	∞	∞	∞	∞	∞ *2e6*	0/15
DBRCGA	25(15)	64(31)	166(148)	165(136)	164(134)	22(18)	13/15
DE	**4.1**(0.9)	**18**(16)	**48**(61)	**48**(60)	**48**(60)	**6.3**(8)	14/15
DE-AUTO	12(9)	49(33)	139(158)	137(136)	136(136)	18(18)	13/15
DE-BFGS	14(9)	52(39)	80(65)	79(64)	78(64)	10(8)	14/15
DE-ROLL	5.2(3)	**17**(9)	**44**(34)	**44**(34)	**43**(34)	**5.6**(4)	15/15
DE-SIMPLEX	37(14)	102(47)	239(227)	236(224)	259(260)	117(122)	2/15
DEctpb	6.9(1.0)	**11**(1)	**17**(9)	**18**(8)	**18**(8)	**2.5**(1)	15/15
IPOPsaACM	5.6(7)	∞	∞	∞	∞	∞ *1e7*	0/5
JADEb	**3.6**(5)	25(22)	125(157)	124(135)	123(134)	16(20)	10/15
JADEctpb	**3.6**(0.3)	**3.4**(0.3)	**3.9**(0.2)*	**4.8**(0.2)	**5.5**(0.2)	**0.82**(0.0)	15/15
MVDE	6.0(0.9)	26(1)	143(273)	143(270)	143(267)	19(35)	10/15
NBIPOPaCMA	8.4(10)	∞	∞	∞	∞	∞ *1e7*	0/15
NIPOPaCMA	**4.9**(5)	∞	∞	∞	∞	∞ *1e7*	0/15
PSO-BFGS	156(93)	∞	∞	∞	∞	∞ *1e6*	0/15
SNES	25(27)	∞	∞	∞	∞	∞ *3e6*	0/15
xNES	17(20)	∞	∞	∞	∞	∞ *2e6*	0/15
xNESas	7.8(9)	∞	∞	∞	∞	∞ *4e6*	0/15

Table 78: 10-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-3	1e-5	1e-7	#succ
f5	20	20	20	20	20	20	15/15
ACOR	8.8(3)	11(3)	11(3)	11(3)	11(3)	11(3)	15/15
BIPOPaCMA	4.9(2)	6.0(2)	6.0(2)	6.0(2)	6.0(2)	6.0(2)	15/15
BIPOPsaACM	5.0(2)	6.1(2)	6.4(2)	6.4(2)	6.4(2)	6.4(2)	15/15
CMA	5.3(2)	6.2(1)	6.2(1)	6.3(1)	6.3(1)	6.3(1)	15/15
CMAES	5.3(0.9)	6.3(1)	6.5(1.0)	6.5(1.0)	6.5(1.0)	6.5(1.0)	15/15
CMAa	5.2(1)	6.5(1)	6.6(1)	6.7(1)	6.7(1)	6.7(1)	15/15
CMAm	4.5(0.8)	5.5(1)	5.7(1)	5.7(1)	5.7(1)	5.7(1)	15/15
CMAma	**4.0**(0.9)	**4.7**(0.9)	**4.8**(0.9)	**4.9**(1.0)	**4.9**(1.0)	**4.9**(1.0)	15/15
CMAmah	**3.1**(1)	**3.8**(1)	**4.0**(1)	**4.0**(1)	**4.0**(1)	**4.0**(1)	15/15
CMAmh	**3.1**(0.7)	**3.8**(1.0)	**4.0**(1.0)	**4.0**(1.0)	**4.0**(1.0)	**4.0**(1.0)	15/15
DBRCGA	115(74)	155(69)	156(72)	157(72)	157(72)	157(72)	15/15
DE	15(5)	21(5)	22(5)	22(5)	22(5)	22(5)	15/15
DE-AUTO	**3.9**(0.3)	**4.0**(0.3)	**4.0**(0.4)	**4.0**(0.4)	**4.0**(0.4)	**4.0**(0.4)	15/15
DE-BFGS	7.4(3)	9.3(4)	9.4(3)	9.4(3)	10(4)	11(6)	15/15
DE-ROLL	6.4(0.4)	6.7(0.7)	6.8(0.7)	7.2(2)	7.6(3)	8.0(5)	15/15
DE-SIMPLEX	351(92)	590(297)	823(362)	1130(356)	1307(386)	7174(1e4)	15/15
DEctpb	21(4)	28(4)	29(4)	29(4)	29(4)	29(4)	15/15
IPOPsaACM	5.0(1)	6.1(1.0)	6.2(0.9)	6.2(0.8)	6.2(0.8)	6.2(0.8)	15/15
JADEb	15(4)	21(5)	22(4)	22(4)	22(4)	22(4)	15/15
JADEctpb	25(9)	33(9)	36(6)	36(6)	36(6)	36(6)	15/15
MVDE	110(17)	163(16)	182(31)	197(41)	197(41)	197(41)	15/15
NBIPOPaCMA	4.9(1)	6.1(1)	6.1(1)	6.1(1)	6.1(1)	6.1(1)	15/15
NIPOPaCMA	5.7(0.8)	6.7(2)	7.0(2)	7.0(2)	7.0(2)	7.0(2)	15/15
PSO-BFGS	7.6(4)	11(6)	12(5)	12(5)	12(5)	12(5)	15/15
SNES	10(4)	13(4)	13(4)	13(4)	13(4)	13(4)	15/15
xNES	9.0(2)	12(4)	12(4)	12(4)	12(4)	12(4)	15/15
xNESas	9.0(3)	12(3)	12(3)	12(3)	12(3)	12(3)	15/15

Table 79: 10-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-3	1e-5	1e-7	#succ
f6	412	623	826	1292	1841	2370	15/15
ACOR	3.9(0.9)	4.3(0.9)	4.5(0.8)	4.5(0.9)	4.3(0.8)	4.3(0.8)	15/15
BIPOPaCMA	**2.0**(0.6)	**1.9**(0.5)	**1.9**(0.3)	**1.7**(0.2)	**1.6**(0.1)	**1.6**(0.1)	15/15
BIPOPsaACM	**1.8**(0.5)	**1.9**(0.5)	**1.9**(0.5)	**1.8**(0.3)	**1.8**(0.3)	**1.7**(0.3)	15/15
CMA	**1.8**(0.4)	**1.9**(0.2)	**1.9**(0.2)	**1.8**(0.3)	**1.7**(0.2)	**1.6**(0.2)	15/15
CMAES	**1.9**(0.7)	**1.9**(0.5)	**1.9**(0.4)	**1.8**(0.3)	**1.7**(0.2)	**1.7**(0.1)	15/15
CMAa	**1.8**(0.6)	**1.8**(0.5)	**1.8**(0.3)	**1.8**(0.3)	**1.7**(0.2)	**1.6**(0.2)	15/15
CMAm	**1.9**(0.6)	**2.0**(0.3)	**1.9**(0.3)	**1.8**(0.3)	**1.7**(0.2)	**1.7**(0.2)	15/15
CMAma	**1.9**(0.5)	**1.8**(0.4)	**1.8**(0.4)	**1.7**(0.4)	**1.5**(0.2)	**1.5**(0.2)	15/15
CMAmah	**1.3**(0.4)	**1.4**(0.5)	**1.5**(0.5)	**1.5**(0.3)	**1.4**(0.4)	**1.5**(0.4)	15/15
CMAmh	**1.4**(0.6)	**1.6**(0.5)	**1.6**(0.4)	**1.7**(0.7)	**1.6**(0.6)	**1.7**(0.4)	15/15
DBRCGA	18(5)	24(5)	28(5)	31(7)	30(5)	30(3)	15/15
DE	17(4)	20(3)	23(4)	24(5)	24(6)	24(6)	15/15
DE-AUTO	**2.4**(1)	**2.4**(1)	**2.3**(0.6)	**2.2**(0.6)	4.0(3)	6.3(8)	15/15
DE-BFGS	**2.2**(2)	**2.0**(1)	**2.1**(2)	5.3(6)	16(7)	84(61)	12/15
DE-ROLL	16(12)	22(19)	26(26)	41(41)	55(42)	185(239)	10/15
DE-SIMPLEX	25(17)	43(23)	55(19)	76(32)	145(79)	∞ *1e6*	0/15
DEctpb	12(2)	14(2)	15(2)	15(2)	14(2)	14(2)	15/15
IPOPsaACM	**1.7**(0.7)	**1.8**(0.5)	**1.9**(0.5)	**1.8**(0.5)	**1.8**(0.4)	**1.8**(0.2)	15/15
JADEb	5.7(3)	8.8(2)	12(3)	46(37)	382(517)	451(464)	2/15
JADEctpb	6.6(1)	7.5(1)	7.9(0.9)	8.3(1)	8.2(1)	8.1(1)	15/15
MVDE	19(6)	27(4)	33(7)	41(8)	48(15)	57(23)	15/15
NBIPOPaCMA	**1.8**(0.6)	**1.9**(0.5)	**1.9**(0.4)	**1.8**(0.2)	**1.6**(0.2)	**1.6**(0.2)	15/15
NIPOPaCMA	**1.8**(0.6)	**1.8**(0.4)	**1.8**(0.3)	**1.8**(0.3)	**1.6**(0.2)	**1.6**(0.2)	15/15
PSO-BFGS	4.0(3)	3.2(2)	**2.8**(2)	9.3(7)	23(9)	220(221)	4/15
SNES	**1.6**(0.3)	**1.7**(0.3)	**1.9**(0.4)	3.2(2)	155(257)	269(619)	13/15
xNES	**2.5**(0.4)	3.3(0.2)	3.9(0.2)	4.1(0.2)	4.1(0.1)	4.1(0.2)	15/15
xNESas	**2.2**(0.2)	3.1(0.3)	3.6(0.3)	3.9(0.3)	3.8(0.2)	3.8(0.1)	15/15

Table 80: 10-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-3	1e-5	1e-7	#succ
f7	172	1611	4195	5141	5141	5389	15/15
ACOR	5.7(3)	21(37)	275(279)	235(240)	235(240)	225(227)	15/15
BIPOPaCMA	**2.0**(0.3)	**1.1**(0.6)	**0.88**(0.4)	**0.85**(0.4)	**0.85**(0.4)	**0.82**(0.3)	15/15
BIPOPsaACM	**1.5**(0.3)	**0.81**(0.5)	**0.72**(0.4)	**0.69**(0.3)	**0.69**(0.3)	**0.70**(0.3)	15/15
CMA	**3.0**(1)	**1.5**(1)	**1.1**(0.7)	**1.4**(0.8)	**1.4**(0.8)	**1.3**(0.7)	15/15
CMAES	**2.9**(1)	**2.2**(3)	6.0(6)	27(37)	27(37)	36(36)	14/15
CMAa	**2.1**(0.5)	**1.2**(1)	**0.91**(0.6)	**0.93**(0.4)	**0.93**(0.4)	**0.90**(0.3)	15/15
CMAm	**2.4**(1)	**2.0**(1)	**1.3**(0.9)	**1.2**(0.8)	**1.2**(0.8)	**1.1**(0.8)	15/15
CMAma	**2.2**(1)	**1.3**(1)	**0.83**(0.4)	**0.79**(0.3)	**0.79**(0.3)	**0.80**(0.3)	15/15
CMAmah	**2.7**(2)	**2.1**(0.9)	**0.99**(0.3)	**0.90**(0.3)	**0.90**(0.3)	**0.87**(0.3)	15/15
CMAmh	4.8(5)	**2.2**(1)	**1.4**(0.4)	**1.3**(0.3)	**1.3**(0.3)	**1.2**(0.3)	15/15
DBRCGA	20(6)	15(16)	58(72)	152(175)	152(175)	146(170)	11/15
DE	19(9)	6.7(3)	22(60)	20(49)	20(49)	19(47)	13/15
DE-AUTO	38(20)	19(16)	62(106)	58(87)	58(87)	58(83)	14/15
DE-BFGS	22(18)	151(278)	385(409)	434(424)	434(407)	635(637)	2/15
DE-ROLL	15(11)	17(18)	26(40)	32(34)	32(34)	33(37)	15/15
DE-SIMPLEX	23(32)	19(18)	31(42)	30(34)	30(34)	30(32)	15/15
DEctpb	16(8)	6.2(2)	5.0(2)	6.3(2)	6.3(2)	6.3(2)	15/15
IPOPsaACM	**1.8**(0.5)	**1.00**(0.5)	**0.70**(0.4)	**0.69**(0.3)	**0.69**(0.3)	**0.72**(0.3)	15/15
JADEb	6.6(2)	157(310)	180(239)	269(341)	269(341)	256(325)	4/15
JADEctpb	8.1(1)	**2.3**(0.7)	20(60)	17(49)	17(49)	16(46)	13/15
MVDE	24(10)	11(3)	12(7)	31(20)	31(20)	33(31)	15/15
NBIPOPaCMA	**2.0**(0.5)	**1.4**(2)	**1.0**(0.7)	**1.3**(0.6)	**1.3**(0.6)	**1.2**(0.6)	15/15
NIPOPaCMA	**2.0**(0.6)	**1.2**(0.7)	**1.0**(0.4)	**0.96**(0.3)	**0.96**(0.3)	**0.93**(0.3)	15/15
PSO-BFGS	2448(3171)	8888(9762)	∞	∞	∞	∞ *1e6*	0/15
SNES	**1.9**(0.5)	87(80)	245(235)	1145(1017)	1145(1114)	1092(1016)	6/15
xNES	**2.4**(0.8)	**0.78**(0.1)$_{\downarrow 2}$	**0.48**(0.0)	**0.58**(0.1)	**0.58**(0.1)	**0.64**(0.1)	15/15
xNESas	**2.4**(1)	**0.76**(0.1)$_{\downarrow 3}$	**0.45**(0.1)	**0.58**(0.1)	**0.58**(0.1)	**0.59**(0.0)	15/15

Table 81: 10-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-3	1e-5	1e-7	#succ
f8	326	921	1114	1267	1315	1343	15/15
ACOR	4.3(0.9)	27(2)	41(2)	76(2)	112(3)	148(4)	15/15
BIPOPaCMA	**2.1**(0.7)	3.5(0.7)	3.6(0.6)	3.7(0.5)	3.8(0.5)	4.0(0.4)	15/15
BIPOPsaACM	**1.2**(0.4)	**1.8**(1)	**1.7**(1)	**1.7**(1)	**1.7**(1.0)	**1.7**(1.0)	15/15
CMA	**2.5**(1)	6.2(6)	6.0(5)	5.9(4)	6.0(4)	6.1(4)	15/15
CMAES	**2.2**(1.0)	4.6(0.9)	4.6(0.7)	4.6(0.6)	4.8(0.5)	4.9(0.5)	15/15
CMAa	**2.1**(0.4)	3.6(0.7)	3.7(0.6)	3.8(0.5)	3.9(0.5)	4.0(0.5)	15/15
CMAm	3.7(5)	4.6(2)	4.7(2)	4.7(2)	4.8(1)	4.9(1)	15/15
CMAma	**2.1**(0.8)	3.7(0.6)	3.8(0.5)	3.8(0.4)	3.9(0.4)	4.0(0.4)	15/15
CMAmah	**1.5**(1)	3.8(4)	3.7(3)	3.7(3)	3.7(3)	3.8(3)	15/15
CMAmh	**1.9**(2)	4.6(3)	4.6(3)	4.5(2)	4.6(2)	4.7(2)	15/15
DBRCGA	29(5)	107(98)	109(73)	127(43)	148(39)	180(40)	15/15
DE	14(4)	64(92)	70(78)	77(67)	88(64)	98(61)	15/15
DE-AUTO	**0.94**(0.2)	**2.0**(0.7)	**1.8**(0.6)	**1.7**(0.2)	**1.6**(0.2)	**1.6**(0.2)	15/15
DE-BFGS	**1.2**(0.2)	**1.4**(1)	**1.3**(0.9)	**1.2**(0.8)	**1.2**(0.8)	**1.1**(0.7)	15/15
DE-ROLL	4.2(3)	8.7(9)	20(17)	35(24)	55(17)	257(373)	8/15
DE-SIMPLEX	5.5(4)	11(12)	11(10)	13(8)	14(8)	17(11)	15/15
DEctpb	15(2)	41(3)	49(2)	60(4)	73(5)	87(5)	15/15
IPOPsaACM	**1.3**(0.8)	**2.0**(2)	**1.9**(1)	**1.8**(1)	**1.8**(1)	**1.9**(1)	15/15
JADEb	6.6(2)	15(13)	16(12)	34(11)	42(10)	42(10)	14/15
JADEctpb	10(2)	16(2)	15(2)	15(2)	16(2)	16(2)	15/15
MVDE	29(6)	631(370)	6125(7522)	1.1e4(1e4)	1.1e4(1e4)	1.1e4(1e4)	0/15
NBIPOPaCMA	**2.6**(1)	4.9(4)	4.8(3)	4.7(3)	4.8(3)	4.9(3)	15/15
NIPOPaCMA	**2.1**(0.7)	5.0(4)	4.9(4)	4.8(3)	4.9(3)	5.0(3)	15/15
PSO-BFGS	**1.4**(0.4)	**1.1**(0.3)	**1.0**(0.2)	**0.94**(0.2)	**0.93**(0.2)	**0.92**(0.2)	15/15
SNES	**1.9**(0.3)	90(26)	286(232)	961(693)	3799(3883)	∞ *3e6*	0/15
xNES	5.3(0.6)	5.7(0.5)	6.1(0.7)	6.2(0.8)	6.7(0.6)	7.5(0.7)	15/15
xNESas	4.5(0.6)	8.0(2)	8.3(2)	8.2(2)	8.4(2)	8.8(2)	15/15

Table 82: 10-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-3	1e-5	1e-7	#succ
f9	200	648	857	1065	1138	1185	15/15
ACOR	9.1(6)	326(21)	303(27)	457(68)	664(125)	868(185)	15/15
BIPOPaCMA	3.4(1)	5.1(1)	4.8(1)	4.4(0.9)	4.5(0.8)	4.5(0.8)	15/15
BIPOPsaACM	**1.6**(0.5)	**2.2**(0.5)	**2.0**(0.4)	**1.8**(0.3)	**1.7**(0.3)	**1.7**(0.3)	15/15
CMA	5.0(5)	6.7(2)	6.2(2)	5.7(1)	5.6(1)	5.7(1)	15/15
CMAES	3.6(2)	8.1(5)	7.3(4)	6.6(3)	6.5(3)	6.5(3)	15/15
CMAa	3.0(0.5)	5.3(1.0)	4.9(0.7)	4.6(0.6)	4.5(0.6)	4.6(0.5)	15/15
CMAm	3.5(2)	6.5(3)	6.0(2)	5.5(2)	5.4(2)	5.5(2)	15/15
CMAma	3.1(2)	7.7(6)	6.8(5)	6.0(4)	5.9(4)	5.9(4)	15/15
CMAmah	**1.9**(0.9)	3.9(1)	3.9(0.9)	3.6(0.7)	3.5(0.7)	3.6(0.7)	15/15
CMAmh	3.1(0.5)	5.9(5)	5.5(4)	5.0(3)	4.9(3)	4.9(3)	15/15
DBRCGA	38(9)	693(802)	627(616)	881(546)	4259(4281)	1.3e4(1e4)	0/15
DE	23(6)	130(70)	186(62)	272(50)	584(439)	3085(3374)	1/15
DE-AUTO	**1.7**(0.4)	4.1(3)	3.3(2)	**2.8**(2)	**2.6**(2)	**2.6**(2)	15/15
DE-BFGS	**2.0**(1.0)	**2.3**(2)	**1.9**(1)	**1.6**(1)	**1.5**(1)	**1.4**(1)	15/15
DE-ROLL	5.1(5)	63(15)	86(18)	106(23)	129(25)	418(436)	6/15
DE-SIMPLEX	10(10)	28(41)	26(29)	22(24)	22(23)	22(22)	15/15
DEctpb	25(4)	133(28)	193(58)	292(56)	677(482)	3117(3259)	1/15
IPOPsaACM	**1.6**(0.4)	**2.0**(0.4)	**1.8**(0.3)	**1.6**(0.2)	**1.6**(0.2)	**1.6**(0.2)	15/15
JADEb	15(20)	24(8)	21(5)	19(4)	19(4)	19(4)	15/15
JADEctpb	15(3)	25(3)	22(2)	20(2)	20(2)	20(2)	15/15
MVDE	48(13)	2.2e4(2e4)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.4(0.4)	7.3(6)	6.4(5)	5.8(4)	5.7(4)	5.8(3)	15/15
NIPOPaCMA	3.1(0.5)	5.7(0.8)	5.3(0.6)	4.9(0.5)	4.9(0.5)	4.9(0.5)	15/15
PSO-BFGS	**1.6**(0.4)	**1.1**(0.3)*	**0.98**(0.2)*	**0.86**(0.2)*	**0.83**(0.2)*	**0.81**(0.2)*	15/15
SNES	3.6(1)	289(307)	619(359)	4.0e4(4e4)	∞	∞ *3e6*	0/15
xNES	8.8(1)	8.0(1)	7.7(1)	7.1(1)	7.5(1)	8.4(0.9)	15/15
xNESas	7.0(1)	8.6(4)	9.1(3)	8.5(3)	8.6(3)	8.8(3)	15/15

Table 83: 10-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-3	1e-5	1e-7	#succ
f10	1835	2172	2455	2802	4543	4739	15/15
ACOR	1180(1005)	3561(3370)	8764(8712)	5.3e4(5e4)	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.4**(0.3)	**1.5**(0.2)	**1.4**(0.1)	**1.3**(0.1)	**0.90**(0.0)$_{\downarrow 2}$	**0.92**(0.1)$_{\downarrow}$	15/15
BIPOPsaACM	**0.41**(0.1)$_{\downarrow 3}$	**0.39**(0.1)$_{\downarrow 4}$	**0.37**(0.1)$_{\downarrow 4}$	**0.36**(0.0)$_{\downarrow 4}$	**0.24**(0.0)$_{\downarrow 4}$	**0.25**(0.0)$_{\downarrow 4}$	15/15
CMA	**2.3**(0.3)	**2.3**(0.2)	**2.1**(0.1)	**2.0**(0.1)	**1.3**(0.1)	**1.3**(0.1)	15/15
CMAES	**2.2**(0.3)	**2.1**(0.3)	**2.0**(0.3)	**1.9**(0.2)	**1.2**(0.1)	**1.2**(0.1)	15/15
CMAa	**1.4**(0.2)	**1.5**(0.2)	**1.4**(0.2)	**1.3**(0.1)	**0.89**(0.1)$_{\downarrow 2}$	**0.92**(0.1)$_{\downarrow}$	15/15
CMAm	**2.1**(0.6)	**2.1**(0.3)	**2.0**(0.3)	**1.9**(0.1)	**1.2**(0.1)	**1.2**(0.1)	15/15
CMAma	**1.3**(0.4)	**1.4**(0.2)	**1.3**(0.1)	**1.3**(0.1)	**0.83**(0.1)$_{\downarrow 4}$	**0.84**(0.0)$_{\downarrow 4}$	15/15
CMAmah	**1.8**(0.3)	**1.7**(0.2)	**1.6**(0.1)	**1.4**(0.1)	**0.92**(0.1)$_{\downarrow 2}$	**0.92**(0.0)$_{\downarrow 2}$	15/15
CMAmh	**2.3**(0.4)	**2.2**(0.3)	**2.0**(0.1)	**1.9**(0.1)	**1.2**(0.1)	**1.2**(0.1)	15/15
DBRCGA	437(415)	3292(3575)	∞	∞	∞	∞ *1e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	**2.4**(3)	**2.0**(3)	**1.8**(2)	**1.6**(2)	**1.0**(1)	**0.99**(1)	15/15
DE-BFGS	**1.7**(2)	**1.5**(2)	**1.3**(1)	**1.2**(1)	**0.73**(0.7)	**0.72**(0.7)	15/15
DE-ROLL	111(34)	142(73)	165(64)	197(71)	148(44)	1524(1585)	0/15
DE-SIMPLEX	20(12)	25(8)	33(8)	46(9)	42(9)	221(214)	3/15
DEctpb	∞	∞	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**0.41**(0.1)$_{\downarrow 3}$	**0.40**(0.1)$_{\downarrow 4}$	**0.38**(0.1)$_{\downarrow 4}$	**0.36**(0.1)$_{\downarrow 4}$	**0.25**(0.0)$_{\downarrow 4}$	**0.25**(0.0)$_{\downarrow 4}$	15/15
JADEb	13(8)	15(7)	16(5)	19(9)	14(5)	16(6)	15/15
JADEctpb	4.4(1)	4.4(1)	4.6(1)	4.7(1)	3.4(0.7)	3.6(0.7)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.3**(0.4)	**1.4**(0.3)	**1.3**(0.2)	**1.3**(0.1)	**0.89**(0.1)$_{\downarrow 3}$	**0.92**(0.1)$_{\downarrow 2}$	15/15
NIPOPaCMA	**1.4**(0.3)	**1.4**(0.3)	**1.4**(0.2)	**1.3**(0.1)	**0.89**(0.1)$_{\downarrow 2}$	**0.92**(0.1)$_{\downarrow}$	15/15
PSO-BFGS	3.9(5)	3.3(4)	**2.9**(4)	**2.6**(3)	**1.6**(2)	**1.6**(2)	15/15
SNES	2.3e4(2e4)	∞	∞	∞	∞	∞ *3e6*	0/15
xNES	**1.5**(0.1)	**1.5**(0.1)	**1.6**(0.1)	**1.9**(0.1)	**1.5**(0.0)	**1.8**(0.0)	15/15
xNESas	**1.4**(0.2)	**1.4**(0.3)	**1.4**(0.2)	**1.5**(0.2)	**1.0**(0.1)	**1.1**(0.2)	15/15

Table 84: 10-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-3	1e-5	1e-7	#succ
f11	266	1041	2602	3338	4092	4843	15/15
ACOR	356(147)	160(33)	92(18)	115(22)	132(23)	140(23)	14/15
BIPOPaCMA	6.6(0.9)	**2.0**(0.2)	**0.87**(0.1)	**0.78**(0.0)$\downarrow_4$	**0.72**(0.0)$\downarrow_4$	**0.67**(0.0)$\downarrow_4$	15/15
BIPOPsaACM	**2.9**(0.2)	**0.79**(0.1)	**0.33**(0.0)$\downarrow_4$	**0.29**(0.0)$\downarrow_4$	**0.25**(0.0)$\downarrow_4$	**0.23**(0.0)$\downarrow_4$	15/15
CMA	14(1)	4.2(0.6)	**1.8**(0.3)	**1.6**(0.2)	**1.4**(0.1)	**1.2**(0.1)	15/15
CMAES	14(2)	4.1(0.4)	**1.8**(0.2)	**1.5**(0.1)	**1.3**(0.1)	**1.2**(0.1)	15/15
CMAa	6.9(0.7)	**2.1**(0.2)	**0.90**(0.1)	**0.80**(0.0)$\downarrow_4$	**0.73**(0.0)$\downarrow_4$	**0.67**(0.0)$\downarrow_4$	15/15
CMAm	14(2)	4.1(0.4)	**1.8**(0.1)	**1.5**(0.1)	**1.3**(0.1)	**1.2**(0.1)	15/15
CMAma	6.8(0.8)	**2.0**(0.2)	**0.88**(0.1)	**0.77**(0.1)$\downarrow_4$	**0.69**(0.0)$\downarrow_4$	**0.63**(0.0)$\downarrow_4$	15/15
CMAmah	9.1(0.8)	**2.6**(0.3)	**1.1**(0.1)	**0.97**(0.1)	**0.84**(0.1)$\downarrow_3$	**0.75**(0.1)$\downarrow_4$	15/15
CMAmh	17(3)	5.1(0.6)	**2.2**(0.2)	**1.9**(0.2)	**1.6**(0.1)	**1.4**(0.1)	15/15
DBRCGA	153(183)	233(152)	149(50)	216(28)	235(18)	1542(1651)	0/15
DE	516(175)	284(74)	210(119)	2234(2471)	∞	∞ *5e5*	0/15
DE-AUTO	**0.43**(0.1)$\downarrow_4$	**0.20**(0.0)$\downarrow_3$	**0.09**(0.0)$\downarrow_4$	**0.08**(0.0)$\downarrow_4$	**0.08**(0.0)$\downarrow_4$	**0.37**(0.5)	15/15
DE-BFGS	**0.52**(0.3)$\downarrow_3$	**0.16**(0.1)$\downarrow_4$	**0.07**(0.0)$\downarrow_4$	**0.07**(0.0)$\downarrow_4$	**0.07**(0.0)$\downarrow_4$	**0.07**(0.0)$\downarrow_4$	15/15
DE-ROLL	293(157)	170(89)	106(64)	138(65)	156(54)	∞ *1e6*	0/15
DE-SIMPLEX	49(33)	42(17)	28(9)	41(7)	49(7)	966(944)	0/15
DEctpb	667(172)	327(67)	392(310)	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**2.8**(0.3)	**0.76**(0.1)	**0.33**(0.0)$\downarrow_4$	**0.28**(0.0)$\downarrow_4$	**0.25**(0.0)$\downarrow_4$	**0.23**(0.0)$\downarrow_4$	15/15
JADEb	22(10)	11(8)	7.3(3)	11(3)	13(3)	13(3)	15/15
JADEctpb	21(8)	6.5(2)	3.1(0.9)	3.0(0.8)	**2.9**(0.8)	**2.9**(0.8)	15/15
MVDE	507(351)	7039(7640)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	6.8(0.7)	**2.0**(0.2)	**0.90**(0.1)	**0.81**(0.1)$\downarrow_4$	**0.73**(0.1)$\downarrow_4$	**0.68**(0.0)$\downarrow_4$	15/15
NIPOPaCMA	7.1(0.6)	**2.1**(0.2)	**0.92**(0.1)	**0.83**(0.1)$\downarrow_3$	**0.75**(0.1)$\downarrow_4$	**0.70**(0.0)$\downarrow_4$	15/15
PSO-BFGS	**0.44**(0.1)$\downarrow_4$	**0.14**(0.0)$\downarrow_4$	**0.06**(0.0)$\downarrow_4$	**0.06**(0.0)$\downarrow_4$	**0.06**(0.0)$\downarrow_4$	**0.99**(3)	15/15
SNES	5.1e4(5e4)	∞	∞	∞	∞	∞ *3e6*	0/15
xNES	6.5(0.8)	**2.1**(0.2)	**1.1**(0.1)	**1.2**(0.1)	**1.4**(0.1)	**1.5**(0.1)	15/15
xNESas	6.7(1)	**2.1**(0.3)	**1.0**(0.1)	**1.0**(0.1)	**0.94**(0.1)	**0.88**(0.1)$\downarrow$	15/15

Table 85: 10-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-3	1e-5	1e-7	#succ
f12	515	896	1240	1569	3660	5154	15/15
ACOR	1391(0.7)	6346(1e4)	2.2e4(3e4)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	3.2(3)	4.4(3)	4.8(2)	4.9(2)	**2.6**(0.9)	**2.1**(0.7)	15/15
BIPOPsaACM	**1.0**(0.6)	**1.1**(1)	**1.1**(1)	**1.4**(0.9)	**0.94**(0.8)	**0.91**(0.7)	15/15
CMA	3.7(2)	4.3(3)	5.1(3)	5.7(3)	3.1(1)	**2.5**(1)	15/15
CMAES	4.0(4)	4.4(4)	4.8(4)	5.3(3)	**2.9**(1)	**2.4**(0.8)	15/15
CMAa	**2.8**(2)	3.1(2)	3.7(2)	4.1(2)	**2.3**(0.7)	**1.8**(0.5)	15/15
CMAm	**2.6**(2)	4.2(3)	5.1(2)	5.6(2)	3.0(0.9)	**2.5**(0.7)	15/15
CMAma	**2.6**(2)	3.3(2)	3.9(2)	4.4(2)	**2.4**(0.9)	**2.0**(0.7)	15/15
CMAmah	4.1(5)	5.0(5)	5.3(4)	5.5(3)	**2.9**(1)	**2.3**(1)	15/15
CMAmh	**2.5**(4)	3.3(5)	3.8(4)	4.6(3)	**2.6**(2)	**2.2**(1)	15/15
DBRCGA	334(972)	1000(1117)	3244(3629)	∞	∞	∞ *1e6*	0/15
DE	337(494)	748(956)	1344(1481)	∞	∞	∞ *5e5*	0/15
DE-AUTO	**2.7**(4)	**2.1**(3)	**2.0**(2)	**1.8**(2)	**0.96**(0.9)	**1.6**(1.0)	15/15
DE-BFGS	**1.3**(2)	**0.98**(1)	**0.97**(1.0)	**0.94**(0.7)	**0.53**(0.3)	**0.59**(0.3)	15/15
DE-ROLL	41(71)	40(68)	47(67)	59(61)	59(40)	344(343)	4/15
DE-SIMPLEX	10(13)	13(11)	16(10)	22(9)	15(8)	55(88)	7/15
DEctpb	224(161)	435(411)	1344(1401)	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**0.97**(0.7)	**1.0**(0.9)	**1.1**(0.9)	**1.4**(0.8)	**0.82**(0.3)	**0.69**(0.3)	15/15
JADEb	10(3)	17(13)	20(15)	24(11)	13(5)	11(4)	15/15
JADEctpb	18(3)	13(2)	13(8)	15(8)	9.0(3)	7.8(3)	15/15
MVDE	416(544)	1081(1230)	5736(6228)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.2(3)	4.6(4)	5.1(4)	5.4(3)	**2.9**(1)	**2.3**(0.8)	15/15
NIPOPaCMA	**2.6**(2)	3.5(3)	3.9(3)	4.4(2)	**2.5**(0.9)	**2.0**(0.7)	15/15
PSO-BFGS	**1.9**(1)	**1.8**(1)	**1.7**(1.0)	**1.5**(0.8)	**1.0**(0.9)	3.5(5)	15/15
SNES	14(29)	64(50)	411(654)	3005(3689)	∞	∞ *3e6*	0/15
xNES	7.9(0.8)	7.0(3)	9.2(3)	10(6)	5.6(3)	5.5(2)	15/15
xNESas	4.1(0.8)	3.5(0.9)	5.8(4)	14(17)	8.0(9)	6.4(7)	15/15

Table 86: 10-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-3	1e-5	1e-7	#succ
f13	387	596	797	4587	6208	7779	15/15
ACOR	1069(1012)	1.9e4(3e4)	3.6e4(5e4)	1.5e4(2e4)	∞	∞ *1e7*	0/15
BIPOPaCMA	**2.5**(2)	3.6(2)	3.3(1)	**0.97**(0.2)	**0.97**(0.2)	**1.2**(0.7)	15/15
BIPOPsaACM	**0.75**(0.1)	**1.0**(0.5)	**1.2**(0.5)	**0.27**(0.1)$_{\downarrow 4}$	**0.30**(0.2)$_{\downarrow 4}$	**0.32**(0.1)$_{\downarrow 4}$	15/15
CMA	**2.7**(2)	5.9(4)	6.1(3)	**1.5**(0.6)	**1.4**(0.5)	**1.4**(0.5)	15/15
CMAES	**2.9**(2)	4.2(3)	4.7(2)	**1.4**(0.7)	**1.9**(1)	**2.6**(2)	15/15
CMAa	**2.3**(1)	3.7(2)	3.6(1)	**0.98**(0.2)	**1.0**(0.3)	**0.99**(0.4)	15/15
CMAm	**1.9**(0.6)	5.0(5)	6.1(4)	**1.7**(0.5)	**1.7**(0.6)	**1.8**(0.7)	15/15
CMAma	**1.7**(0.4)	3.7(2)	5.0(3)	**1.1**(0.4)	**1.3**(0.5)	**1.4**(0.6)	15/15
CMAmah	**2.4**(3)	5.4(4)	5.6(2)	**1.4**(0.5)	**1.6**(0.6)	**1.6**(0.6)	15/15
CMAmh	**2.9**(3)	6.1(6)	8.9(4)	**2.0**(0.4)	**2.1**(1)	**2.2**(1)	15/15
DBRCGA	201(175)	551(841)	2133(2733)	1487(1635)	∞	∞ *1e6*	0/15
DE	21(7)	51(28)	189(74)	∞	∞	∞ *5e5*	0/15
DE-AUTO	**1.5**(0.1)	**1.1**(0.1)	**1.00**(0.1)	**0.52**(0.4)	**1.6**(1)	32(27)	10/15
DE-BFGS	**0.84**(0.1)	**0.74**(0.1)	**0.70**(0.0)	**0.17**(0.0)$_{\downarrow 4}$	**2.5**(0.3)	∞ *1e6*	0/15
DE-ROLL	16(16)	17(13)	31(25)	10(8)	13(5)	65(81)	8/15
DE-SIMPLEX	11(11)	13(10)	16(12)	4.7(1)	4.6(1)	14(12)	7/15
DEctpb	25(8)	78(29)	225(86)	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**0.96**(0.4)	**1.4**(1)	**1.3**(0.7)	**0.32**(0.1)$_{\downarrow 4}$	**0.31**(0.1)$_{\downarrow 4}$	**0.31**(0.1)$_{\downarrow 4}$	15/15
JADEb	11(10)	19(14)	25(17)	6.7(3)	8.7(4)	14(5)	15/15
JADEctpb	11(2)	14(2)	13(2)	3.1(0.4)	3.2(0.9)	3.1(0.8)	15/15
MVDE	42(11)	141(83)	3337(3573)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.8**(2)	3.6(2)	3.9(1)	**0.90**(0.3)	**1.0**(0.4)	**1.4**(1)	15/15
NIPOPaCMA	**2.4**(2)	3.7(2)	3.6(2)	**1.1**(0.4)	**1.1**(0.5)	**1.2**(0.5)	15/15
PSO-BFGS	**0.92**(0.4)	**0.80**(0.3)	**0.75**(0.2)	**0.18**(0.0)$_{\downarrow 4}$	357(404)	∞ *1e6*	0/15
SNES	23(39)	97(99)	370(274)	492(436)	1652(1587)	5379(5383)	0/15
xNES	5.5(0.3)	6.0(0.1)	6.1(0.1)	**1.7**(0.0)	**1.7**(0.0)	**1.7**(0.0)	15/15
xNESas	3.6(0.8)	3.5(1.0)	16(27)	8.0(11)	9.5(14)	10(12)	15/15

Table 87: 10-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-3	1e-5	1e-7	#succ
f14	37	98	133	392	687	4305	15/15
ACOR	4.3(3)	6.4(1)	7.6(1)	13(4)	662(245)	∞ *1e7*	0/15
BIPOPaCMA	**2.2**(1)	3.0(0.6)	3.7(0.6)	3.3(0.4)	3.5(0.3)	**0.86**(0.1)$_{\downarrow 2}$	15/15
BIPOPsaACM	**2.7**(1)	**2.2**(0.5)	**2.4**(0.3)	**1.6**(0.1)	**1.4**(0.1)	**0.31**(0.0)$_{\downarrow 4}$	15/15
CMA	**2.5**(2)	3.1(0.7)	3.8(0.5)	3.9(0.7)	5.3(0.6)	**1.4**(0.2)	15/15
CMAES	**2.3**(2)	3.1(0.9)	3.9(0.7)	4.0(0.4)	5.2(0.5)	**1.3**(0.1)	15/15
CMAa	**3.0**(2)	3.3(0.6)	4.1(0.8)	3.2(0.5)	3.5(0.4)	**0.84**(0.1)$_{\downarrow 3}$	15/15
CMAm	**2.5**(2)	**2.9**(0.8)	3.2(0.7)	3.8(0.8)	5.2(0.5)	**1.5**(0.2)	15/15
CMAma	**1.9**(1)	**2.5**(0.6)	3.1(0.6)	**2.8**(0.3)	3.5(0.3)	**0.86**(0.1)$_{\downarrow 2}$	15/15
CMAmah	**1.6**(1)	**1.9**(0.6)	**2.2**(0.7)	**2.3**(0.4)	3.4(0.5)	**0.97**(0.1)	15/15
CMAmh	**1.4**(1)	**1.8**(0.6)	**2.1**(0.4)	**2.9**(0.6)	5.3(0.8)	**1.5**(0.3)	15/15
DBRCGA	18(14)	38(8)	54(9)	60(18)	375(161)	∞ *1e6*	0/15
DE	8.8(7)	19(4)	23(5)	46(12)	1102(799)	∞ *5e5*	0/15
DE-AUTO	**1.9**(1.0)	**1.2**(0.2)	**1.1**(0.2)	**0.63**(0.1)$_{\downarrow 4}$	**0.53**(0.0)$_{\downarrow 4}$	11(11)	2/15
DE-BFGS	**1.9**(0.3)	**1.1**(0.2)	**1.1**(0.1)	**0.64**(0.1)$_{\downarrow 4}$	**0.55**(0.1)$_{\downarrow 4}$	19(29)	0/15
DE-ROLL	**2.1**(0.6)	19(21)	21(18)	16(14)	111(46)	∞ *1e6*	0/15
DE-SIMPLEX	4.5(4)	16(10)	34(24)	20(10)	24(13)	19(21)	8/15
DEctpb	7.1(7)	20(6)	25(4)	46(11)	2049(2183)	∞ *5e5*	0/15
IPOPsaACM	**2.2**(2)	**2.3**(0.5)	**2.4**(0.5)	**1.6**(0.2)	**1.5**(0.2)	**0.31**(0.0)$_{\downarrow 4}$	15/15
JADEb	3.8(2)	7.8(2)	11(1)	14(3)	20(9)	20(20)	7/15
JADEctpb	4.8(3)	11(2)	15(2)	16(2)	16(3)	3.4(0.6)	15/15
MVDE	13(10)	35(4)	47(4)	87(25)	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.1**(2)	3.0(1)	3.7(0.6)	3.3(0.6)	3.7(0.4)	**0.88**(0.1)$_{\downarrow}$	15/15
NIPOPaCMA	3.0(2)	3.2(0.8)	4.0(0.6)	3.3(0.4)	3.7(0.3)	**0.87**(0.1)$_{\downarrow 2}$	15/15
PSO-BFGS	**1.9**(0.8)	**1.2**(0.2)	**1.1**(0.2)	**0.66**(0.1)$_{\downarrow 4}$	**0.55**(0.1)$_{\downarrow 4}$	259(346)	0/15
SNES	**1.8**(1.0)	**2.1**(0.6)	3.4(0.6)	6.2(2)	∞	∞ *3e6*	0/15
xNES	**2.0**(0.9)	3.1(1)	8.9(1)	7.7(0.3)	7.1(0.3)	**1.5**(0.1)	15/15
xNESas	**2.0**(2)	3.3(0.9)	7.1(2)	5.9(0.9)	5.5(0.7)	**1.2**(0.1)	15/15

Table 88: 10-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-3	1e-5	1e-7	#succ
f15	4774	39246	73643	75790	77814	79834	12/15
ACOR	41(40)	220(255)	436(488)	424(462)	413(450)	402(438)	4/15
BIPOPaCMA	**1.1**(0.7)	**1.5**(1)	**1.2**(0.7)	**1.2**(0.7)	**1.2**(0.7)	**1.2**(0.7)	15/15
BIPOPsaACM	**1.0**(1.0)	**1.1**(0.8)	**0.89**(0.5)	**0.87**(0.5)	**0.92**(0.8)	**0.91**(0.8)	15/15
CMA	**0.89**(0.7)	**1.2**(0.7)	**0.79**(0.4)	**0.80**(0.4)	**0.81**(0.4)	**0.82**(0.4)	15/15
CMAES	**2.0**(2)	190(194)	∞	∞	∞	∞ *5e5*	0/15
CMAa	**1.1**(1)	**1.0**(0.6)	**0.76**(0.4)	**0.77**(0.4)	**0.78**(0.4)	**0.79**(0.4)	15/15
CMAm	**0.74**(0.5)	**1.0**(0.8)	**1.0**(0.6)	**1.0**(0.6)	**1.1**(0.6)	**1.1**(0.6)	15/15
CMAma	**0.91**(1.0)	**0.89**(0.4)	**0.93**(0.7)	**0.94**(0.7)	**0.95**(0.7)	**0.96**(0.7)	15/15
CMAmah	**1.4**(1)	**0.96**(0.3)	**0.78**(0.4)	**0.79**(0.4)	**0.80**(0.4)	**0.80**(0.4)	15/15
CMAmh	**1.3**(1)	**0.97**(0.8)	**0.95**(0.8)	**0.95**(0.8)	**0.96**(0.8)	**0.97**(0.8)	15/15
DBRCGA	126(143)	∞	∞	∞	∞	∞ *1e6*	0/15
DE	108(73)	∞	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	24(14)	68(65)	203(228)	197(198)	192(212)	187(201)	1/15
DE-BFGS	4.5(3)	6.5(4)	8.8(8)	8.5(8)	8.3(8)	8.1(8)	12/15
DE-ROLL	24(24)	38(34)	199(218)	194(195)	189(199)	184(194)	1/15
DE-SIMPLEX	18(10)	16(14)	29(28)	28(27)	28(26)	27(26)	6/15
DEctpb	84(59)	∞	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**0.90**(0.9)	**0.72**(0.5)	**0.76**(0.4)	**0.74**(0.4)	**0.73**(0.4)	**0.73**(0.4)	15/15
JADEb	14(15)	∞	∞	∞	∞	∞ *5e5*	0/15
JADEctpb	3.9(1)	∞	∞	∞	∞	∞ *5e5*	0/15
MVDE	37(29)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**0.77**(0.6)	**1.9**(0.9)	**1.3**(0.8)	**1.3**(0.8)	**1.3**(0.8)	**1.3**(0.8)	15/15
NIPOPaCMA	**0.71**(0.6)	**0.78**(0.8)	**0.75**(0.4)	**0.76**(0.4)	**0.77**(0.4)	**0.78**(0.4)	15/15
PSO-BFGS	43(30)	∞	∞	∞	∞	∞ *1e6*	0/15
SNES	5.0(6)	503(556)	∞	∞	∞	∞ *3e6*	0/15
xNES	**2.4**(3)	190(216)	∞	∞	∞	∞ *2e6*	0/15
xNESas	3.7(4)	168(203)	407(524)	395(436)	385(443)	375(440)	2/15

Table 89: 10-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-3	1e-5	1e-7	#succ
f16	425	7029	15779	51151	65798	71570	15/15
ACOR	169(139)	981(1089)	489(491)	364(407)	683(694)	2005(2166)	1/15
BIPOPaCMA	**2.6**(2)	**0.71**(1)	**0.84**(1.0)	**0.75**(0.8)	**0.78**(0.8)	**0.76**(0.7)	15/15
BIPOPsaACM	**2.4**(2)	**0.67**(0.7)	**0.82**(0.5)	**0.69**(0.6)	**0.63**(0.5)	**0.61**(0.5)	15/15
CMA	**2.2**(1)	**1.2**(1)	**1.8**(2)	**1.0**(0.9)	**0.84**(0.7)	**0.80**(0.6)	15/15
CMAES	**2.7**(0.9)	**2.0**(2)	8.3(9)	41(45)	107(129)	98(108)	0/15
CMAa	**2.4**(2)	**0.78**(1)	**0.90**(0.9)	**1.0**(0.8)	**0.84**(0.6)	**0.80**(0.6)	15/15
CMAm	**1.6**(0.8)	**0.95**(1)	**1.3**(0.8)	**0.77**(0.6)	**0.76**(0.7)	**0.73**(0.6)	15/15
CMAma	**1.4**(0.7)	**1.2**(1)	**1.2**(0.7)	**0.67**(0.4)	**0.56**(0.4)	**0.53**(0.3)	15/15
CMAmah	3.2(4)	**0.85**(0.7)	**1.0**(0.6)	**0.62**(0.4)	**0.52**(0.4)	**0.49**(0.3)	15/15
CMAmh	**2.6**(4)	**1.1**(1)	**1.3**(0.9)	**0.88**(0.5)	**0.74**(0.4)	**0.70**(0.4)	15/15
DBRCGA	8.6(6)	56(66)	283(317)	∞	∞	∞ *1e6*	0/15
DE	106(76)	∞	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	18(22)	45(37)	90(94)	293(314)	∞	∞ *1e6*	0/15
DE-BFGS	26(24)	15(10)	39(41)	279(294)	∞	∞ *1e6*	0/15
DE-ROLL	13(10)	49(49)	148(160)	∞	∞	∞ *1e6*	0/15
DE-SIMPLEX	6.0(10)	13(9)	94(109)	134(141)	107(107)	∞ *1e6*	0/15
DEctpb	114(104)	∞	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**2.5**(1)	**0.67**(0.7)	**0.72**(0.6)	**0.44**(0.2)	**0.36**(0.1)↓	**0.34**(0.1)↓	15/15
JADEb	20(14)	112(132)	207(253)	∞	∞	∞ *5e5*	0/15
JADEctpb	17(9)	82(107)	∞	∞	∞	∞ *5e5*	0/15
MVDE	20(17)	193(214)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.3(2)	**0.67**(0.5)	**1.1**(0.6)	**0.48**(0.4)	**0.40**(0.3)↓	**0.38**(0.3)↓	15/15
NIPOPaCMA	**2.8**(2)	**0.63**(0.5)	**0.68**(0.7)	**0.44**(0.2)↓	**0.37**(0.2)↓	**0.36**(0.2)↓	15/15
PSO-BFGS	41(26)	245(322)	∞	∞	∞	∞ *1e6*	0/15
SNES	**2.6**(2)	**1.4**(2)	14(12)	65(67)	322(357)	∞ *3e6*	0/15
xNES	8.2(5)	**2.2**(3)	3.9(5)	3.2(3)	**2.6**(2)	**2.4**(2)	15/15
xNESas	7.1(5)	**1.8**(2)	3.2(6)	**2.2**(2)	**1.8**(2)	**1.7**(1)	15/15

Table 90: 10-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-3	1e-5	1e-7	#succ
f17	26	429	2203	9851	20190	26503	15/15
ACOR	5.4(3)	**2.6**(0.7)	**1.1**(0.4)	24(31)	239(338)	278(281)	11/15
BIPOPaCMA	**2.1**(1)	**1.1**(0.5)	**0.81**(1)	**1.3**(1.0)	**0.90**(0.3)	**1.2**(0.8)	15/15
BIPOPsaACM	**2.0**(2)	**2.6**(1)	**1.5**(2)	**1.1**(0.5)	**1.1**(0.6)	**2.1**(2)	15/15
CMA	**1.9**(2)	**1.1**(0.3)	**0.66**(0.2)	**1.1**(0.9)	**0.81**(0.3)	**1.1**(0.4)	15/15
CMAES	**2.0**(1)	**1.1**(0.6)	**0.43**(0.1)$_{\downarrow}$	**2.6**(4)	∞	∞ *5e5*	0/15
CMAa	**2.4**(2)	**1.0**(0.3)	**0.61**(0.1)	**0.80**(0.5)	**0.75**(0.3)	**0.86**(0.3)	15/15
CMAm	**1.8**(1.0)	**1.1**(0.6)	**1.1**(1)	**0.80**(0.5)	**0.80**(0.1)	**0.92**(0.4)	15/15
CMAma	**1.5**(1)	3.0(0.4)	**1.2**(1)	**0.84**(0.5)	**0.75**(0.2)	**0.79**(0.4)	15/15
CMAmah	**1.3**(0.7)	4.2(7)	**1.6**(1)	**1.3**(0.6)	**1.1**(0.6)	**1.1**(0.4)	15/15
CMAmh	**1.5**(2)	6.6(9)	**2.4**(2)	**1.1**(0.9)	**0.99**(0.3)	**1.1**(0.4)	15/15
DBRCGA	3.7(4)	16(6)	77(67)	1426(1777)	∞	∞ *1e6*	0/15
DE	3.5(4)	7.4(2)	3.8(0.9)	**2.6**(0.8)	12(13)	45(55)	5/15
DE-AUTO	36(98)	207(181)	150(239)	108(109)	69(75)	169(189)	1/15
DE-BFGS	6.9(8)	38(24)	144(230)	115(136)	83(101)	∞ *1e6*	0/15
DE-ROLL	13(12)	99(62)	118(229)	454(504)	∞	∞ *1e6*	0/15
DE-SIMPLEX	18(39)	114(35)	467(683)	∞	∞	∞ *1e6*	0/15
DEctpb	4.0(5)	8.2(2)	4.6(0.7)	3.4(0.5)	5.1(2)	14(12)	13/15
IPOPsaACM	**2.4**(2)	**1.1**(0.3)	**1.1**(1)	**1.2**(0.7)	**1.2**(0.5)	**1.4**(0.6)	15/15
JADEb	**2.7**(3)	4.1(2)	**2.7**(1)	14(23)	75(90)	∞ *5e5*	0/15
JADEctpb	3.2(4)	5.2(1.0)	**2.8**(0.6)	**1.9**(0.5)	5.2(12)	6.8(10)	12/15
MVDE	4.7(5)	16(3)	13(4)	42(51)	158(176)	566(585)	0/15
NBIPOPaCMA	3.0(3)	3.2(7)	**1.5**(2)	**1.3**(0.9)	**1.0**(0.5)	**1.3**(0.4)	15/15
NIPOPaCMA	**2.1**(1.0)	**1.1**(0.2)	**0.84**(1)	**1.1**(0.5)	**0.81**(0.3)	**0.94**(0.5)	15/15
PSO-BFGS	7.7(8)	108(99)	201(237)	125(118)	170(182)	∞ *1e6*	0/15
SNES	**1.6**(1)	**1.1**(0.7)	4.2(7)	6.4(6)	28(20)	517(526)	2/15
xNES	**2.6**(2)	**1.8**(0.7)	**1.2**(0.2)	**0.69**(0.0)	**1.5**(1)	6.1(7)	15/15
xNESas	**1.5**(1)	**1.7**(0.3)	**1.1**(0.1)	**0.63**(0.0)	**1.2**(1)	**2.8**(3)	15/15

Table 91: 10-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-3	1e-5	1e-7	#succ
f18	238	836	7012	27536	37234	42708	15/15
ACOR	**2.8**(1)	**2.9**(1)	118(35)	747(913)	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.0**(0.4)	**2.2**(4)	**0.84**(0.9)	**0.72**(0.5)	**0.85**(0.4)	**0.96**(0.4)	15/15
BIPOPsaACM	**1.5**(0.6)	**2.2**(4)	**0.81**(0.6)	**0.63**(0.4)	**0.91**(0.6)	**0.91**(0.6)	15/15
CMA	**1.0**(0.4)	**1.7**(0.5)	**1.0**(0.7)	**0.83**(0.5)	**0.92**(0.3)	**0.93**(0.3)	15/15
CMAES	**1.2**(0.6)	**2.0**(4)	**1.4**(2)	45(49)	∞	∞ *5e5*	0/15
CMAa	**1.1**(0.4)	**2.9**(4)	**0.85**(1)	**0.74**(0.3)	**0.74**(0.3)$_{\downarrow}$	**0.84**(0.3)	15/15
CMAm	**0.94**(0.4)	**0.91**(0.4)	**0.66**(0.4)	**0.82**(0.4)	**0.82**(0.3)$_{\downarrow}$	**0.85**(0.3)$_{\downarrow 2}$	15/15
CMAma	**1.0**(0.4)	**1.6**(3)	**0.78**(0.4)	**0.63**(0.5)	**0.70**(0.3)$_{\downarrow 2}$	**0.69**(0.2)$_{\downarrow 3}$	15/15
CMAmah	**1.8**(0.8)	8.4(6)	**2.2**(3)	**0.97**(0.7)	**0.92**(0.6)	**0.88**(0.5)	15/15
CMAmh	**1.2**(1)	6.3(7)	**2.0**(2)	**1.1**(0.5)	**1.0**(0.4)	**1.0**(0.4)	15/15
DBRCGA	12(4)	25(7)	108(133)	∞	∞	∞ *1e6*	0/15
DE	5.9(2)	12(7)	10(4)	19(20)	96(94)	∞ *5e5*	0/15
DE-AUTO	106(99)	250(359)	108(144)	82(73)	399(417)	∞ *1e6*	0/15
DE-BFGS	25(15)	51(31)	71(76)	115(127)	191(202)	∞ *1e6*	0/15
DE-ROLL	79(39)	315(611)	421(504)	∞	∞	∞ *1e6*	0/15
DE-SIMPLEX	135(112)	1304(1799)	973(1262)	532(528)	∞	∞ *1e6*	0/15
DEctpb	6.1(2)	13(5)	6.0(3)	18(13)	197(248)	∞ *5e5*	0/15
IPOPsaACM	**1.3**(0.6)	**1.2**(0.5)	**1.6**(1)	**0.75**(0.5)	**1.0**(0.4)	**1.3**(0.6)	15/15
JADEb	3.2(2)	5.6(2)	4.6(7)	∞	∞	∞ *5e5*	0/15
JADEctpb	4.1(2)	6.4(2)	**1.6**(0.3)	**1.9**(3)	4.9(7)	16(20)	7/15
MVDE	10(4)	32(10)	53(74)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.2**(0.5)	**2.1**(4)	**0.67**(0.7)	**0.81**(0.6)	**1.1**(0.7)	**1.1**(0.6)	15/15
NIPOPaCMA	**1.2**(0.4)	**1.0**(0.2)	**0.87**(0.9)	**0.81**(0.5)	**0.85**(0.3)	**0.86**(0.2)	15/15
PSO-BFGS	74(31)	188(213)	133(160)	538(600)	∞	∞ *1e6*	0/15
SNES	**1.3**(0.9)	6.2(18)	5.9(6)	35(26)	∞	∞ *3e6*	0/15
xNES	**1.1**(0.7)	**2.2**(0.2)	**0.54**(0.0)	**0.29**(0.0)$_{\downarrow 4}$	**1.1**(0.6)	4.1(4)	15/15
xNESas	**1.1**(0.5)	**2.2**(0.5)	**0.72**(0.1)	**0.32**(0.0)$_{\downarrow 4}$	**0.75**(0.5)	**1.3**(0.8)	15/15

Table 92: 10-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-3	1e-5	1e-7	#succ
f19	1	1	10609	1.4e6	1.4e6	1.4e6	15/15
ACOR	187(48)	1.8e6(2e6)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	63(48)	1.0e4(4478)	**11**(9)	**0.77**(0.3)	**0.77**(0.3)	**0.77**(0.3)	15/15
BIPOPsaACM	44(37)	1.1e4(8202)	**5.9**(5)	**0.78**(0.5)	**0.78**(0.5)	**0.78**(0.5)	15/15
CMA	56(28)	8548(2692)	37(38)	**1.1**(0.5)	**1.1**(0.5)	**1.2**(0.8)	13/15
CMAES	67(50)	1.3e4(9380)	144(165)	∞	∞	∞ *5e5*	0/15
CMAa	63(34)	**7971**(5628)	35(50)	**0.95**(0.8)	**0.95**(0.8)	**0.94**(0.8)	12/15
CMAm	52(45)	8856(7009)	32(56)	**0.80**(0.4)	**0.80**(0.4)	**0.80**(0.4)	14/15
CMAma	56(42)	5.7e4(2e4)	31(38)	**1.1**(0.9)	**1.1**(0.9)	**1.1**(0.9)	12/15
CMAmah	**43**(28)	6.3e4(8e4)	27(31)	**0.77**(0.4)	**0.77**(0.4)	**0.77**(0.4)	15/15
CMAmh	**42**(26)	**7109**(6223)	55(74)	**1.2**(1)	**1.2**(0.8)	**1.2**(0.9)	12/15
DBRCGA	379(265)	1.3e5(5e4)	1396(1461)	∞	∞	∞ *1e6*	0/15
DE	387(218)	7.5e6(8e6)	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	1579(2240)	4.7e4(4e4)	96(99)	∞	∞	∞ *1e6*	0/15
DE-BFGS	665(492)	**6773**(6367)	**10**(12)	∞	∞	∞ *1e6*	0/15
DE-ROLL	801(1046)	2.7e4(2e4)	105(87)	∞	∞	∞ *1e6*	0/15
DE-SIMPLEX	1048(1127)	2.6e4(2e4)	42(53)	∞	∞	∞ *1e6*	0/15
DEctpb	305(222)	3.5e6(4e6)	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	60(42)	1.8e4(8701)	**9.3**(8)	**0.49**(0.3)$_{\downarrow 2}$	**0.49**(0.3)$_{\downarrow 2}$	**0.49**(0.3)$_{\downarrow 2}$	15/15
JADEb	174(106)	2.0e5(1e5)	∞	∞	∞	∞ *5e5*	0/15
JADEctpb	165(106)	7.8e4(6e4)	679(742)	∞	∞	∞ *5e5*	0/15
MVDE	473(308)	4.8e5(4e5)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	73(34)	**8153**(7547)	13(13)	**0.82**(0.5)	**0.82**(0.5)	**0.82**(0.5)	15/15
NIPOPaCMA	55(24)	8205(6590)	29(47)	**1.5**(1)	**1.5**(1)	**1.5**(1)	15/15
PSO-BFGS	766(800)	1.3e4(8284)	16(9)	∞	∞	∞ *1e6*	0/15
SNES	47(20)	3.5e4(7e4)	4148(4384)	∞	∞	∞ *3e6*	0/15
xNES	**40**(23)	2.6e5(3e5)	3158(3435)	∞	∞	∞ *2e6*	0/15
xNESas	**38**(24)	4.0e5(6e5)	1440(1650)	∞	∞	∞ *5e6*	0/15

Table 93: 10-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-3	1e-5	1e-7	#succ
f20	32	15426	5.5e5	5.7e5	5.8e5	5.9e5	15/15
ACOR	11(4)	**1.6**(2)	**1.3**(1)	**1.2**(1)	**1.2**(1)	**1.2**(1)	15/15
BIPOPaCMA	4.6(1)	3.2(2)	**1.2**(0.4)	**1.2**(0.4)	**1.2**(0.3)	**1.2**(0.3)	15/15
BIPOPsaACM	4.4(0.6)	**1.4**(1)	**1.1**(0.5)	**1.1**(0.5)	**1.0**(0.5)	**1.0**(0.5)	15/15
CMA	4.9(2)	**2.8**(0.8)	**0.89**(0.4)	**0.90**(0.4)	**0.91**(0.4)	**0.92**(0.4)	15/15
CMAES	5.7(2)	22(20)	∞	∞	∞	∞ *5e5*	0/15
CMAa	4.8(2)	**1.8**(0.8)	**0.86**(0.4)	**0.88**(0.4)	**0.88**(0.4)	**0.89**(0.4)	15/15
CMAm	3.9(2)	3.2(2)	**0.88**(0.4)	**0.90**(0.4)	**0.90**(0.4)	**0.91**(0.4)	15/15
CMAma	4.2(1)	**2.1**(0.9)	**0.77**(0.4)	**0.78**(0.4)	**0.79**(0.4)	**0.79**(0.4)	15/15
CMAmah	**3.0**(0.8)	**2.5**(1)	**0.83**(0.4)	**0.85**(0.4)	**0.85**(0.4)	**0.86**(0.4)	15/15
CMAmh	**3.0**(0.7)	3.3(2)	**0.75**(0.4)	**0.77**(0.4)	**0.78**(0.4)	**0.78**(0.4)	15/15
DBRCGA	49(8)	5.8(6)	∞	∞	∞	∞ *1e6*	0/15
DE	27(11)	**0.77**(0.3)	**0.48**(0.5)$_{\downarrow}$	**0.47**(0.5)$_{\downarrow}$	**0.46**(0.5)$_{\downarrow}$	**0.46**(0.5)$_{\downarrow}$	13/15
DE-AUTO	**3.2**(0.5)	**1.6**(1)	13(14)	12(12)	12(14)	12(14)	2/15
DE-BFGS	4.6(2)	**0.43**(0.3)	∞	∞	∞	∞ *1e6*	0/15
DE-ROLL	49(78)	**0.57**(0.7)	**3.0**(3)	**2.9**(3)	**2.8**(3)	**2.8**(3)	7/15
DE-SIMPLEX	11(6)	3.1(2)	∞	∞	∞	∞ *1e6*	0/15
DEctpb	26(6)	**1.9**(0.5)	**0.14**(0.0)$_{\downarrow 4}$	**0.15**(0.0)$_{\downarrow 4}$	**0.15**(0.0)$_{\downarrow 4}$	**0.15**(0.0)$_{\downarrow 4}$	15/15
IPOPsaACM	4.3(0.7)	**0.86**(0.4)	**0.74**(0.4)	**0.75**(0.5)	**0.75**(0.4)	**0.74**(0.4)	15/15
JADEb	12(4)	**0.27**(0.1)	**3.0**(3)	**2.9**(3)	**2.9**(3)	**2.8**(3)	3/15
JADEctpb	14(6)	**0.73**(0.2)	**0.16**(0.2)$_{\downarrow 4}$	**0.21**(0.2)$_{\downarrow 4}$	**0.29**(0.2)$_{\downarrow 4}$	**0.34**(0.2)$_{\downarrow 4}$	15/15
MVDE	50(13)	**0.98**(0.4)	**0.22**(0.0)$_{\downarrow 3}$	**0.23**(0.0)$_{\downarrow 3}$	**0.24**(0.0)$_{\downarrow 3}$	**0.25**(0.0)$_{\downarrow 3}$	14/15
NBIPOPaCMA	4.9(2)	3.1(2)	**1.3**(0.5)	**1.3**(0.5)	**1.3**(0.5)	**1.3**(0.5)	15/15
NIPOPaCMA	4.5(1)	**2.6**(1)	**0.77**(0.4)	**0.78**(0.4)	**0.79**(0.4)	**0.80**(0.4)	15/15
PSO-BFGS	4.3(2)	**1.0**(0.8)	26(29)	25(28)	25(24)	24(27)	1/15
SNES	**3.1**(0.8)	7.2(6)	∞	∞	∞	∞ *3e6*	0/15
xNES	3.6(2)	**1.1**(1)	∞	∞	∞	∞ *2e6*	0/15
xNESas	3.4(2)	**2.1**(3)	106(119)	102(116)	100(104)	99(109)	1/15

Table 94: 10-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-3	1e-5	1e-7	#succ
f21	130	2236	4392	4618	5074	11329	15/15
ACOR	36(4)	1457(2351)	1746(2270)	1661(2166)	1512(1971)	677(880)	10/15
BIPOPaCMA	**2.7**(0.7)	**5.9**(12)	14(15)	13(14)	12(13)	5.4(6)	15/15
BIPOPsaACM	**2.5**(4)	**2.3**(2)	**1.5**(2)	**1.5**(2)	**1.4**(2)	**0.61**(0.7)	15/15
CMA	6.8(12)	21(25)	11(13)	11(13)	11(12)	4.9(5)	15/15
CMAES	7.0(20)	6.4(6)	**6.0**(9)	**5.7**(8)	**5.2**(7)	**2.4**(3)	15/15
CMAa	**2.8**(0.7)	53(148)	30(78)	29(73)	26(66)	12(30)	13/15
CMAm	**2.5**(1)	50(134)	46(75)	44(71)	40(65)	18(29)	12/15
CMAma	5.7(9)	89(146)	47(74)	45(71)	41(65)	19(29)	12/15
CMAmah	**2.4**(5)	71(147)	63(96)	60(82)	55(74)	25(38)	11/15
CMAmh	**2.3**(5)	108(151)	67(83)	65(79)	59(73)	27(33)	11/15
DBRCGA	18(8)	40(68)	47(56)	46(53)	42(48)	20(21)	14/15
DE	24(15)	17(22)	10(11)	10(11)	10(10)	4.6(4)	15/15
DE-AUTO	4.4(7)	28(49)	32(36)	31(34)	28(31)	13(14)	15/15
DE-BFGS	**2.6**(2)	7.6(10)	8.8(18)	8.4(18)	7.7(16)	32(51)	4/15
DE-ROLL	22(31)	53(86)	48(92)	45(87)	41(80)	18(36)	15/15
DE-SIMPLEX	16(23)	83(156)	83(96)	79(92)	72(83)	32(37)	14/15
DEctpb	21(9)	43(112)	23(57)	22(54)	21(50)	10(22)	13/15
IPOPsaACM	**2.5**(4)	15(23)	48(109)	46(104)	42(95)	19(43)	15/15
JADEb	23(45)	25(31)	18(18)	18(18)	16(16)	7.4(7)	15/15
JADEctpb	7.7(3)	**6.0**(6)	**3.6**(3)	**5.0**(5)	**6.3**(7)	**3.7**(4)	15/15
MVDE	21(9)	8.9(8)	6.5(4)	13(9)	19(13)	12(7)	15/15
NBIPOPaCMA	5.6(11)	11(16)	10(11)	9.3(10)	8.5(9)	**3.8**(4)	15/15
NIPOPaCMA	6.1(10)	99(140)	71(75)	68(72)	62(65)	28(29)	15/15
PSO-BFGS	**2.6**(2)	**2.2**(3)	**2.1**(3)	**2.1**(3)	**1.9**(3)	26(44)	7/15
SNES	116(229)	82(94)	77(117)	73(111)	67(101)	30(45)	15/15
xNES	125(230)	66(58)	94(146)	89(139)	81(126)	37(57)	14/15
xNESas	84(155)	69(85)	58(59)	55(56)	50(51)	22(23)	15/15

Table 95: 10-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-3	1e-5	1e-7	#succ
f22	98	2839	6353	6798	8296	10351	15/15
ACOR	9762(3e4)	5191(5996)	1.1e4(1e4)	1.0e4(1e4)	8351(9534)	6694(7246)	2/15
BIPOPaCMA	29(34)	**6.4**(9)	143(202)	133(189)	109(155)	88(124)	15/15
BIPOPsaACM	13(13)	**3.7**(6)	**32**(18)	**30**(17)	**25**(14)	**20**(11)	15/15
CMA	**6.4**(15)	157(222)	1357(1439)	1268(1444)	1039(1157)	833(908)	1/15
CMAES	22(29)	12(12)	56(61)	53(57)	43(45)	**35**(38)	11/15
CMAa	10(15)	127(209)	1359(1543)	1270(1368)	1041(1111)	834(925)	1/15
CMAm	14(14)	210(327)	∞	∞	∞	∞ *6e5*	0/15
CMAma	26(53)	153(230)	1365(1531)	1276(1406)	1045(1088)	838(992)	1/15
CMAmah	**6.8**(18)	246(323)	∞	∞	∞	∞ *6e5*	0/15
CMAmh	17(36)	194(314)	∞	∞	∞	∞ *6e5*	0/15
DBRCGA	27(16)	38(41)	62(92)	60(87)	52(69)	43(53)	13/15
DE	68(19)	45(62)	50(50)	53(51)	46(44)	39(33)	11/15
DE-AUTO	144(286)	81(104)	206(275)	193(238)	158(238)	127(152)	5/15
DE-BFGS	**4.2**(6)	12(17)	**26**(28)	**24**(27)	**20**(22)	121(154)	0/15
DE-ROLL	34(84)	44(62)	140(158)	132(176)	109(138)	127(144)	5/15
DE-SIMPLEX	95(316)	65(137)	90(104)	85(83)	70(68)	69(78)	10/15
DEctpb	30(28)	128(175)	235(274)	225(257)	187(211)	152(185)	4/15
IPOPsaACM	120(46)	175(219)	1652(1871)	1544(1714)	1265(1434)	1014(1172)	9/15
JADEb	66(146)	**11**(13)	**33**(41)	32(38)	26(32)	**21**(25)	13/15
JADEctpb	22(4)	68(91)	111(118)	117(126)	144(163)	147(179)	4/15
MVDE	33(17)	141(183)	253(318)	270(304)	869(941)	∞ *1e6*	0/15
NBIPOPaCMA	38(35)	17(13)	34(16)	**31**(15)	**26**(12)	**21**(10)	15/15
NIPOPaCMA	81(201)	61(114)	131(147)	123(137)	101(112)	81(90)	15/15
PSO-BFGS	**5.2**(5)	**1.8**(2)	**3.0**(4)	**2.8**(4)	**2.3**(3)	93(116)	0/15
SNES	307(307)	87(108)	93(113)	89(103)	96(120)	105(89)	14/15
xNES	125(155)	105(190)	131(168)	123(147)	101(127)	81(102)	13/15
xNESas	70(204)	53(70)	84(124)	79(116)	65(95)	52(76)	15/15

Table 96: 10-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-3	1e-5	1e-7	#succ
f23	2.8	915	16425	2.0e5	2.1e5	2.1e5	15/15
ACOR	**2.5**(2)	1656(2613)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**2.7**(3)	20(13)	**1.8**(2)	**1.4**(1)	**1.4**(1)	**1.4**(1)	15/15
BIPOPsaACM	4.9(4)	19(15)	**1.8**(1)	**0.55**(0.3)	**0.65**(0.4)	**0.92**(0.3)	15/15
CMA	**1.8**(2)	548(489)	∞	∞	∞	∞ *2e6*	0/15
CMAES	**2.9**(2)	44(44)	22(28)	∞	∞	∞ *5e5*	0/15
CMAa	**2.8**(2)	277(305)	727(835)	∞	∞	∞ *2e6*	0/15
CMAm	**1.2**(0.7)	243(343)	734(926)	∞	∞	∞ *2e6*	0/15
CMAma	**2.9**(2)	67(90)	224(277)	124(140)	120(131)	118(130)	1/15
CMAmah	3.9(5)	136(266)	459(566)	129(142)	125(145)	123(126)	1/15
CMAmh	3.2(2)	423(667)	1455(1627)	∞	∞	∞ *2e6*	0/15
DBRCGA	**1.8**(2)	105(121)	∞	∞	∞	∞ *1e6*	0/15
DE	**2.5**(1)	1384(1537)	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	**1.2**(0.9)	**2.4**(2)	12(13)	∞	∞	∞ *1e6*	0/15
DE-BFGS	**1.8**(2)	**3.6**(6)	52(65)	∞	∞	∞ *1e6*	0/15
DE-ROLL	**1.5**(1)	5.7(7)	∞	∞	∞	∞ *1e6*	0/15
DE-SIMPLEX	**1.9**(2)	**0.57**(0.6)	**7.0**(6)	∞	∞	∞ *1e6*	0/15
DEctpb	**1.3**(1)	473(549)	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	**2.5**(3)	199(326)	429(609)	114(133)	111(129)	108(139)	5/15
JADEb	**1.9**(2)	169(135)	∞	∞	∞	∞ *5e5*	0/15
JADEctpb	**1.5**(1)	89(93)	137(154)	∞	∞	∞ *5e5*	0/15
MVDE	**2.0**(2)	163(280)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.4**(2)	18(19)	**2.9**(2)	**1.5**(1)	**1.5**(1.0)	**1.5**(1.0)	15/15
NIPOPaCMA	**2.8**(2)	88(109)	8.4(8)	**1.1**(0.7)	**1.2**(0.7)	**1.2**(0.7)	15/15
PSO-BFGS	**1.8**(2)	**3.0**(4)	22(16)	∞	∞	∞ *1e6*	0/15
SNES	**1.3**(1)	60(59)	113(141)	∞	∞	∞ *3e6*	0/15
xNES	**1.8**(2)	933(1037)	∞	∞	∞	∞ *2e6*	0/15
xNESas	**1.4**(1)	594(669)	∞	∞	∞	∞ *5e6*	0/15

Table 97: 10-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-3	1e-5	1e-7	#succ
f24	98761	1.0e6	7.5e7	7.5e7	7.5e7	7.5e7	1/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**0.98**(1)	**2.2**(2)	**0.93**(1)	**0.93**(1)	**0.93**(1)	**0.93**(1)	2/15
BIPOPsaACM	**1.3**(2)	**1.6**(2)	**0.61**(0.7)	**2.0**(2)	**2.0**(2)	**2.0**(2)	1/15
CMA	41(51)	27(32)	∞	∞	∞	∞ *2e6*	0/15
CMAES	**0.95**(1)	∞	∞	∞	∞	∞ *5e5*	0/15
CMAa	18(30)	13(13)	∞	∞	∞	∞ *2e6*	0/15
CMAm	18(21)	5.5(7)	∞	∞	∞	∞ *2e6*	0/15
CMAma	27(32)	5.8(7)	**0.39**(0.4)	**0.39**(0.4)	**0.39**(0.5)	**0.39**(0.5)	1/15
CMAmah	56(71)	27(31)	∞	∞	∞	∞ *2e6*	0/15
CMAmh	82(111)	13(14)	∞	∞	∞	∞ *2e6*	0/15
DBRCGA	32(38)	∞	∞	∞	∞	∞ *1e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *5e5*	0/15
DE-AUTO	143(172)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-BFGS	142(157)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-ROLL	41(46)	6.9(7)	∞	∞	∞	∞ *1e6*	0/15
DE-SIMPLEX	21(30)	6.8(7)	∞	∞	∞	∞ *1e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *5e5*	0/15
IPOPsaACM	72(101)	17(19)	∞	∞	∞	∞ *1e7*	0/15
JADEb	21(25)	∞	∞	∞	∞	∞ *5e5*	0/15
JADEctpb	34(38)	∞	∞	∞	∞	∞ *5e5*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**0.90**(0.8)	**1.2**(2)	**0.58**(0.7)	**0.59**(0.6)	**0.59**(0.6)	**0.59**(0.7)	3/15
NIPOPaCMA	6.8(14)	**1.0**(2)	**0.23**(0.3)	**0.31**(0.3)	**0.31**(0.3)	**0.31**(0.3)	5/15
PSO-BFGS	8.4(10)	7.0(8)	∞	∞	∞	∞ *1e6*	0/15
SNES	**1.4**(2)	∞	∞	∞	∞	∞ *3e6*	0/15
xNES	336(364)	∞	∞	∞	∞	∞ *2e6*	0/15
xNESas	731(861)	∞	∞	∞	∞	∞ *5e6*	0/15

Table 98: 20-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-3	1e-5	1e-7	#succ
f1	43	43	43	43	43	43	15/15
ACOR	24(5)	43(8)	60(8)	95(9)	129(10)	164(8)	15/15
BIPOPaCMA	7.5(2)	14(2)	20(2)	33(2)	46(4)	59(4)	15/15
BIPOPsaACM	4.0(0.2)	5.1(0.4)	6.6(0.7)	10(0.7)	13(0.8)	16(1)	15/15
CMA	7.3(1)	13(1)	19(1)	32(2)	43(2)	56(2)	15/15
CMAES	7.5(2)	13(2)	20(2)	33(2)	45(3)	58(4)	15/15
CMAa	7.8(1)	14(2)	20(2)	32(2)	45(3)	58(3)	15/15
CMAm	6.1(1)	10(1)	14(2)	23(1)	32(1)	41(2)	15/15
CMAma	5.8(0.8)	10(1.0)	14(1)	23(1)	32(1)	41(2)	15/15
CMAmah	3.8(0.8)	6.6(0.9)	10(1)	15(1)	21(1)	27(1)	15/15
CMAmh	**3.8**(0.6)	6.7(0.7)	10(1)	15(1)	22(2)	28(2)	15/15
DBRCGA	142(31)	304(46)	485(63)	799(93)	1119(109)	1449(135)	15/15
DE	89(17)	162(31)	241(28)	400(27)	558(30)	717(39)	15/15
DE-AUTO	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	15/15
DE-BFGS	**2.0**(0.2)	**2.2**(0)	**2.2**(0)	**2.2**(0)	**2.2**(0)	**2.2**(0)	15/15
DE-ROLL	6.4(7)	36(35)	37(36)	38(36)	38(36)	38(36)	15/15
DE-SIMPLEX	71(41)	181(83)	237(92)	389(99)	461(117)	840(800)	15/15
DEctpb	91(14)	181(15)	269(21)	440(21)	615(20)	803(34)	15/15
IPOPsaACM	3.9(0.2)	**5.0**(0.4)	**6.5**(0.5)	**9.5**(0.7)	**13**(0.7)	**16**(0.8)	15/15
JADEb	35(3)	67(4)	102(5)	179(13)	260(14)	346(17)	15/15
JADEctpb	47(7)	94(8)	143(8)	240(8)	340(10)	437(13)	15/15
MVDE	144(16)	299(10)	445(13)	743(10)	1048(21)	1355(25)	15/15
NBIPOPaCMA	7.9(1)	14(1)	20(1)	33(2)	46(2)	59(3)	15/15
NIPOPaCMA	7.7(2)	14(1)	20(2)	33(2)	45(2)	58(3)	15/15
PSO-BFGS	**1.9**(0.2)	**2.2**(0)	**2.2**(0)	**2.2**(0)	**2.2**(0)	**2.2**(0)	15/15
SNES	5.4(0.8)	14(1)	25(3)	45(2)	66(2)	86(2)	15/15
xNES	5.8(3)	70(5)	137(6)	274(5)	410(7)	546(9)	15/15
xNESas	7.3(2)	41(9)	61(16)	88(23)	110(25)	128(32)	15/15

Table 99: 20-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-3	1e-5	1e-7	#succ
f2	385	386	387	390	391	393	15/15
ACOR	10(0.9)	12(0.7)	14(0.5)	17(1)	21(0.9)	25(0.9)	15/15
BIPOPaCMA	23(4)	27(3)	29(3)	31(2)	33(1)	34(1)	15/15
BIPOPsaACM	6.8(1)	8.0(1)	8.9(1)	10(1)	10(1)	**10**(1)	15/15
CMA	34(5)	40(6)	43(3)	45(3)	47(1)	48(1)	15/15
CMAES	37(4)	43(3)	45(2)	47(1)	48(1)	50(1)	15/15
CMAa	23(3)	27(3)	29(3)	31(2)	32(2)	34(2)	15/15
CMAm	34(6)	39(6)	42(5)	45(2)	47(2)	48(2)	15/15
CMAma	22(4)	25(3)	27(2)	29(2)	31(1)	32(1)	15/15
CMAmah	23(5)	26(4)	28(2)	30(1)	31(1)	32(1)	15/15
CMAmh	32(5)	36(4)	38(2)	40(2)	41(2)	41(2)	15/15
DBRCGA	75(6)	93(7)	113(8)	147(10)	183(9)	220(9)	15/15
DE	41(3)	50(3)	59(3)	76(5)	93(5)	110(5)	15/15
DE-AUTO	**3.5**(2)	**3.9**(2)	**4.3**(2)	**4.7**(2)	**5.1**(2)	**5.7**(3)	15/15
DE-BFGS	**5.7**(4)	**6.1**(4)	**6.2**(4)	**6.5**(4)	**7.1**(5)	**10**(5)	15/15
DE-ROLL	15(12)	16(12)	16(12)	16(12)	17(12)	17(12)	15/15
DE-SIMPLEX	90(20)	104(16)	120(23)	135(24)	149(23)	287(246)	15/15
DEctpb	47(2)	56(3)	66(3)	86(4)	105(4)	125(5)	15/15
IPOPsaACM	7.3(1)	8.3(2)	8.9(2)	10(2)	**10**(1)	**10**(1)	15/15
JADEb	20(2)	25(2)	30(2)	39(2)	48(3)	57(4)	15/15
JADEctpb	28(1)	34(1)	39(2)	50(2)	61(3)	71(4)	15/15
MVDE	76(2)	92(2)	109(3)	141(2)	173(3)	206(4)	15/15
NBIPOPaCMA	23(4)	27(3)	29(2)	32(2)	33(2)	34(2)	15/15
NIPOPaCMA	23(3)	26(3)	29(2)	31(2)	33(2)	34(2)	15/15
PSO-BFGS	**5.2**(3)	**5.4**(3)	**5.6**(3)	**6.7**(5)	**7.6**(5)	12(12)	15/15
SNES	**4.8**(0.3)	**5.9**(0.2)	**7.0**(0.3)	**9.2**(0.3)	11(0.3)	14(0.4)	15/15
xNES	29(0.7)	36(0.7)	43(0.9)	58(1)	72(0.8)	87(1)	15/15
xNESas	26(1)	31(2)	34(3)	38(4)	41(6)	43(6)	15/15

Table 100: 20-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	5066	7626	7635	7643	7646	7651	15/15
ACOR	1018(1197)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	9.0(5)	1.7e4(2e4)	∞	∞	∞	∞ *2e7*	0/15
BIPOPsaACM	10(7)	∞	∞	∞	∞	∞ *2e7*	0/5
CMA	13(9)	∞	∞	∞	∞	∞ *3e6*	0/15
CMAES	638(691)	∞	∞	∞	∞	∞ *1e6*	0/15
CMAa	8.7(7)	∞	∞	∞	∞	∞ *3e6*	0/15
CMAm	**8.5**(6)	∞	∞	∞	∞	∞ *3e6*	0/15
CMAma	**7.1**(3)	∞	∞	∞	∞	∞ *3e6*	0/15
CMAmah	13(7)	4956(5374)	4950(5811)	4945(5275)	4944(5839)	4941(5786)	1/15
CMAmh	13(16)	∞	∞	∞	∞	∞ *3e6*	0/15
DBRCGA	144(64)	450(415)	1181(1278)	1180(1178)	1181(1326)	1182(1365)	3/15
DE	39(10)	67(49)	167(170)	168(170)	168(162)	169(162)	9/15
DE-AUTO	47(49)	224(179)	401(309)	401(353)	401(353)	401(309)	8/15
DE-BFGS	56(24)	132(68)	181(131)	181(151)	181(149)	191(159)	13/15
DE-ROLL	15(11)	**55**(30)	**82**(65)	**82**(65)	**82**(65)	**82**(65)	15/15
DE-SIMPLEX	119(44)	212(139)	355(283)	355(297)	355(283)	484(409)	4/15
DEctpb	114(10)	94(8)	95(7)	96(7)	97(7)	98(7)	15/15
IPOPsaACM	11(15)	∞	∞	∞	∞	∞ *2e7*	0/5
JADEb	**6.3**(0.3)	**13**(13)	**17**(20)	**18**(20)	**19**(20)	**20**(20)	15/15
JADEctpb	**6.4**(0.3)	**6.0**(0.2)	**6.8**(0.2)	**8.3**(0.2)	**10**(0.2)	**11**(0.2)	15/15
MVDE	28(2)	**23**(3)	**33**(3)	**35**(3)	**36**(3)	**38**(3)	14/15
NBIPOPaCMA	12(8)	∞	∞	∞	∞	∞ *2e7*	0/15
NIPOPaCMA	9.4(6)	∞	∞	∞	∞	∞ *2e7*	0/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	550(526)	∞	∞	∞	∞	∞ *7e6*	0/15
xNES	629(781)	∞	∞	∞	∞	∞ *7e6*	0/15
xNESas	1055(1471)	∞	∞	∞	∞	∞ *1e7*	0/15

Table 101: 20-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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	4722	7628	7666	7700	7758	1.4e5	9/15
ACOR	1.5e4(2e4)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	3.0e4(3e4)	∞	∞	∞	∞	∞ *2e7*	0/15
BIPOPsaACM	∞	∞	∞	∞	∞	∞ *2e7*	0/5
CMA	∞	∞	∞	∞	∞	∞ *3e6*	0/15
CMAES	∞	∞	∞	∞	∞	∞ *1e6*	0/15
CMAa	∞	∞	∞	∞	∞	∞ *3e6*	0/15
CMAm	∞	∞	∞	∞	∞	∞ *3e6*	0/15
CMAma	∞	∞	∞	∞	∞	∞ *3e6*	0/15
CMAmah	∞	∞	∞	∞	∞	∞ *2e6*	0/15
CMAmh	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DBRCGA	236(100)	∞	∞	∞	∞	∞ *2e6*	0/15
DE	30(9)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	67(50)	1265(1305)	3887(4114)	3870(4290)	3841(4000)	211(227)	1/15
DE-BFGS	143(83)	589(526)	3893(4440)	3876(4551)	3847(3872)	212(227)	1/15
DE-ROLL	**26**(19)	165(86)	**407**(392)	**406**(325)	**403**(385)	**22**(21)	8/15
DE-SIMPLEX	172(76)	388(277)	3910(4178)	3893(4225)	3866(4000)	∞ *2e6*	0/15
DEctpb	144(19)	**119**(14)	**311**(265)	**311**(264)	**310**(259)	**17**(14)	6/15
IPOPsaACM	1.9e4(2e4)	∞	∞	∞	∞	∞ *2e7*	0/5
JADEb	**17**(11)	**102**(122)	**265**(268)	**265**(264)	**264**(267)	**15**(16)	6/15
JADEctpb	**8.0**(0.4)	**7.0**(0.3)	**8.0**(0.2)*	**10**(0.2)*	**11**(0.3)*	**0.71**(0.0)*	15/15
MVDE	**28**(4)	**71**(68)	869(1042)	867(1039)	862(967)	48(50)	2/15
NBIPOPaCMA	6.1e4(7e4)	∞	∞	∞	∞	∞ *2e7*	0/15
NIPOPaCMA	∞	∞	∞	∞	∞	∞ *2e7*	0/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	4050(3765)	∞	∞	∞	∞	∞ *7e6*	0/15
xNES	6323(7716)	∞	∞	∞	∞	∞ *7e6*	0/15
xNESas	4193(4743)	∞	∞	∞	∞	∞ *1e7*	0/15

Table 102: 20-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-3	1e-5	1e-7	#succ
f5	41	41	41	41	41	41	15/15
ACOR	10(3)	12(4)	12(4)	12(4)	12(4)	12(4)	15/15
BIPOPaCMA	5.5(0.9)	6.6(0.8)	6.7(0.9)	6.7(0.9)	6.7(0.9)	6.7(0.9)	15/15
BIPOPsaACM	4.7(0.7)	5.3(0.7)	5.4(0.7)	5.4(0.7)	5.4(0.7)	5.4(0.7)	15/15
CMA	4.9(1)	5.7(0.9)	5.9(1)	5.9(1)	5.9(1)	5.9(1)	15/15
CMAES	5.1(1.0)	6.2(0.9)	6.2(0.9)	6.2(0.9)	6.2(0.9)	6.2(0.9)	15/15
CMAa	5.5(1)	6.5(2)	6.6(2)	6.6(2)	6.6(2)	6.6(2)	15/15
CMAm	4.4(1)	5.4(1)	5.5(1)	5.5(1)	5.5(1)	5.5(1)	15/15
CMAma	4.6(1)	5.2(2)	5.3(1)	5.3(1)	5.3(1)	5.3(1)	15/15
CMAmah	**3.1**(0.6)	**4.0**(1)	**4.1**(1)	**4.1**(1)	**4.1**(1)	**4.1**(1)	15/15
CMAmh	**3.2**(1)	**3.7**(1)	**3.8**(1)	**3.8**(1)	**3.8**(1)	**3.8**(1)	15/15
DBRCGA	151(38)	213(84)	228(106)	233(112)	234(112)	234(112)	15/15
DE	27(6)	35(4)	36(6)	36(6)	36(6)	36(6)	15/15
DE-AUTO	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	**3.1**(0.1)	15/15
DE-BFGS	14(8)	22(14)	24(16)	24(16)	26(20)	26(20)	15/15
DE-ROLL	**3.8**(0.7)	**4.0**(0.9)	**4.0**(0.9)	**4.0**(0.9)	**4.0**(0.9)	**4.0**(0.9)	15/15
DE-SIMPLEX	578(126)	869(181)	1437(334)	2145(454)	2753(766)	2.9e4(3e4)	8/15
DEctpb	37(7)	43(4)	46(9)	46(10)	46(10)	46(10)	15/15
IPOPsaACM	4.5(0.7)	5.1(0.7)	5.2(0.8)	5.2(0.8)	5.2(0.8)	5.2(0.8)	15/15
JADEb	28(8)	35(7)	37(8)	37(8)	37(8)	37(8)	15/15
JADEctpb	43(9)	52(7)	54(8)	54(8)	54(8)	54(8)	15/15
MVDE	212(18)	307(31)	379(42)	449(86)	462(95)	463(95)	15/15
NBIPOPaCMA	5.1(1)	6.1(1)	6.3(1)	6.3(1)	6.3(1)	6.3(1)	15/15
NIPOPaCMA	5.6(1)	6.4(1)	6.6(1)	6.6(1)	6.6(1)	6.6(1)	15/15
PSO-BFGS	22(16)	31(32)	31(32)	33(36)	33(36)	33(36)	15/15
SNES	9.4(2)	12(3)	12(3)	12(3)	12(3)	12(3)	15/15
xNES	10(1)	12(1)	12(1)	12(1)	12(1)	12(1)	15/15
xNESas	8.6(1)	10(1)	11(2)	11(2)	11(2)	11(2)	15/15

Table 103: 20-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-3	1e-5	1e-7	#succ
f6	1296	2343	3413	5220	6728	8409	15/15
ACOR	6.5(2)	5.3(1)	4.8(0.9)	4.7(0.6)	4.8(0.6)	4.9(0.6)	15/15
BIPOPaCMA	**1.5**(0.2)	**1.2**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	15/15
BIPOPsaACM	**1.4**(0.3)	**1.2**(0.2)	**1.1**(0.2)	**1.1**(0.2)	**1.3**(0.3)	**1.4**(0.3)	15/15
CMA	**1.7**(0.2)	**1.3**(0.2)	**1.2**(0.1)	**1.2**(0.1)	**1.2**(0.1)	**1.2**(0.1)	15/15
CMAES	**1.7**(0.5)	**1.3**(0.3)	**1.2**(0.3)	**1.2**(0.1)	**1.2**(0.2)	**1.2**(0.1)	15/15
CMAa	**1.6**(0.3)	**1.3**(0.2)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	15/15
CMAm	**1.7**(0.3)	**1.3**(0.2)	**1.2**(0.1)	**1.2**(0.2)	**1.2**(0.2)	**1.3**(0.1)	15/15
CMAma	**1.5**(0.3)	**1.2**(0.1)	**1.0**(0.1)	**1.0**(0.1)	**1.1**(0.1)	**1.1**(0.1)	15/15
CMAmah	**1.2**(0.3)	**1.1**(0.2)	**1.0**(0.2)	**1.1**(0.3)	**1.2**(0.3)	**1.3**(0.3)	15/15
CMAmh	**1.2**(0.4)	**1.1**(0.3)	**1.1**(0.3)	**1.3**(0.5)	**1.8**(0.5)	**2.3**(1)	15/15
DBRCGA	26(11)	55(8)	46(9)	43(8)	43(10)	43(11)	15/15
DE	53(9)	46(7)	46(7)	50(9)	57(11)	61(12)	15/15
DE-AUTO	**1.9**(0.7)	**2.2**(2)	4.3(3)	12(3)	16(3)	71(126)	10/15
DE-BFGS	6.8(5)	8.5(6)	17(16)	32(36)	96(149)	295(334)	2/15
DE-ROLL	21(7)	23(35)	23(24)	69(35)	209(297)	1025(1176)	1/15
DE-SIMPLEX	34(13)	34(10)	42(23)	102(61)	329(184)	∞ *2e6*	0/15
DEctpb	29(3)	23(2)	21(2)	21(1)	21(1)	21(1)	15/15
IPOPsaACM	**1.5**(0.4)	**1.2**(0.3)	**1.1**(0.2)	**1.1**(0.2)	**1.2**(0.2)	**1.3**(0.3)	15/15
JADEb	25(13)	72(53)	362(353)	∞	∞	∞ *1e6*	0/15
JADEctpb	9.4(0.7)	7.8(0.8)	7.3(0.7)	7.2(0.9)	7.4(0.9)	7.4(0.9)	15/15
MVDE	37(7)	35(8)	35(7)	37(7)	40(9)	43(10)	15/15
NBIPOPaCMA	**1.5**(0.3)	**1.2**(0.2)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	15/15
NIPOPaCMA	**1.5**(0.2)	**1.2**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	**1.1**(0.1)	15/15
PSO-BFGS	9.4(8)	20(18)	40(52)	148(193)	198(267)	352(384)	0/15
SNES	**1.3**(0.2)	**1.2**(0.2)	**1.2**(0.2)	35(57)	137(396)	445(523)	11/15
xNES	4.9(0.3)	4.8(0.2)	4.7(0.2)	5.0(0.1)	5.3(0.1)	5.4(0.1)	15/15
xNESas	4.8(0.2)	4.6(0.2)	4.5(0.1)	4.8(0.1)	5.2(0.1)	5.3(0.1)	15/15

Table 104: 20-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-3	1e-5	1e-7	#succ
f7	1351	4274	9503	16524	16524	16969	15/15
ACOR	76(36)	3.5e4(4e4)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.3**(1)	**2.9**(2)	**2.3**(1)	**1.5**(0.6)	**1.5**(0.6)	**1.4**(0.6)	15/15
BIPOPsaACM	**1.0**(0.9)	**1.6**(0.6)	**0.84**(0.3)	**0.61**(0.1)$_{\downarrow 3}$	**0.61**(0.1)$_{\downarrow 3}$	**0.60**(0.1)$_{\downarrow 3}$	15/15
CMA	**1.7**(1)	3.9(1)	**2.7**(2)	**1.7**(1.0)	**1.7**(1.0)	**1.6**(0.9)	15/15
CMAES	**1.5**(1)	191(214)	754(840)	∞	∞	∞ *1e6*	0/15
CMAa	**1.0**(1.0)	**2.3**(1.0)	**1.7**(0.7)	**1.1**(0.4)	**1.1**(0.4)	**1.0**(0.4)	15/15
CMAm	**1.7**(1)	4.2(2)	**2.7**(1.0)	**1.7**(0.6)	**1.7**(0.6)	**1.6**(0.6)	15/15
CMAma	**1.6**(1)	**2.7**(1)	**1.8**(0.7)	**1.1**(0.4)	**1.1**(0.4)	**1.1**(0.4)	15/15
CMAmah	**1.7**(1)	**2.4**(0.7)	**1.5**(0.6)	**0.95**(0.3)	**0.95**(0.3)	**0.93**(0.3)	15/15
CMAmh	**2.9**(1)	4.4(1)	**2.6**(1)	**1.6**(0.6)	**1.6**(0.6)	**1.6**(0.6)	15/15
DBRCGA	80(75)	∞	∞	∞	∞	∞ *2e6*	0/15
DE	24(6)	94(122)	235(316)	256(274)	256(274)	249(295)	3/15
DE-AUTO	28(11)	577(588)	522(534)	439(424)	439(414)	427(415)	4/15
DE-BFGS	502(758)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-ROLL	26(34)	259(265)	548(571)	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	125(107)	1278(1262)	∞	∞	∞	∞ *2e6*	0/15
DEctpb	29(5)	32(10)	28(5)	20(4)	20(4)	20(6)	14/15
IPOPsaACM	**1.0**(1)	**1.6**(0.6)	**0.92**(0.6)	**0.66**(0.3)$_{\downarrow 2}$	**0.66**(0.3)$_{\downarrow 2}$	**0.65**(0.3)$_{\downarrow 2}$	15/15
JADEb	119(370)	3279(3685)	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	4.8(0.9)	272(351)	686(789)	402(480)	402(510)	391(442)	2/15
MVDE	25(5)	106(124)	470(532)	882(938)	882(908)	860(914)	1/15
NBIPOPaCMA	**1.1**(1)	3.9(0.8)	**2.6**(1)	**1.6**(0.6)	**1.6**(0.6)	**1.6**(0.6)	15/15
NIPOPaCMA	**0.99**(0.4)	**2.8**(2)	**1.7**(0.9)	**1.2**(0.3)	**1.2**(0.3)	**1.2**(0.3)	15/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	32(59)	2715(2771)	∞	∞	∞	∞ *7e6*	0/15
xNES	**1.8**(0.4)	**1.6**(0.1)	**1.1**(0.0)	**0.94**(0.1)	**0.94**(0.1)	**0.96**(0.1)	15/15
xNESas	**1.9**(0.2)	**1.5**(0.1)	**1.0**(0.1)	**0.89**(0.1)	**0.89**(0.1)	**0.91**(0.1)	15/15

Table 105: 20-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-3	1e-5	1e-7	#succ
f8	2039	3871	4040	4219	4371	4484	15/15
ACOR	24(8)	66(114)	72(101)	89(86)	107(84)	125(83)	15/15
BIPOPaCMA	3.3(0.9)	4.0(3)	4.3(3)	4.4(3)	4.4(3)	4.5(3)	15/15
BIPOPsaACM	**1.3**(0.2)	**1.5**(0.9)	**1.5**(0.9)	**1.6**(0.8)	**1.6**(0.8)	**1.6**(0.8)	15/15
CMA	3.7(0.6)	4.4(0.3)	4.7(0.3)	4.9(0.3)	4.9(0.3)	5.0(0.3)	15/15
CMAES	3.9(0.8)	4.3(0.7)	4.7(0.7)	4.8(0.7)	4.9(0.7)	4.9(0.7)	15/15
CMAa	3.6(0.7)	3.5(0.6)	3.8(0.6)	4.0(0.6)	4.0(0.6)	4.0(0.6)	15/15
CMAm	3.9(0.7)	5.0(4)	5.3(4)	5.4(3)	5.4(3)	5.4(3)	15/15
CMAma	3.1(0.6)	4.2(3)	4.4(3)	4.5(3)	4.5(2)	4.5(2)	15/15
CMAmah	**2.6**(0.5)	3.4(2)	**3.6**(2)	**3.7**(2)	**3.6**(2)	**3.6**(2)	15/15
CMAmh	3.2(1)	4.5(3)	4.7(3)	4.8(3)	4.8(3)	4.8(3)	15/15
DBRCGA	50(40)	150(262)	159(250)	184(239)	213(233)	257(242)	12/15
DE	53(4)	95(6)	106(9)	120(11)	130(11)	138(12)	14/15
DE-AUTO	**1.5**(0.4)	4.2(3)	5.2(5)	8.2(5)	9.3(4)	12(5)	15/15
DE-BFGS	**1.5**(1)	**2.8**(4)	**2.8**(4)	**3.2**(3)	**3.2**(3)	**3.2**(3)	15/15
DE-ROLL	6.4(8)	15(16)	20(19)	28(21)	33(20)	129(117)	13/15
DE-SIMPLEX	12(8)	13(8)	15(8)	19(8)	24(10)	81(56)	14/15
DEctpb	52(3)	66(2)	76(2)	89(4)	100(4)	111(4)	15/15
IPOPsaACM	**1.4**(0.2)	**1.3**(0.1)	**1.4**(0.1)	**1.4**(0.1)	**1.4**(0.1)	**1.4**(0.1)	15/15
JADEb	12(4)	14(12)	14(11)	15(11)	16(10)	17(10)	15/15
JADEctpb	18(1)	16(0.6)	16(0.6)	17(0.6)	17(0.7)	18(0.7)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.2(0.7)	**3.4**(1)	3.6(1)	3.8(1)	3.8(1.0)	3.8(1.0)	15/15
NIPOPaCMA	3.3(0.4)	3.9(2)	4.1(2)	4.2(2)	4.3(2)	4.3(2)	15/15
PSO-BFGS	**1.6**(1)	4.1(4)	4.7(5)	6.0(4)	6.3(4)	9.0(12)	15/15
SNES	37(10)	145(138)	299(251)	1107(1152)	1.3e4(1e4)	2.6e4(3e4)	0/15
xNES	7.5(0.8)	6.9(1)	7.5(1)	7.7(1)	8.4(1.0)	10(0.9)	15/15
xNESas	7.2(0.6)	7.9(2)	9.1(3)	9.4(4)	10(4)	10(4)	15/15

Table 106: 20-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-3	1e-5	1e-7	#succ
f9	1716	3102	3277	3455	3594	3727	15/15
ACOR	45(7)	78(8)	119(11)	286(31)	473(52)	651(74)	15/15
BIPOPaCMA	3.8(1.0)	4.4(0.6)	4.7(0.6)	4.8(0.5)	4.8(0.5)	4.8(0.5)	15/15
BIPOPsaACM	**1.5**(0.3)	**1.7**(0.2)	**1.7**(0.2)	**1.8**(0.2)	**1.8**(0.2)	**1.7**(0.2)	15/15
CMA	4.7(0.9)	5.1(0.6)	5.4(0.6)	5.6(0.5)	5.6(0.5)	5.6(0.5)	15/15
CMAES	4.5(1)	5.0(0.7)	5.4(0.6)	5.5(0.6)	5.5(0.6)	5.5(0.6)	15/15
CMAa	3.9(0.7)	4.1(0.4)	4.4(0.4)	4.5(0.4)	4.5(0.4)	4.5(0.4)	15/15
CMAm	4.1(1)	5.4(0.7)	5.7(0.6)	5.8(0.6)	5.8(0.6)	5.8(0.6)	15/15
CMAma	3.4(0.9)	4.1(0.6)	4.3(0.5)	**4.4**(0.5)	**4.4**(0.4)	**4.4**(0.4)	15/15
CMAmah	**2.9**(0.9)	4.8(3)	4.9(3)	5.0(3)	4.9(3)	4.9(2)	15/15
CMAmh	3.1(2)	4.2(0.9)	4.5(0.9)	4.6(0.9)	4.6(0.8)	4.6(0.8)	15/15
DBRCGA	353(124)	1855(1640)	∞	∞	∞	∞ *2e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	**2.0**(0.9)	6.9(5)	8.8(6)	11(5)	11(4)	20(30)	15/15
DE-BFGS	**1.8**(1)	**2.6**(2)	**2.8**(1)	**2.7**(1)	**2.7**(1)	**2.7**(1)	15/15
DE-ROLL	25(16)	44(18)	54(26)	63(23)	83(44)	1299(1470)	1/15
DE-SIMPLEX	24(8)	149(212)	144(198)	140(188)	142(179)	207(294)	13/15
DEctpb	417(90)	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**1.6**(0.4)	**1.8**(1)	**1.9**(1)	**1.9**(1)	**1.9**(1.0)	**1.9**(1.0)	15/15
JADEb	24(6)	32(24)	33(23)	35(22)	35(21)	36(20)	15/15
JADEctpb	36(3)	30(3)	32(3)	33(2)	33(2)	33(2)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.8(0.7)	**4.0**(0.3)	**4.3**(0.3)	4.5(0.2)	4.5(0.2)	4.5(0.2)	15/15
NIPOPaCMA	3.9(1)	4.5(0.5)	4.8(0.5)	4.9(0.5)	4.9(0.5)	4.9(0.5)	15/15
PSO-BFGS	**1.7**(0.7)	4.9(4)	5.7(4)	7.1(5)	6.9(5)	6.9(4)	15/15
SNES	520(442)	1.8e4(2e4)	3.5e4(4e4)	∞	∞	∞ *8e6*	0/15
xNES	8.9(1)	8.5(1)	9.3(2)	9.4(2)	10(1)	11(1)	15/15
xNESas	8.1(1)	8.9(2)	10(2)	10(2)	11(2)	11(2)	15/15

Table 107: 20-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-3	1e-5	1e-7	#succ
f10	7413	8661	10735	14920	17073	17476	15/15
ACOR	2.0e4(2e4)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.2**(0.2)	**1.2**(0.2)	**1.1**(0.1)	**0.83**(0.0)$_{\downarrow 4}$	**0.76**(0.0)$_{\downarrow 4}$	**0.77**(0.0)$_{\downarrow 4}$	15/15
BIPOPsaACM	**0.36**(0.1)$_{\downarrow 4}$	**0.35**(0.0)$_{\downarrow 4}$	**0.31**(0.0)$_{\downarrow 4}$	**0.24**(0.0)$_{\downarrow 4}$	**0.23**(0.0)$_{\downarrow 4}$	**0.23**(0.0)$_{\downarrow 4}$	15/15
CMA	**1.8**(0.3)	**1.8**(0.2)	**1.6**(0.1)	**1.2**(0.1)	**1.1**(0.0)	**1.1**(0.0)	15/15
CMAES	**1.7**(0.1)	**1.7**(0.2)	**1.6**(0.1)	**1.2**(0.0)	**1.1**(0.0)	**1.1**(0.0)	15/15
CMAa	**1.2**(0.2)	**1.2**(0.2)	**1.0**(0.1)	**0.82**(0.0)$_{\downarrow 4}$	**0.75**(0.0)$_{\downarrow 4}$	**0.76**(0.0)$_{\downarrow 4}$	15/15
CMAm	**1.8**(0.2)	**1.8**(0.2)	**1.6**(0.1)	**1.2**(0.0)	**1.1**(0.0)	**1.1**(0.0)	15/15
CMAma	**1.1**(0.2)	**1.1**(0.1)	**0.98**(0.1)	**0.76**(0.0)$_{\downarrow 4}$	**0.70**(0.0)$_{\downarrow 4}$	**0.71**(0.0)$_{\downarrow 4}$	15/15
CMAmah	**1.2**(0.2)	**1.2**(0.2)	**1.0**(0.1)	**0.79**(0.1)$_{\downarrow 4}$	**0.71**(0.0)$_{\downarrow 4}$	**0.71**(0.0)$_{\downarrow 4}$	15/15
CMAmh	**1.6**(0.2)	**1.6**(0.2)	**1.4**(0.1)	**1.1**(0.0)	**0.95**(0.0)	**0.94**(0.0)$_{\downarrow}$	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	**1.5**(1)	**1.5**(1)	**1.8**(2)	**2.5**(2)	4.6(2)	17(11)	9/15
DE-BFGS	6.1(6)	5.3(5)	4.3(4)	3.1(3)	**2.7**(3)	**2.6**(3)	15/15
DE-ROLL	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	138(105)	817(821)	∞	∞	∞	∞ *2e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**0.35**(0.1)$_{\downarrow 4}$	**0.36**(0.1)$_{\downarrow 4}$	**0.31**(0.0)$_{\downarrow 4}$	**0.24**(0.0)$_{\downarrow 4}$	**0.22**(0.0)$_{\downarrow 4}$	**0.23**(0.0)$_{\downarrow 4}$	15/15
JADEb	39(17)	54(24)	64(16)	116(73)	862(923)	∞ *1e6*	0/15
JADEctpb	12(5)	15(4)	15(4)	15(4)	15(3)	18(4)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.1**(0.1)	**1.1**(0.2)	**1.0**(0.1)	**0.80**(0.0)$_{\downarrow 4}$	**0.73**(0.0)$_{\downarrow 4}$	**0.75**(0.0)$_{\downarrow 4}$	15/15
NIPOPaCMA	**1.2**(0.2)	**1.2**(0.1)	**1.0**(0.1)	**0.81**(0.0)$_{\downarrow 4}$	**0.74**(0.0)$_{\downarrow 4}$	**0.76**(0.0)$_{\downarrow 4}$	15/15
PSO-BFGS	29(15)	24(12)	20(10)	14(7)	12(6)	12(6)	14/15
SNES	∞	∞	∞	∞	∞	∞ *8e6*	0/15
xNES	**1.5**(0.0)	**1.6**(0.0)	**1.6**(0.0)	**1.5**(0.0)	**1.7**(0.0)	**2.0**(0.0)	15/15
xNESas	**1.3**(0.1)	**1.4**(0.1)	**1.3**(0.1)	**1.0**(0.1)	**0.99**(0.1)	**1.0**(0.1)	15/15

Table 108: 20-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-3	1e-5	1e-7	#succ
f11	1002	2228	6278	9762	12285	14831	15/15
ACOR	1002(53)	1328(2262)	679(810)	995(1040)	1037(1227)	1462(1687)	2/15
BIPOPaCMA	4.5(0.3)	**2.3**(0.1)	**0.87**(0.0)	**0.64**(0.0)$_{\downarrow 4}$	**0.56**(0.0)$_{\downarrow 4}$	**0.51**(0.0)$_{\downarrow 4}$	15/15
BIPOPsaACM	**2.5**(0.4)	**1.2**(0.2)	**0.44**(0.1)	**0.30**(0.0)$_{\downarrow 4}$	**0.26**(0.0)$_{\downarrow 4}$	**0.23**(0.0)$_{\downarrow 4}$	15/15
CMA	10(1.0)	5.1(0.3)	**1.9**(0.1)	**1.4**(0.0)	**1.2**(0.0)	**1.0**(0.0)	15/15
CMAES	11(0.8)	5.3(0.2)	**2.0**(0.1)	**1.4**(0.0)	**1.2**(0.0)	**1.0**(0.0)	15/15
CMAa	4.5(0.2)	**2.2**(0.1)	**0.86**(0.0)	**0.63**(0.0)$_{\downarrow 4}$	**0.55**(0.0)$_{\downarrow 4}$	**0.50**(0.0)$_{\downarrow 4}$	15/15
CMAm	11(0.7)	5.4(0.4)	**2.0**(0.1)	**1.4**(0.1)	**1.2**(0.1)	**1.1**(0.0)	15/15
CMAma	4.3(0.5)	**2.1**(0.2)	**0.82**(0.1)	**0.59**(0.0)$_{\downarrow 4}$	**0.51**(0.0)$_{\downarrow 4}$	**0.45**(0.0)$_{\downarrow 4}$	15/15
CMAmah	4.8(0.5)	**2.4**(0.2)	**0.92**(0.1)	**0.66**(0.0)$_{\downarrow 4}$	**0.56**(0.0)$_{\downarrow 4}$	**0.49**(0.0)$_{\downarrow 4}$	15/15
CMAmh	11(0.9)	5.6(0.3)	**2.1**(0.1)	**1.5**(0.1)	**1.3**(0.0)	**1.1**(0.0)	15/15
DBRCGA	431(168)	396(54)	189(21)	165(8)	154(5)	∞ *2e6*	0/15
DE	7377(8476)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	**0.38**(0.5)	**0.19**(0.2)$_{\downarrow 3}$	**0.07**(0.1)$_{\downarrow 4}$	**0.06**(0.1)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	**0.10**(0.0)$_{\downarrow 4}$	15/15
DE-BFGS	**0.20**(0.1)$_{\downarrow 4}$	**0.11**(0.1)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.04**(9e-3)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	15/15
DE-ROLL	510(225)	6543(7136)	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	90(38)	162(67)	142(53)	1512(1538)	∞	∞ *2e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**2.5**(0.5)	**1.2**(0.2)	**0.45**(0.1)	**0.31**(0.1)$_{\downarrow 4}$	**0.26**(0.1)$_{\downarrow 4}$	**0.23**(0.0)$_{\downarrow 4}$	15/15
JADEb	281(507)	140(229)	54(81)	41(52)	37(42)	35(34)	12/15
JADEctpb	92(19)	46(8)	18(4)	15(3)	15(3)	15(3)	14/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	4.6(0.4)	**2.3**(0.2)	**0.89**(0.1)	**0.64**(0.0)$_{\downarrow 4}$	**0.56**(0.0)$_{\downarrow 4}$	**0.51**(0.0)$_{\downarrow 4}$	15/15
NIPOPaCMA	4.5(0.3)	**2.3**(0.1)	**0.87**(0.0)	**0.64**(0.0)$_{\downarrow 4}$	**0.56**(0.0)$_{\downarrow 4}$	**0.50**(0.0)$_{\downarrow 4}$	15/15
PSO-BFGS	**0.25**(0.2)$_{\downarrow 4}$	**0.14**(0.1)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	15/15
SNES	1.2e5(1e5)	∞	∞	∞	∞	∞ *8e6*	0/15
xNES	4.9(0.3)	3.3(0.2)	**1.6**(0.1)	**1.6**(0.0)	**1.8**(0.0)	**1.9**(0.0)	15/15
xNESas	4.8(0.3)	3.1(0.2)	**1.4**(0.1)	**1.1**(0.2)	**1.00**(0.2)	**0.91**(0.2)	15/15

Table 109: 20-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-3	1e-5	1e-7	#succ
f12	1042	1938	2740	4140	12407	13827	15/15
ACOR	3665(4801)	1.0e4(1e4)	2.4e4(3e4)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	3.3(3)	3.6(3)	4.0(2)	3.7(1)	**1.5**(0.4)	**1.5**(0.4)	15/15
BIPOPsaACM	**0.99**(0.9)	**1.1**(1)	**1.2**(0.9)	**1.2**(0.9)	**0.55**(0.3)$_{\downarrow}$	**0.59**(0.3)$_{\downarrow 2}$	15/15
CMA	3.4(5)	5.4(4)	5.6(3)	5.1(2)	**2.1**(0.9)	**2.2**(0.9)	15/15
CMAES	**2.2**(0.2)	3.2(3)	4.0(3)	4.0(2)	**1.8**(0.8)	**1.9**(0.7)	15/15
CMAa	**2.4**(0.2)	3.4(2)	3.4(2)	3.4(1)	**1.4**(0.5)	**1.5**(0.5)	15/15
CMAm	3.2(4)	4.1(5)	4.8(5)	4.6(3)	**2.0**(1)	**2.1**(1.0)	15/15
CMAma	**2.3**(2)	3.1(3)	3.2(2)	3.1(1)	**1.3**(0.5)	**1.4**(0.5)	15/15
CMAmah	**1.2**(1)	**2.1**(2)	**2.6**(2)	**2.5**(1)	**1.1**(0.4)	**1.1**(0.3)	15/15
CMAmh	4.5(5)	6.1(6)	6.4(5)	5.6(3)	**2.4**(1)	**2.4**(1)	15/15
DBRCGA	185(16)	1209(1550)	1.0e4(1e4)	∞	∞	∞ *2e6*	0/15
DE	99(6)	478(538)	1497(1825)	∞	∞	∞ *1e6*	0/15
DE-AUTO	**2.2**(2)	**2.3**(3)	**2.9**(3)	4.4(4)	4.5(2)	39(49)	7/15
DE-BFGS	**1.4**(0.8)	**1.4**(1)	**1.6**(1)	**1.7**(1)	**1.1**(0.6)	4.6(4)	15/15
DE-ROLL	21(35)	18(24)	18(17)	27(20)	25(20)	100(100)	6/15
DE-SIMPLEX	34(31)	30(23)	28(17)	31(17)	21(17)	621(724)	0/15
DEctpb	194(208)	406(392)	1276(1306)	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**0.67**(0.1)	**0.88**(0.7)	**1.1**(0.7)	**1.2**(0.5)	**0.56**(0.2)$_{\downarrow 2}$	**0.60**(0.2)$_{\downarrow 2}$	15/15
JADEb	23(24)	34(30)	40(29)	39(17)	17(6)	18(5)	15/15
JADEctpb	19(4)	20(15)	28(15)	28(10)	13(3)	14(3)	15/15
MVDE	108(31)	272(275)	528(582)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.3**(0.2)	**2.7**(2)	3.2(2)	3.2(1)	**1.3**(0.5)	**1.4**(0.5)	15/15
NIPOPaCMA	3.5(3)	3.6(3)	3.5(2)	3.4(1)	**1.4**(0.4)	**1.4**(0.4)	15/15
PSO-BFGS	**2.2**(2)	**2.3**(2)	**2.3**(2)	3.7(3)	5.0(4)	21(24)	13/15
SNES	23(38)	37(41)	122(57)	3134(3400)	∞	∞ *8e6*	0/15
xNES	16(0.5)	11(0.4)	9.3(1)	8.3(0.8)	3.5(0.2)	3.6(0.2)	15/15
xNESas	6.6(4)	16(8)	18(18)	35(38)	21(21)	22(21)	15/15

Table 110: 20-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-3	1e-5	1e-7	#succ
f13	652	2021	2751	18749	24455	30201	15/15
ACOR	1.8e4(2e4)	3.2e4(4e4)	5.1e4(6e4)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	4.1(3)	3.3(3)	3.7(3)	**0.85**(0.4)	**1.1**(0.8)	**1.4**(0.6)	15/15
BIPOPsaACM	**1.1**(0.9)	**0.89**(0.7)	**1.4**(1.0)	**0.38**(0.1)$_{\downarrow 4}$	**0.42**(0.2)$_{\downarrow 4}$	**0.40**(0.1)$_{\downarrow 4}$	15/15
CMA	**2.5**(0.4)	5.1(4)	7.5(6)	**1.7**(1)	**1.9**(0.9)	**2.0**(1)	15/15
CMAES	6.3(5)	5.1(3)	4.5(3)	**1.9**(2)	4.6(5)	8.4(9)	12/15
CMAa	**2.4**(0.3)	3.5(3)	4.5(3)	**1.1**(0.8)	**1.2**(0.7)	**1.5**(1.0)	15/15
CMAm	3.1(4)	3.2(4)	6.2(4)	**1.7**(1)	**2.4**(0.9)	**2.4**(0.7)	15/15
CMAma	**2.9**(3)	3.5(3)	4.4(2)	**0.94**(0.4)	**1.1**(0.5)	**1.5**(1)	15/15
CMAmah	3.6(3)	3.3(4)	4.2(3)	**1.3**(0.4)	**1.4**(0.6)	**1.8**(0.9)	15/15
CMAmh	3.7(3)	5.1(5)	6.4(6)	**1.8**(0.7)	**2.4**(1.0)	**2.7**(0.7)	15/15
DBRCGA	183(295)	398(495)	2064(2545)	∞	∞	∞ *2e6*	0/15
DE	41(7)	214(306)	702(845)	∞	∞	∞ *1e6*	0/15
DE-AUTO	**1.8**(0.5)	**0.91**(0.4)	**0.95**(0.3)	**0.70**(0.6)	4.5(3)	32(35)	7/15
DE-BFGS	**1.3**(0.1)	**0.59**(0.1)$_{\downarrow 4}$	**0.53**(0.0)$_{\downarrow 4}$	**0.18**(0.2)$_{\downarrow 4}$	92(123)	∞ *2e6*	0/15
DE-ROLL	24(15)	18(20)	17(15)	5.8(4)	24(16)	289(321)	1/15
DE-SIMPLEX	28(17)	15(7)	16(6)	9.0(6)	195(227)	∞ *2e6*	0/15
DEctpb	50(8)	103(76)	607(559)	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**1.7**(2)	**1.7**(0.8)	**1.5**(0.7)	**0.34**(0.2)$_{\downarrow 4}$	**0.37**(0.1)$_{\downarrow 4}$	**0.41**(0.2)$_{\downarrow 4}$	15/15
JADEb	61(53)	91(112)	175(194)	795(827)	∞	∞ *1e6*	0/15
JADEctpb	17(2)	14(5)	15(4)	3.6(0.6)	4.8(0.8)	9.0(2)	15/15
MVDE	68(5)	297(495)	2523(3019)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.3(3)	**2.6**(2)	3.7(3)	**1.1**(1.0)	**1.2**(0.6)	**1.3**(0.8)	15/15
NIPOPaCMA	3.3(3)	3.7(3)	4.1(2)	**0.95**(0.3)	**1.1**(0.4)	**1.5**(0.5)	15/15
PSO-BFGS	**1.2**(0.1)	**0.56**(0.0)$_{\downarrow 4}$	**0.51**(0.0)$_{\downarrow 4}$	**0.21**(0.1)$_{\downarrow 4}$	133(167)	∞ *2e6*	0/15
SNES	11(0.5)	54(59)	153(139)	140(126)	796(784)	∞ *7e6*	0/15
xNES	16(0.5)	7.8(0.2)	7.9(0.2)	**1.8**(0.0)	**1.8**(0.0)	**1.9**(0.0)	15/15
xNESas	7.0(3)	4.6(3)	19(28)	17(21)	40(33)	81(83)	0/15

Table 111: 20-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-3	1e-5	1e-7	#succ
f14	75	239	304	932	1648	15661	15/15
ACOR	15(4)	9.5(2)	11(2)	30(8)	∞	∞ *1e7*	0/15
BIPOPaCMA	3.2(1)	**2.6**(0.5)	3.3(0.4)	3.2(0.3)	3.8(0.2)	**0.68**(0.0)$_{\downarrow 4}$	15/15
BIPOPsaACM	3.2(1)	**1.8**(0.6)	**1.9**(0.4)	**1.5**(0.2)	**1.4**(0.2)	**0.23**(0.0)$_{\downarrow 4}$	15/15
CMA	4.5(2)	**2.9**(0.6)	3.7(0.5)	4.1(0.4)	6.1(0.5)	**1.2**(0.1)	15/15
CMAES	4.2(1)	**3.0**(0.5)	3.7(0.4)	4.2(0.3)	6.2(0.5)	**1.2**(0.1)	15/15
CMAa	3.8(1)	**2.7**(0.3)	3.5(0.5)	3.1(0.2)	3.9(0.2)	**0.69**(0.0)$_{\downarrow 4}$	15/15
CMAm	**2.9**(1)	**2.3**(0.4)	**2.8**(0.3)	3.7(0.4)	6.3(0.6)	**1.2**(0.1)	15/15
CMAma	3.3(1)	**2.3**(0.4)	**2.8**(0.4)	**2.9**(0.3)	3.7(0.3)	**0.65**(0.0)$_{\downarrow 4}$	15/15
CMAmah	**2.0**(0.6)	**1.5**(0.3)	**1.9**(0.3)	**2.3**(0.3)	3.4(0.4)	**0.66**(0.0)$_{\downarrow 4}$	15/15
CMAmh	**2.3**(1)	**1.6**(0.4)	**1.9**(0.3)	**2.8**(0.3)	5.7(0.7)	**1.2**(0.1)	15/15
DBRCGA	32(9)	45(10)	67(12)	92(18)	1640(1210)	∞ *2e6*	0/15
DE	55(19)	46(6)	53(6)	502(176)	∞	∞ *1e6*	0/15
DE-AUTO	**2.0**(0.3)	**0.92**(0.1)	**0.93**(0.1)	**0.58**(0.0)$_{\downarrow 4}$	**0.91**(0.0)$_{\downarrow 3}$	62(91)	0/15
DE-BFGS	**1.7**(0.4)	**0.84**(0.1)	**0.90**(0.2)	**0.62**(0.1)$_{\downarrow 4}$	**0.56**(0.1)$_{\downarrow 4}$	125(150)	0/15
DE-ROLL	7.4(14)	18(21)	17(16)	33(7)	3481(3152)	∞ *2e6*	0/15
DE-SIMPLEX	12(10)	40(32)	53(17)	30(9)	122(52)	∞ *2e6*	0/15
DEctpb	57(23)	47(8)	57(10)	814(261)	∞	∞ *1e6*	0/15
IPOPsaACM	3.0(0.6)	**1.8**(0.3)	**1.9**(0.4)	**1.4**(0.2)	**1.4**(0.1)	**0.23**(0.0)$_{\downarrow 4}$	15/15
JADEb	14(4)	13(2)	18(2)	21(3)	77(30)	∞ *1e6*	0/15
JADEctpb	18(6)	18(1)	23(2)	20(1)	38(24)	62(77)	5/15
MVDE	57(10)	60(6)	78(4)	1465(1263)	∞	∞ *1e6*	0/15
NBIPOPaCMA	4.3(1)	**3.0**(0.5)	3.7(0.7)	3.2(0.5)	3.9(0.4)	**0.67**(0.1)$_{\downarrow 4}$	15/15
NIPOPaCMA	4.3(1)	**2.8**(0.6)	3.5(0.7)	3.3(0.3)	3.9(0.3)	**0.69**(0.0)$_{\downarrow 4}$	15/15
PSO-BFGS	**1.7**(0.6)	**0.85**(0.1)	**0.98**(0.2)	**0.63**(0.1)$_{\downarrow 4}$	**0.57**(0.1)$_{\downarrow 4}$	892(978)	0/15
SNES	**2.6**(0.9)	**2.4**(0.4)	3.9(0.4)	8.5(4)	∞	∞ *8e6*	0/15
xNES	**2.4**(1.0)	7.9(1)	19(0.7)	14(0.4)	12(0.3)	**1.7**(0.0)	15/15
xNESas	**2.6**(0.8)	7.6(1)	14(3)	12(1)	10(1)	**1.5**(0.1)	15/15

Table 112: 20-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-3	1e-5	1e-7	#succ
f15	30378	1.5e5	3.1e5	3.2e5	4.5e5	4.6e5	15/15
ACOR	919(1153)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**0.88**(0.4)	**1.6**(0.6)	**1.2**(0.6)	**1.2**(0.6)	**0.89**(0.5)	**0.89**(0.4)	15/15
BIPOPsaACM	**0.65**(0.6)	**1.3**(0.6)	**0.91**(0.7)	**0.89**(0.6)	**0.66**(0.5)	**0.65**(0.5)	15/15
CMA	**0.98**(0.7)	**0.98**(0.4)	**0.76**(0.2)	**0.77**(0.2)	**0.57**(0.2)$_{\downarrow}$	**0.58**(0.2)$_{\downarrow}$	15/15
CMAES	37(36)	∞	∞	∞	∞	∞ *1e6*	0/15
CMAa	**0.90**(0.5)	**1.0**(0.3)	**0.60**(0.3)	**0.61**(0.3)	**0.45**(0.2)$_{\downarrow 3}$	**0.46**(0.3)$_{\downarrow 3}$	15/15
CMAm	**0.81**(0.6)	**1.1**(0.3)	**0.69**(0.3)	**0.70**(0.3)	**0.52**(0.3)$_{\downarrow 2}$	**0.53**(0.3)$_{\downarrow 2}$	15/15
CMAma	**0.62**(0.2)$_{\downarrow 3}$	**0.98**(0.3)	**0.65**(0.3)	**0.67**(0.3)	**0.49**(0.2)$_{\downarrow 3}$	**0.50**(0.2)$_{\downarrow 3}$	15/15
CMAmah	**0.92**(0.6)	**1.2**(0.6)	**0.64**(0.3)	**0.65**(0.3)	**0.48**(0.2)$_{\downarrow 3}$	**0.49**(0.2)$_{\downarrow 3}$	15/15
CMAmh	**0.98**(0.6)	**1.1**(0.3)	**0.66**(0.3)	**0.67**(0.3)	**0.50**(0.3)$_{\downarrow 2}$	**0.50**(0.3)$_{\downarrow 2}$	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	59(46)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-BFGS	28(15)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-ROLL	32(19)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	25(11)	∞	∞	∞	∞	∞ *2e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**0.60**(0.5)	**0.92**(0.7)	**0.53**(0.4)	**0.52**(0.4)	**0.37**(0.3)$_{\downarrow 4}$	**0.37**(0.3)$_{\downarrow 4}$	15/15
JADEb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	39(35)	∞	∞	∞	∞	∞ *1e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.2**(0.9)	**1.2**(0.5)	**0.79**(0.5)	**0.79**(0.5)	**0.58**(0.4)$_{\downarrow}$	**0.59**(0.4)$_{\downarrow}$	15/15
NIPOPaCMA	**0.81**(0.3)	**0.99**(0.3)	**0.67**(0.3)	**0.68**(0.3)	**0.50**(0.3)$_{\downarrow 2}$	**0.51**(0.3)$_{\downarrow 2}$	15/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	49(76)	∞	∞	∞	∞	∞ *8e6*	0/15
xNES	43(41)	∞	∞	∞	∞	∞ *7e6*	0/15
xNESas	44(52)	∞	∞	∞	∞	∞ *2e7*	0/15

Table 113: 20-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-3	1e-5	1e-7	#succ
f16	1384	27265	77015	1.9e5	2.0e5	2.2e5	15/15
ACOR	1.0e5(1e5)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.7**(0.6)	**0.87**(0.5)	**0.78**(0.5)	**0.92**(0.4)	**1.2**(0.8)	**1.1**(0.8)	15/15
BIPOPsaACM	**1.9**(0.6)	**0.74**(0.4)	**0.51**(0.3)	**0.60**(0.5)	**0.84**(0.5)	**0.83**(0.5)	15/15
CMA	**1.8**(1)	**1.1**(0.4)	**0.82**(0.7)	**1.1**(0.9)	**1.2**(0.9)	**1.1**(0.8)	15/15
CMAES	**1.9**(0.8)	**2.7**(2)	∞	∞	∞	∞ *1e6*	0/15
CMAa	**1.9**(0.6)	**0.76**(0.3)	**0.83**(0.7)	**0.81**(0.5)	**1.00**(0.9)	**0.95**(0.8)	15/15
CMAm	**1.3**(0.6)	**0.85**(0.5)	**1.3**(1)	**1.4**(1)	**1.4**(1)	**1.3**(1)	15/15
CMAma	**2.2**(3)	**0.63**(0.6)	**0.84**(0.6)	**0.76**(0.6)	**0.85**(0.9)	**0.79**(0.9)	15/15
CMAmah	**2.3**(3)	**0.91**(0.5)	**0.90**(0.6)	**0.92**(0.5)	**1.3**(1)	**1.2**(0.9)	15/15
CMAmh	**3.0**(3)	**1.1**(0.6)	**1.1**(0.7)	**1.0**(0.8)	**1.1**(0.8)	**1.0**(0.8)	15/15
DBRCGA	118(162)	∞	∞	∞	∞	∞ *2e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	40(46)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-BFGS	595(508)	242(257)	∞	∞	∞	∞ *2e6*	0/15
DE-ROLL	20(18)	1093(1101)	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	54(37)	∞	∞	∞	∞	∞ *2e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	**1.8**(0.8)	**0.55**(0.4)	**0.77**(0.8)	**0.52**(0.4)	**0.55**(0.4)	**0.50**(0.3)$_{\downarrow}$	15/15
JADEb	60(42)	∞	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	24(8)	∞	∞	∞	∞	∞ *1e6*	0/15
MVDE	1353(1596)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.6**(2)	**0.80**(0.4)	**0.51**(0.2)$_{\downarrow}$	**0.42**(0.2)$_{\downarrow}$	**0.43**(0.2)$_{\downarrow}$	**0.41**(0.2)$_{\downarrow}$	15/15
NIPOPaCMA	**2.0**(0.9)	**0.57**(0.3)	**0.41**(0.3)$_{\downarrow}$	**0.38**(0.1)$_{\downarrow 3}$	**0.39**(0.1)$_{\downarrow 2}$	**0.37**(0.1)$_{\downarrow 2}$	15/15
PSO-BFGS	542(550)	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	**2.7**(1)	11(15)	157(133)	∞	∞	∞ *8e6*	0/15
xNES	17(8)	**2.3**(2)	15(13)	48(54)	56(70)	50(52)	7/15
xNESas	20(10)	4.2(5)	9.2(7)	108(119)	133(158)	119(141)	6/15

Table 114: 20-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-3	1e-5	1e-7	#succ
f17	63	1030	4005	30677	56288	80472	15/15
ACOR	12(8)	4.5(1)	269(447)	4564(5379)	∞	∞ *1e7*	0/15
BIPOPaCMA	**3.0**(1)	**1.1**(0.3)	**1.7**(2)	**1.0**(0.4)	**0.90**(0.5)	**1.1**(0.4)	15/15
BIPOPsaACM	3.2(2)	**1.2**(0.4)	**2.7**(3)	**1.2**(0.7)	**1.2**(0.5)	**1.4**(0.8)	15/15
CMA	**2.2**(1)	**1.00**(0.3)	**1.5**(2)	**0.81**(0.3)	**0.93**(0.4)	**0.91**(0.3)	15/15
CMAES	**2.8**(2)	**0.96**(0.4)	**1.5**(2)	8.1(8)	∞	∞ *1e6*	0/15
CMAa	**2.3**(1)	**0.87**(0.2)	**0.52**(0.2)	**0.70**(0.3)	**0.80**(0.4)	**0.92**(0.2)	15/15
CMAm	**2.2**(0.5)	**0.82**(0.3)	**1.4**(1)	**0.59**(0.3)$_{\downarrow 2}$	**0.82**(0.4)	**0.92**(0.1)	15/15
CMAma	**2.2**(2)	**0.86**(0.2)	**1.4**(2)	**0.70**(0.3)	**0.79**(0.3)$_{\downarrow}$	**0.82**(0.2)$_{\downarrow}$	15/15
CMAmah	**2.0**(1)	8.8(10)	4.0(2)	**0.92**(0.4)	**0.96**(0.4)	**0.94**(0.3)	15/15
CMAmh	**1.8**(0.8)	22(28)	7.7(6)	**1.4**(0.8)	**1.3**(0.7)	**1.3**(0.6)	15/15
DBRCGA	18(9)	2347(2992)	∞	∞	∞	∞ *2e6*	0/15
DE	26(19)	16(4)	13(4)	8.8(9)	∞	∞ *1e6*	0/15
DE-AUTO	48(68)	335(185)	529(507)	∞	∞	∞ *2e6*	0/15
DE-BFGS	17(19)	117(48)	327(297)	952(1077)	∞	∞ *2e6*	0/15
DE-ROLL	15(17)	358(276)	535(572)	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	34(40)	381(238)	2127(2525)	∞	∞	∞ *2e6*	0/15
DEctpb	16(12)	17(3)	11(1)	4.3(0.6)	63(62)	183(193)	1/15
IPOPsaACM	**2.5**(2)	**0.91**(0.3)	**0.98**(1)	**1.2**(0.5)	**1.2**(0.4)	**1.1**(0.5)	15/15
JADEb	9.3(6)	14(12)	85(138)	466(570)	∞	∞ *1e6*	0/15
JADEctpb	7.8(5)	7.4(1)	4.4(0.7)	**1.7**(0.5)	7.2(9)	23(25)	2/15
MVDE	19(14)	29(5)	24(5)	34(34)	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.6**(1)	**1.00**(0.2)	**0.77**(0.3)	**1.2**(0.5)	**1.4**(0.8)	**1.2**(0.7)	15/15
NIPOPaCMA	**2.5**(1)	**1.1**(0.3)	**1.9**(2)	**0.79**(0.4)	**0.88**(0.3)	**0.81**(0.2)	15/15
PSO-BFGS	19(15)	1652(1526)	∞	∞	∞	∞ *2e6*	0/15
SNES	**2.0**(1)	**1.0**(0.3)	5.9(10)	3.9(5)	239(237)	∞ *8e6*	0/15
xNES	**1.9**(1)	3.6(0.6)	**3.0**(0.1)	**0.94**(0.0)	**2.7**(3)	12(14)	15/15
xNESas	**2.1**(1.0)	3.5(0.4)	**2.9**(0.2)	**0.92**(0.0)	**1.4**(0.7)	12(9)	15/15

Table 115: 20-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-3	1e-5	1e-7	#succ
f18	621	3972	19561	67569	1.3e5	1.5e5	15/15
ACOR	4.7(2)	3.5(1)	493(767)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**0.94**(0.2)	**0.77**(0.1)	**1.5**(0.7)	**1.4**(0.5)	**1.2**(0.7)	**1.5**(0.7)	15/15
BIPOPsaACM	**1.0**(0.3)	**1.5**(1)	**0.92**(0.4)	**0.96**(0.4)	**1.6**(0.6)	**1.6**(0.5)	15/15
CMA	**0.96**(0.2)	**0.70**(0.4)	**0.89**(0.7)	**0.98**(0.3)	**1.1**(0.8)	**1.1**(0.8)	15/15
CMAES	**1.1**(0.4)	**2.0**(2)	4.2(5)	∞	∞	∞ *1e6*	0/15
CMAa	**0.96**(0.3)	**0.96**(2)	**0.96**(0.9)	**0.79**(0.3)	**0.85**(0.4)	**0.87**(0.3)	15/15
CMAm	**0.81**(0.3)	**1.0**(1)	**0.61**(0.7)	**0.89**(0.3)	**0.97**(0.3)	**0.95**(0.3)	15/15
CMAma	**0.85**(0.2)	**0.57**(0.3)	**0.78**(0.7)	**0.68**(0.2)	**0.77**(0.4)	**0.74**(0.3)	15/15
CMAmah	**0.95**(0.5)	**2.5**(2)	**1.2**(0.7)	**0.79**(0.3)	**0.88**(0.4)	**0.91**(0.3)	15/15
CMAmh	3.3(8)	3.4(2)	**1.2**(0.7)	**1.1**(0.7)	**1.1**(0.3)	**1.1**(0.3)	15/15
DBRCGA	13(6)	7528(8309)	∞	∞	∞	∞ *2e6*	0/15
DE	17(4)	16(5)	15(7)	∞	∞	∞ *1e6*	0/15
DE-AUTO	131(69)	416(351)	∞	∞	∞	∞ *2e6*	0/15
DE-BFGS	69(61)	350(340)	1503(1587)	∞	∞	∞ *2e6*	0/15
DE-ROLL	87(28)	518(756)	1470(1740)	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	115(81)	1124(1284)	1462(1663)	∞	∞	∞ *2e6*	0/15
DEctpb	17(5)	14(4)	7.8(2)	50(54)	∞	∞ *1e6*	0/15
IPOPsaACM	**0.96**(0.5)	**1.4**(2)	**0.91**(0.6)	**0.78**(0.5)	**0.88**(0.4)	**1.3**(0.8)	15/15
JADEb	6.3(3)	13(15)	127(146)	∞	∞	∞ *1e6*	0/15
JADEctpb	7.2(2)	4.4(1)	**1.5**(0.4)	19(22)	∞	∞ *1e6*	0/15
MVDE	23(4)	37(18)	133(136)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.0**(0.3)	**1.4**(2)	**1.4**(0.8)	**1.2**(0.7)	**0.97**(0.3)	**0.92**(0.3)	15/15
NIPOPaCMA	**1.0**(0.3)	**0.76**(0.1)	**0.79**(0.4)	**0.88**(0.3)	**0.85**(0.4)	**0.84**(0.3)	15/15
PSO-BFGS	210(159)	7505(7562)	∞	∞	∞	∞ *2e6*	0/15
SNES	**1.0**(0.4)	**2.0**(0.4)	6.3(4)	547(594)	∞	∞ *8e6*	0/15
xNES	**1.3**(0.6)	**2.0**(0.2)	**0.84**(0.0)$_{\downarrow 2}$	**0.50**(0.0)$_{\downarrow 4}$	**1.3**(2)	11(14)	15/15
xNESas	**1.2**(0.5)	**1.9**(0.1)	**0.81**(0.0)$_{\downarrow 3}$	**0.48**(0.0)$_{\downarrow 4}$	**0.58**(0.3)	5.6(6)	15/15

Table 116: 20-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-3	1e-5	1e-7	#succ
f19	1	1	3.4e5	6.2e6	6.7e6	6.7e6	15/15
ACOR	686(252)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	184(66)	2.9e4(2e4)	**1.4**(1)	**1.0**(0.4)	**1.0**(0.4)	**1.0**(0.4)	15/15
BIPOPsaACM	143(52)	**2.5e4**(1e4)	**0.42**(0.3)	**0.72**(0.4)$_{\downarrow}$	**0.73**(0.4)	**0.73**(0.4)	15/15
CMA	170(56)	3.1e4(3e4)	**2.0**(3)	**0.94**(0.7)	**1.7**(2)	**1.7**(1)	5/15
CMAES	162(70)	4.8e4(4e4)	∞	∞	∞	∞ *1e6*	0/15
CMAa	156(72)	7.7e4(1e4)	**2.5**(4)	**0.73**(0.5)	**0.88**(0.9)	**0.88**(0.7)	8/15
CMAm	134(58)	**1.8e4**(1e4)	**1.1**(0.6)	**2.3**(2)	**2.9**(3)	**2.8**(3)	3/15
CMAma	135(44)	4.2e4(3e4)	3.2(4)	**1.0**(0.9)	**1.6**(2)	**2.1**(2)	4/15
CMAmah	**95**(46)	8.5e4(2e5)	**2.5**(4)	**0.91**(0.8)	**1.3**(1)	**1.3**(1)	6/15
CMAmh	**82**(52)	**2.4e4**(3e4)	3.3(4)	**1.8**(2)	**2.9**(3)	**2.8**(3)	3/15
DBRCGA	975(165)	6.9e5(8e5)	∞	∞	∞	∞ *2e6*	0/15
DE	2739(802)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	2751(2816)	1.1e5(8e4)	87(98)	∞	∞	∞ *2e6*	0/15
DE-BFGS	3206(3658)	3.8e4(2e4)	5.4(6)	∞	∞	∞ *2e6*	0/15
DE-ROLL	3941(5048)	2.2e5(3e5)	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	8348(6218)	1.5e5(5e4)	∞	∞	∞	∞ *2e6*	0/15
DEctpb	2148(731)	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	154(50)	3.0e4(2e4)	**0.61**(0.5)	**0.33**(0.1)	**0.32**(0.2)	**0.32**(0.2)	14/15
JADEb	826(254)	3.1e6(4e6)	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	856(206)	7.0e5(6e5)	∞	∞	∞	∞ *1e6*	0/15
MVDE	2928(795)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	180(56)	2.9e4(2e4)	**0.98**(0.9)	**0.69**(0.3)$_{\downarrow}$	**0.64**(0.3)$_{\downarrow 2}$	**0.65**(0.3)$_{\downarrow 2}$	15/15
NIPOPaCMA	169(62)	**2.8e4**(2e4)	**1.7**(2)	**0.59**(0.4)$_{\downarrow 2}$	**0.56**(0.3)$_{\downarrow 2}$	**0.56**(0.3)$_{\downarrow 2}$	15/15
PSO-BFGS	3614(6276)	3.5e4(1e4)	**1.4**(1)	∞	∞	∞ *2e6*	0/15
SNES	118(40)	1.3e5(1e5)	∞	∞	∞	∞ *8e6*	0/15
xNES	**105**(59)	∞	∞	∞	∞	∞ *6e6*	0/15
xNESas	**108**(35)	∞	∞	∞	∞	∞ *1e7*	0/15

Table 117: 20-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-3	1e-5	1e-7	#succ
f20	82	46150	3.1e6	5.5e6	5.6e6	5.6e6	14/15
ACOR	16(4)	**1.6**(1)	24(24)	27(27)	26(28)	26(28)	1/15
BIPOPaCMA	4.9(1)	4.8(2)	**1.4**(0.6)	**0.95**(0.3)	**0.95**(0.3)	**0.95**(0.3)	15/15
BIPOPsaACM	**2.9**(0.5)	**2.1**(1)	**0.97**(0.7)	**0.87**(0.4)	**0.86**(0.4)	**0.85**(0.4)	15/15
CMA	4.8(1)	5.4(2)	**0.79**(0.4)	**1.2**(1)	**1.2**(1)	**1.2**(1)	6/15
CMAES	5.2(1)	156(163)	∞	∞	∞	∞ *1e6*	0/15
CMAa	4.8(1)	3.2(1)	**0.90**(0.4)	**1.1**(1)	**1.1**(1)	**1.7**(2)	5/15
CMAm	3.4(0.7)	5.4(3)	**1.1**(0.7)	**1.4**(1)	**2.0**(2)	3.3(4)	3/15
CMAma	3.9(0.7)	**3.0**(1)	**1.1**(0.7)	5.0(5)	5.0(5)	4.9(5)	2/15
CMAmah	**2.5**(0.8)	3.4(1)	**0.87**(0.4)	**2.4**(3)	3.2(4)	3.2(3)	3/15
CMAmh	**2.6**(0.8)	6.1(3)	**1.3**(1)	10(12)	10(11)	10(11)	1/15
DBRCGA	34(6)	148(130)	∞	∞	∞	∞ *2e6*	0/15
DE	51(9)	**2.4**(1)	**0.79**(0.9)	∞	∞	∞ *1e6*	0/15
DE-AUTO	**2.1**(0.5)	3.4(2)	∞	∞	∞	∞ *2e6*	0/15
DE-BFGS	6.3(4)	**1.0**(1.0)	∞	∞	∞	∞ *2e6*	0/15
DE-ROLL	21(18)	**0.84**(0.8)	4.4(5)	5.3(6)	5.3(6)	5.2(6)	1/15
DE-SIMPLEX	21(27)	3.6(3)	∞	∞	∞	∞ *2e6*	0/15
DEctpb	56(8)	104(108)	4.8(5)	**2.7**(3)	**2.7**(3)	**2.7**(3)	1/15
IPOPsaACM	**2.8**(0.5)	**1.7**(0.8)	**0.49**(0.2)$_{\downarrow 3}$	**0.45**(0.2)$_{\downarrow}$	**0.45**(0.2)$_{\downarrow}$	**0.45**(0.2)$_{\downarrow}$	15/15
JADEb	19(3)	**0.56**(0.6)	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	24(3)	**1.2**(0.2)	**0.46**(0.4)	**0.85**(0.8)	**2.7**(3)	∞ *1e6*	0/15
MVDE	83(11)	4.3(1)	**0.26**(0.2)	**0.31**(0.3)	**0.36**(0.4)	**0.36**(0.4)	6/15
NBIPOPaCMA	4.3(0.7)	4.6(2)	**1.1**(0.5)	**0.98**(0.6)	**0.98**(0.6)	**0.98**(0.6)	15/15
NIPOPaCMA	4.5(1)	3.1(1)	**0.73**(0.3)	**0.59**(0.2)	**0.60**(0.2)	**0.60**(0.2)	15/15
PSO-BFGS	7.1(1)	**0.87**(1)	∞	∞	∞	∞ *2e6*	0/15
SNES	3.1(0.9)	18(19)	∞	∞	∞	∞ *7e6*	0/15
xNES	5.6(2)	**1.1**(0.9)	∞	∞	∞	∞ *6e6*	0/15
xNESas	5.4(3)	**1.1**(0.7)	∞	∞	∞	∞ *1e7*	0/15

Table 118: 20-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-3	1e-5	1e-7	#succ
f21	561	6541	14103	14643	15567	17589	15/15
ACOR	2743(8907)	9938(1e4)	9927(1e4)	9561(1e4)	8994(9957)	7960(9665)	1/15
BIPOPaCMA	7.8(12)	110(57)	72(89)	69(86)	65(81)	58(71)	15/15
BIPOPsaACM	**2.6**(4)	**1.5**(1)	**6.0**(11)	**5.8**(11)	**5.5**(10)	**4.8**(9)	15/15
CMA	5.0(5)	122(182)	57(85)	55(81)	52(76)	46(68)	9/15
CMAES	5.4(4)	**9.4**(10)	**5.5**(6)	**5.3**(6)	**5.0**(5)	**4.5**(5)	15/15
CMAa	3.2(4)	95(101)	77(121)	74(89)	70(111)	62(99)	8/15
CMAm	3.5(4)	109(147)	80(116)	77(109)	73(109)	65(97)	8/15
CMAma	3.0(5)	92(170)	95(124)	92(121)	86(114)	76(101)	7/15
CMAmah	25(22)	124(178)	76(105)	73(85)	69(111)	61(96)	8/15
CMAmh	8.7(7)	102(175)	75(123)	73(89)	69(111)	61(75)	8/15
DBRCGA	103(6)	162(255)	97(142)	95(137)	90(128)	81(98)	10/15
DE	33(64)	45(68)	30(35)	29(37)	28(32)	25(32)	13/15
DE-AUTO	50(111)	52(72)	37(48)	36(47)	34(44)	30(39)	14/15
DE-BFGS	10(11)	33(56)	17(26)	16(25)	15(24)	205(247)	1/15
DE-ROLL	84(121)	66(79)	66(94)	64(87)	60(79)	53(75)	12/15
DE-SIMPLEX	89(131)	208(309)	159(215)	154(205)	145(165)	196(241)	5/15
DEctpb	22(11)	139(229)	65(73)	63(102)	61(96)	55(60)	8/15
IPOPsaACM	**2.6**(4)	53(94)	157(308)	151(297)	142(279)	126(247)	15/15
JADEb	20(34)	24(36)	19(22)	18(22)	17(20)	**15**(18)	14/15
JADEctpb	7.2(2)	33(62)	21(37)	20(37)	19(33)	18(29)	13/15
MVDE	29(17)	64(81)	36(40)	62(76)	73(96)	81(95)	7/15
NBIPOPaCMA	**1.9**(4)	**1.5**(1)	**13**(18)	**12**(18)	**12**(17)	**10**(15)	15/15
NIPOPaCMA	**2.5**(5)	129(193)	135(138)	130(133)	123(126)	109(111)	15/15
PSO-BFGS	**1.7**(1)	**0.64**(0.6)	**0.56**(0.9)	**0.55**(0.9)	**0.57**(1)	96(119)	1/15
SNES	76(71)	93(116)	70(84)	67(81)	63(76)	56(67)	15/15
xNES	142(281)	112(168)	54(75)	53(72)	50(68)	44(60)	15/15
xNESas	45(71)	66(98)	37(44)	35(42)	33(40)	30(45)	30/30

Table 119: 20-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-3	1e-5	1e-7	#succ
f22	467	5580	23491	24948	26847	1.3e5	12/15
ACOR	1.4e4(2e4)	3585(4480)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	37(59)	260(240)	273(465)	257(405)	239(400)	48(75)	13/15
BIPOPsaACM	7.7(9)	100(96)	178(320)	173(301)	168(274)	35(54)	15/15
CMA	12(14)	433(619)	∞	∞	∞	∞ *1e6*	0/15
CMAES	**3.8**(5)	**42**(90)	**142**(146)	**133**(146)	**124**(136)	**25**(26)	4/15
CMAa	10(13)	232(307)	∞	∞	∞	∞ *1e6*	0/15
CMAm	7.0(12)	188(306)	∞	∞	∞	∞ *1e6*	0/15
CMAma	**6.7**(12)	235(312)	∞	∞	∞	∞ *1e6*	0/15
CMAmah	187(29)	185(264)	∞	∞	∞	∞ *1e6*	0/15
CMAmh	6.9(8)	314(411)	∞	∞	∞	∞ *1e6*	0/15
DBRCGA	100(259)	259(304)	392(437)	372(397)	350(357)	70(81)	3/15
DE	23(10)	92(111)	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	128(88)	234(273)	281(305)	265(281)	246(249)	216(230)	0/15
DE-BFGS	**5.7**(13)	135(186)	151(148)	142(134)	132(124)	∞ *2e6*	0/15
DE-ROLL	68(139)	199(199)	396(416)	374(392)	348(343)	221(223)	0/15
DE-SIMPLEX	38(81)	338(538)	1194(1364)	1125(1324)	1046(1193)	208(241)	0/15
DEctpb	98(14)	282(367)	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	175(98)	978(1833)	∞	∞	∞	∞ *2e7*	0/15
JADEb	46(66)	**75**(92)	**143**(149)	**135**(141)	**126**(131)	**25**(24)	4/15
JADEctpb	25(45)	261(298)	638(660)	601(641)	559(615)	∞ *1e6*	0/15
MVDE	40(28)	397(516)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	32(41)	**17**(16)	**51**(89)	**48**(84)	**44**(78)	**8.8**(15)	15/15
NIPOPaCMA	42(93)	319(438)	861(1086)	811(830)	754(950)	150(198)	9/15
PSO-BFGS	**1.7**(2)	**3.0**(5)	**10**(13)	**9.0**(13)	**8.6**(12)	209(238)	0/15
SNES	205(255)	227(281)	312(302)	294(277)	317(339)	111(126)	4/15
xNES	104(171)	231(329)	168(181)	158(155)	147(163)	**29**(30)	12/15
xNESas	50(86)	132(176)	226(236)	213(241)	198(203)	39(41)	22/30

Table 120: 20-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-3	1e-5	1e-7	#succ
f23	3.2	1614	67457	4.9e5	8.1e5	8.4e5	15/15
ACOR	**1.8**(2)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	4.7(9)	43(44)	**1.2**(1)	**1.4**(1)	**0.85**(0.7)	**0.90**(0.6)	15/15
BIPOPsaACM	**3.0**(6)	21(13)	**0.61**(0.3)	**1.4**(1)	**1.3**(1)	**1.3**(1)	15/15
CMA	3.4(4)	∞	∞	∞	∞	∞ *3e6*	0/15
CMAES	**2.9**(3)	571(707)	63(73)	∞	∞	∞ *1e6*	0/15
CMAa	6.5(5)	1.1e4(1e4)	556(628)	∞	∞	∞ *3e6*	0/15
CMAm	3.9(4)	1.1e4(1e4)	577(620)	∞	∞	∞ *3e6*	0/15
CMAma	**2.5**(3)	1.1e4(1e4)	255(315)	∞	∞	∞ *3e6*	0/15
CMAmah	**2.9**(3)	4164(4936)	516(601)	∞	∞	∞ *2e6*	0/15
CMAmh	**2.8**(3)	4205(4701)	519(585)	∞	∞	∞ *2e6*	0/15
DBRCGA	**1.7**(2)	415(427)	∞	∞	∞	∞ *2e6*	0/15
DE	**2.4**(2)	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	**2.2**(2)	**3.8**(3)	36(44)	∞	∞	∞ *2e6*	0/15
DE-BFGS	**2.1**(2)	**7.0**(7)	54(66)	∞	∞	∞ *2e6*	0/15
DE-ROLL	**1.9**(2)	15(14)	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	**1.6**(1)	**1.3**(0.9)$^{\star 2}$	36(43)	∞	∞	∞ *2e6*	0/15
DEctpb	**1.2**(0.6)	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	4.3(6)	2.9e4(3e4)	906(1043)	∞	∞	∞ *2e7*	0/15
JADEb	**1.4**(0.9)	673(625)	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	**2.0**(2)	131(68)	∞	∞	∞	∞ *1e6*	0/15
MVDE	**2.2**(3)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	3.1(3)	28(34)	**0.86**(0.7)	**1.4**(0.4)	**0.89**(0.2)	**0.90**(0.2)	15/15
NIPOPaCMA	3.8(5)	142(65)	**3.9**(2)	**0.72**(0.4)	**0.48**(0.2)	**0.50**(0.2)	15/15
PSO-BFGS	**1.6**(2)	**4.7**(4)	66(74)	∞	∞	∞ *2e6*	0/15
SNES	**1.5**(1)	102(102)	261(335)	∞	∞	∞ *7e6*	0/15
xNES	**2.0**(2)	∞	∞	∞	∞	∞ *6e6*	0/15
xNESas	**1.5**(2)	9.9e4(1e5)	∞	∞	∞	∞ *1e7*	0/30

Table 121: 20-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-3	1e-5	1e-7	#succ
f24	1.3e6	7.5e6	5.2e7	5.2e7	5.2e7	5.2e7	3/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.00**(1)	**0.94**(0.9)	**2.8**(3)	**2.8**(3)	**2.8**(3)	**2.8**(3)	2/15
BIPOPsaACM	**0.99**(1)	**0.88**(0.7)	**0.80**(0.8)	**0.80**(0.8)	**0.80**(0.8)	**0.79**(0.8)	6/15
CMA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
CMAES	∞	∞	∞	∞	∞	∞ *1e6*	0/15
CMAa	42(46)	∞	∞	∞	∞	∞ *4e6*	0/15
CMAm	12(14)	3.6(4)	∞	∞	∞	∞ *4e6*	0/15
CMAma	19(22)	∞	∞	∞	∞	∞ *4e6*	0/15
CMAmah	42(45)	∞	∞	∞	∞	∞ *4e6*	0/15
CMAmh	42(49)	∞	∞	∞	∞	∞ *4e6*	0/15
DBRCGA	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
DE-AUTO	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-BFGS	4.3(5)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-ROLL	4.7(5)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-SIMPLEX	22(24)	∞	∞	∞	∞	∞ *2e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
IPOPsaACM	28(32)	38(40)	∞	∞	∞	∞ *2e7*	0/15
JADEb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
JADEctpb	∞	∞	∞	∞	∞	∞ *1e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.3**(1.0)	**0.35**(0.3)	**0.61**(0.6)	**0.61**(0.6)	**0.61**(0.6)	**0.61**(0.7)	7/15
NIPOPaCMA	**1.6**(2)	**0.42**(0.4)	**0.35**(0.3)	**0.35**(0.3)	**0.35**(0.3)	**0.35**(0.3)	11/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *2e6*	0/15
SNES	12(12)	∞	∞	∞	∞	∞ *8e6*	0/15
xNES	∞	∞	∞	∞	∞	∞ *6e6*	0/15
xNESas	∞	∞	∞	∞	∞	∞ *1e7*	0/30

Table 122: 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-3	1e-5	1e-7	#succ
f1	83	83	83	83	83	83	15/15
ACOR	53(11)	83(13)	114(14)	177(23)	235(18)	296(21)	15/15
BIPOPaCMA	9.4(1)	15(2)	21(2)	33(2)	45(3)	58(2)	15/15
CMA	10(0.8)	15(2)	21(1)	33(1)	45(1)	57(2)	15/15
CMAES	9.4(1)	15(0.8)	21(1)	33(2)	45(1)	57(1)	15/15
CMAa	9.3(0.8)	15(1)	21(1)	34(1)	46(1)	58(2)	15/15
CMAm	7.1(0.8)	11(0.8)	16(1)	24(0.8)	32(1)	41(2)	15/15
CMAma	7.3(0.8)	11(0.7)	16(0.9)	24(1)	33(1)	41(1)	15/15
CMAmah	4.6(0.5)	**7.3**(0.3)	**10**(0.8)	**16**(0.9)	21(1.0)	27(1)	15/15
CMAmh	**4.5**(0.5)	7.4(0.8)	10(0.6)	16(0.6)	**21**(1)	**27**(1)	15/15
DBRCGA	229(41)	420(42)	625(72)	1006(66)	1386(60)	1798(130)	15/15
DE	253(23)	425(39)	600(52)	946(69)	1282(63)	1623(87)	15/15
DE-AUTO	**2.6**(0.1)	**2.6**(0.1)	**2.6**(0.1)	**2.6**(0.1)	**2.6**(0.1)	**2.6**(0.1)	15/15
DE-BFGS	**1.5**(0.2)	**1.6**(0)	**1.6**(0)	**1.6**(0)	**1.6**(0)	**1.6**(0)	15/15
DE-ROLL	18(17)	53(60)	54(61)	54(61)	54(61)	54(61)	15/15
DE-SIMPLEX	152(73)	242(81)	319(106)	431(107)	547(104)	1381(772)	15/15
DEctpb	259(27)	448(25)	632(29)	1013(46)	1401(86)	1777(101)	15/15
JADEb	72(5)	127(6)	182(7)	295(11)	410(17)	524(13)	15/15
JADEctpb	94(4)	152(7)	211(7)	326(7)	439(8)	553(10)	15/15
MVDE	329(23)	568(20)	815(18)	1301(18)	1792(19)	2277(32)	15/15
NBIPOPaCMA	9.5(1)	15(1)	22(1)	34(0.9)	46(2)	58(1)	15/15
NIPOPaCMA	10(0.8)	15(1)	21(1.0)	34(1)	46(2)	58(1)	15/15
PSO-BFGS	**1.4**(0.2)	**1.6**(0)	**1.6**(0)	**1.6**(0)	**1.6**(0)	**1.6**(0)	15/15
SNES	8.9(0.9)	20(1)	32(2)	55(2)	78(2)	101(2)	15/15
xNES	63(7)	215(8)	370(13)	672(11)	979(8)	1282(18)	15/15
xNESas	43(18)	83(60)	106(69)	140(62)	161(78)	182(78)	30/30

Table 123: 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-3	1e-5	1e-7	#succ
f2	796	797	799	800	802	804	15/15
ACOR	**17**(2)	**20**(3)	**23**(3)	**30**(4)	**36**(4)	**43**(4)	15/15
BIPOPaCMA	38(3)	45(3)	49(3)	55(3)	57(2)	59(2)	15/15
CMA	59(7)	69(7)	76(6)	85(4)	89(3)	90(3)	15/15
CMAES	59(3)	69(5)	77(6)	86(3)	89(1)	90(1)	15/15
CMAa	38(5)	44(5)	49(5)	55(3)	57(2)	59(2)	15/15
CMAm	59(5)	69(4)	75(4)	83(4)	86(4)	88(2)	15/15
CMAma	36(4)	41(5)	46(3)	51(3)	54(1)	55(2)	15/15
CMAmah	35(4)	42(5)	47(5)	52(3)	55(2)	56(2)	15/15
CMAmh	49(6)	58(6)	65(5)	71(3)	73(2)	74(2)	15/15
DBRCGA	95(13)	113(9)	138(17)	179(12)	216(10)	264(8)	15/15
DE	92(10)	110(10)	129(12)	166(10)	201(10)	237(11)	15/15
DE-AUTO	**1.9**(0.8)$^{\star 3}$	**2.1**(0.9)$^{\star 3}$	**2.3**(0.9)$^{\star 2}$	**2.5**(0.9)$^{\star 2}$	**3.3**(0.5)$^{\star 2}$	**3.8**(0.7)$^{\star 3}$	15/15
DE-BFGS	35(10)	46(12)	55(17)	71(16)	90(18)	1295(2535)	3/15
DE-ROLL	**20**(18)	**21**(18)	**21**(18)	**21**(18)	**22**(17)	**26**(17)	15/15
DE-SIMPLEX	91(12)	102(17)	109(19)	122(16)	134(14)	7.4e4(8e4)	0/15
DEctpb	104(8)	124(8)	143(6)	182(8)	221(8)	259(9)	15/15
JADEb	32(2)	38(2)	44(2)	56(3)	68(3)	80(3)	15/15
JADEctpb	37(1)	43(2)	49(2)	61(2)	73(3)	84(4)	15/15
MVDE	124(2)	149(3)	174(3)	225(4)	275(3)	325(4)	15/15
NBIPOPaCMA	37(3)	43(4)	47(5)	53(4)	57(2)	59(2)	15/15
NIPOPaCMA	37(4)	43(4)	48(4)	53(3)	57(2)	58(1)	15/15
PSO-BFGS	86(13)	101(15)	115(19)	156(25)	188(13)	2188(2500)	3/15
SNES	**5.3**(0.2)	**6.4**(0.2)	**7.6**(0.2)	**10**(0.3)	**12**(0.3)	**15**(0.3)	15/15
xNES	64(1)	80(0.9)	96(0.7)	127(1)	160(0.9)	191(1)	15/15
xNESas	60(2)	71(7)	79(13)	90(25)	97(35)	100(36)	30/30

Table 124: 40-D, running time excess ERT/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-3	1e-5	1e-7	#succ
f3	15526	15602	15612	15646	15651	15656	15/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	2395(2759)	∞	∞	∞	∞	∞ *4e7*	0/15
CMA	5301(6290)	∞	∞	∞	∞	∞ *6e6*	0/15
CMAES	∞	∞	∞	∞	∞	∞ *2e6*	0/15
CMAa	5158(6324)	∞	∞	∞	∞	∞ *6e6*	0/15
CMAm	∞	∞	∞	∞	∞	∞ *6e6*	0/15
CMAma	∞	∞	∞	∞	∞	∞ *6e6*	0/15
CMAmah	4723(5032)	∞	∞	∞	∞	∞ *5e6*	0/15
CMAmh	2268(2590)	∞	∞	∞	∞	∞ *5e6*	0/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	886(903)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	486(394)	**3823**(3720)	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	**110**(106)	**1847**(2012)	**3774**(4359)	**3765**(4158)	**3764**(4093)	**3763**(4091)	1/15
DE-SIMPLEX	**282**(172)	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	**13**(14)	**44**(52)	**114**(116)	**116**(128)	**119**(140)	**121**(128)	10/15
JADEctpb	**10**(0.4)	**13**(0.2)	**15**(0.2)	**17**(0.2)	**20**(0.2)	**22**(0.2)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	8177(9296)	∞	∞	∞	∞	∞ *4e7*	0/15
NIPOPaCMA	4615(5542)	∞	∞	∞	∞	∞ *4e7*	0/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
SNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNESas	∞	∞	∞	∞	∞	∞ *2e7*	0/20

Table 125: 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.

Δf_{opt}	1e1	1e0	1e-1	1e-3	1e-5	1e-7	#succ
f4	15536	15601	15659	15703	15733	2.8e5	6/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	∞	∞	∞	∞	∞	∞ *4e7*	0/15
CMA	∞	∞	∞	∞	∞	∞ *6e6*	0/15
CMAES	∞	∞	∞	∞	∞	∞ *2e6*	0/15
CMAa	∞	∞	∞	∞	∞	∞ *5e6*	0/15
CMAm	∞	∞	∞	∞	∞	∞ *6e6*	0/15
CMAma	∞	∞	∞	∞	∞	∞ *6e6*	0/15
CMAmah	∞	∞	∞	∞	∞	∞ *5e6*	0/15
CMAmh	∞	∞	∞	∞	∞	∞ *5e6*	0/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	**464**(399)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	**605**(658)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	**12**(0.3)$^{\star 4}$	**16**(0.3)$^{\star 4}$	**18**(0.3)$^{\star 4}$	**21**(0.2)$^{\star 4}$	**24**(0.2)$^{\star 4}$	**1.5**(0.0)$^{\star 4}$	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	∞	∞	∞	∞	∞	∞ *4e7*	0/15
NIPOPaCMA	∞	∞	∞	∞	∞	∞ *4e7*	0/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
SNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNESas	∞	∞	∞	∞	∞	∞ *2e7*	0/15

Table 126: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ 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-3	1e-5	1e-7	#succ
f5	98	116	120	121	121	121	15/15
ACOR	11(2)	12(2)	12(2)	12(2)	12(2)	12(2)	15/15
BIPOPaCMA	4.6(0.7)	4.5(0.8)	4.4(0.7)	4.4(0.7)	4.4(0.7)	4.4(0.7)	15/15
CMA	4.5(0.5)	4.3(0.6)	4.3(0.5)	4.2(0.5)	4.2(0.5)	4.2(0.5)	15/15
CMAES	4.5(0.4)	4.5(0.5)	4.5(0.4)	4.5(0.4)	4.5(0.4)	4.5(0.4)	15/15
CMAa	4.7(1.0)	4.6(0.7)	4.5(0.7)	4.5(0.7)	4.5(0.7)	4.5(0.7)	15/15
CMAm	4.3(0.4)	4.2(0.3)	4.0(0.3)	4.0(0.3)	4.0(0.3)	4.0(0.3)	15/15
CMAma	**4.0**(0.7)	**4.1**(0.6)	**4.0**(0.5)	**4.0**(0.5)	**4.0**(0.5)	**4.0**(0.5)	15/15
CMAmah	**2.7**(0.4)	**2.7**(0.4)	**2.7**(0.6)	**2.7**(0.6)	**2.7**(0.6)	**2.7**(0.6)	15/15
CMAmh	**2.8**(0.5)	**2.8**(0.7)	**2.7**(0.7)	**2.7**(0.7)	**2.7**(0.7)	**2.7**(0.7)	15/15
DBRCGA	184(49)	208(66)	244(93)	300(167)	344(231)	379(310)	15/15
DE	43(7)	46(10)	45(9)	45(9)	45(9)	45(9)	15/15
DE-AUTO	**2.1**(0.1)	**1.8**(0.1)	**1.7**(0.1)	**1.7**(0.1)	**1.7**(0.1)	**1.7**(0.1)	15/15
DE-BFGS	49(36)	52(37)	53(40)	53(40)	56(40)	56(40)	15/15
DE-ROLL	8.3(8)	7.1(7)	7.0(7)	7.5(8)	8.1(9)	8.8(10)	15/15
DE-SIMPLEX	840(189)	1334(262)	4382(1515)	5476(1747)	6166(2147)	1.1e5(1e5)	2/15
DEctpb	59(7)	57(7)	56(8)	56(8)	56(8)	56(8)	15/15
JADEb	39(4)	39(4)	40(6)	40(5)	40(5)	40(5)	15/15
JADEctpb	62(7)	62(7)	62(7)	63(4)	63(4)	63(4)	15/15
MVDE	335(17)	417(18)	524(27)	753(38)	980(53)	1206(40)	15/15
NBIPOPaCMA	4.5(0.9)	4.5(0.8)	4.4(0.7)	4.4(0.7)	4.4(0.7)	4.4(0.7)	15/15
NIPOPaCMA	4.8(0.7)	4.6(0.8)	4.5(0.8)	4.5(0.8)	4.5(0.8)	4.5(0.8)	15/15
PSO-BFGS	77(74)	94(78)	93(75)	103(82)	103(82)	107(82)	15/15
SNES	8.0(1)	7.7(1)	7.6(1)	7.7(1.0)	7.7(1.0)	7.7(1.0)	15/15
xNES	7.5(0.9)	7.2(0.9)	7.1(0.8)	7.1(0.7)	7.1(0.7)	7.1(0.7)	15/15
xNESas	7.3(1.0)	7.0(0.8)	6.9(0.8)	6.9(0.8)	6.9(0.8)	6.9(0.8)	15/15

Table 127: 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-3	1e-5	1e-7	#succ
f6	3507	5523	7168	11538	15007	19222	15/15
ACOR	14(3)	13(2)	13(1)	12(1)	12(1)	12(1)	15/15
BIPOPaCMA	**1.6**(0.2)	**1.5**(0.3)	**1.4**(0.2)	**1.3**(0.2)	**1.3**(0.1)	**1.3**(0.1)	15/15
CMA	**1.6**(0.2)	**1.4**(0.2)	**1.4**(0.2)	**1.3**(0.1)	**1.4**(0.1)	**1.3**(0.1)	15/15
CMAES	**1.6**(0.3)	**1.5**(0.2)	**1.5**(0.2)	**1.3**(0.1)	**1.4**(0.1)	**1.4**(0.1)	15/15
CMAa	**1.6**(0.2)	**1.4**(0.2)	**1.4**(0.1)	**1.3**(0.1)	**1.3**(0.1)	**1.3**(0.1)	15/15
CMAm	**1.5**(0.2)	**1.3**(0.2)	**1.3**(0.2)	**1.3**(0.1)	**1.3**(0.1)	**1.3**(0.1)	15/15
CMAma	**1.5**(0.2)	**1.3**(0.2)	**1.3**(0.2)	**1.2**(0.1)	**1.2**(0.1)	**1.2**(0.1)	15/15
CMAmah	**1.2**(0.2)	**1.2**(0.3)	**1.3**(0.3)	**1.3**(0.3)	**1.5**(0.3)	**1.6**(0.2)	15/15
CMAmh	**1.4**(0.3)	**1.4**(0.3)	**1.5**(0.3)	**1.6**(0.3)	**1.9**(0.4)	**2.2**(0.5)	15/15
DBRCGA	44(16)	55(25)	63(24)	72(18)	79(21)	79(16)	15/15
DE	264(58)	258(41)	433(288)	∞	∞	∞ *2e6*	0/15
DE-AUTO	6.5(5)	8.9(3)	13(5)	22(5)	37(15)	479(556)	0/15
DE-BFGS	62(65)	84(101)	316(424)	341(519)	278(400)	∞ *4e6*	0/15
DE-ROLL	17(12)	25(14)	51(30)	348(293)	∞	∞ *4e6*	0/15
DE-SIMPLEX	36(11)	43(10)	52(27)	424(434)	∞	∞ *4e6*	0/15
DEctpb	80(6)	70(4)	68(3)	61(2)	61(2)	178(158)	5/15
JADEb	456(413)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	13(0.7)	13(0.8)	13(0.7)	12(0.8)	12(1)	12(0.8)	15/15
MVDE	70(7)	67(10)	70(7)	69(7)	498(532)	∞ *1e6*	0/15
NBIPOPaCMA	**1.5**(0.2)	**1.4**(0.2)	**1.3**(0.1)	**1.2**(0.1)	**1.2**(0.1)	**1.2**(0.1)	15/15
NIPOPaCMA	**1.6**(0.3)	**1.4**(0.2)	**1.4**(0.1)	**1.3**(0.1)	**1.3**(0.1)	**1.2**(0.1)	15/15
PSO-BFGS	406(574)	297(375)	234(294)	330(523)	274(400)	∞ *4e6*	0/15
SNES	**1.4**(0.2)	**1.4**(0.2)	**1.7**(0.4)	94(198)	218(309)	890(952)	6/15
xNES	12(0.4)	12(0.2)	12(0.1)	12(0.2)	13(0.1)	12(0.1)	15/15
xNESas	12(0.4)	12(0.2)	13(0.2)	12(0.2)	12(0.1)	12(0.1)	15/15

Table 128: 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-3	1e-5	1e-7	#succ
f7	10698	17839	41037	66294	66294	68145	15/15
ACOR	1204(1552)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.2**(0.9)	4.5(2)	**2.4**(0.9)	**1.5**(0.6)	**1.5**(0.6)	**1.5**(0.6)	15/15
CMA	**1.6**(0.8)	4.7(2)	**2.6**(2)	**1.7**(1)	**1.7**(1)	**1.6**(1.0)	15/15
CMAES	8.5(8)	∞	∞	∞	∞	∞ *2e6*	0/15
CMAa	**1.2**(0.6)	**3.2**(1)	**1.6**(0.5)	**1.0**(0.3)	**1.0**(0.3)	**1.0**(0.3)	15/15
CMAm	**1.5**(0.7)	4.8(1)	**2.4**(0.2)	**1.6**(0.1)	**1.6**(0.1)	**1.5**(0.1)	15/15
CMAma	**1.1**(0.5)	**2.8**(1)	**1.5**(0.5)	**0.95**(0.3)	**0.95**(0.3)	**0.93**(0.3)	15/15
CMAmah	**1.7**(0.6)	3.3(1)	**1.7**(0.5)	**1.1**(0.3)	**1.1**(0.3)	**1.1**(0.3)	15/15
CMAmh	**2.0**(0.6)	5.2(0.4)	**2.5**(0.2)	**1.6**(0.1)	**1.6**(0.1)	**1.6**(0.1)	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	37(15)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	211(188)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	287(291)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	30(6)	198(190)	341(386)	215(254)	215(254)	210(232)	2/15
JADEb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	219(288)	∞	∞	∞	∞	∞ *2e6*	0/15
MVDE	29(10)	825(898)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.2**(0.9)	3.2(0.7)	**1.8**(0.6)	**1.2**(0.4)	**1.2**(0.4)	**1.1**(0.4)	15/15
NIPOPaCMA	**0.89**(0.8)	3.2(1.0)	**1.9**(0.5)	**1.2**(0.3)	**1.2**(0.3)	**1.2**(0.3)	15/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
SNES	43(44)	∞	∞	∞	∞	∞ *2e7*	0/15
xNES	**1.7**(0.1)	**2.0**(0.1)	**1.3**(0.1)	**1.1**(0.0)	**1.1**(0.0)	**1.1**(0.0)	15/15
xNESas	**1.7**(0.1)	**2.0**(0.1)	**1.3**(0.1)	**1.2**(0.0)	**1.2**(0.0)	**1.1**(0.0)	15/15

Table 129: 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-3	1e-5	1e-7	#succ
f8	7080	10655	11012	11430	11701	11969	15/15
ACOR	48(34)	382(488)	375(474)	379(462)	389(447)	399(440)	11/15
BIPOPaCMA	5.5(0.6)	6.1(4)	6.3(4)	6.3(4)	6.2(3)	6.2(3)	15/15
CMA	7.0(0.4)	6.4(0.3)	6.6(0.3)	6.6(0.2)	6.6(0.2)	6.6(0.2)	15/15
CMAES	7.3(0.9)	6.6(0.6)	6.8(0.6)	6.8(0.6)	6.8(0.6)	6.8(0.5)	15/15
CMAa	**5.4**(0.5)	**4.6**(0.3)	**4.8**(0.3)	**4.8**(0.3)	**4.8**(0.3)	**4.8**(0.3)	15/15
CMAm	7.1(1)	7.5(5)	7.6(5)	7.6(4)	7.6(4)	7.6(4)	15/15
CMAma	**5.1**(0.3)	**4.9**(0.4)	**5.0**(0.4)	**5.0**(0.4)	**5.0**(0.3)	**5.0**(0.3)	15/15
CMAmah	**4.2**(0.8)*	**4.3**(3)	**4.4**(3)	**4.4**(3)	**4.4**(3)	**4.4**(3)	15/15
CMAmh	**5.2**(1)	**5.2**(2)	**5.3**(2)	**5.4**(2)	**5.4**(2)	**5.4**(2)	15/15
DBRCGA	73(55)	175(191)	181(194)	199(186)	219(175)	280(194)	10/15
DE	172(7)	174(7)	200(91)	∞	∞	∞ *2e6*	0/15
DE-AUTO	11(3)	11(2)	11(3)	12(3)	12(3)	37(47)	14/15
DE-BFGS	10(3)	31(49)	30(47)	30(46)	30(44)	31(43)	14/15
DE-ROLL	31(19)	40(35)	43(33)	45(34)	46(29)	159(116)	11/15
DE-SIMPLEX	23(21)	65(100)	66(96)	67(93)	69(90)	∞ *4e6*	0/15
DEctpb	148(5)	136(5)	144(5)	160(7)	1277(1282)	∞ *2e6*	0/15
JADEb	22(8)	31(22)	31(21)	32(20)	33(20)	35(19)	15/15
JADEctpb	32(1)	27(0.8)	28(0.7)	28(0.8)	29(0.9)	30(1)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	5.5(0.7)	6.5(4)	6.6(4)	6.6(3)	6.6(3)	6.6(3)	15/15
NIPOPaCMA	5.5(0.4)	7.8(8)	7.9(8)	7.8(8)	7.8(8)	7.8(8)	15/15
PSO-BFGS	13(4)	42(7)	41(7)	41(6)	41(9)	41(15)	14/15
SNES	152(100)	202(102)	228(103)	546(407)	3009(3434)	2.8e4(3e4)	0/15
xNES	14(0.9)	12(0.7)	12(0.7)	13(0.7)	14(0.6)	16(0.6)	15/15
xNESas	14(0.9)	13(2)	13(2)	14(2)	14(2)	15(2)	15/15

Table 130: 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-3	1e-5	1e-7	#succ
f9	6122	12982	13300	13651	13909	14142	15/15
ACOR	187(13)	254(385)	295(376)	433(366)	589(360)	798(374)	5/15
BIPOPaCMA	**6.0**(0.8)	**4.5**(3)	**4.6**(3)	**4.7**(3)	**4.7**(3)	**4.7**(3)	15/15
CMA	8.2(1)	6.2(4)	6.4(4)	6.5(4)	6.5(4)	6.5(4)	15/15
CMAES	8.5(0.9)	5.8(0.5)	6.0(0.4)	6.1(0.4)	6.1(0.4)	6.1(0.4)	15/15
CMAa	6.3(0.6)	4.8(0.3)	5.0(0.3)	5.0(0.3)	5.0(0.3)	5.0(0.2)	15/15
CMAm	8.2(1)	6.3(4)	6.4(4)	6.5(4)	6.5(4)	6.5(4)	15/15
CMAma	**5.8**(0.5)	**4.3**(3)	**4.4**(3)	**4.5**(3)	**4.5**(3)	**4.5**(3)	15/15
CMAmah	**4.7**(0.7)	**4.0**(2)	**4.2**(2)	**4.2**(2)	**4.2**(2)	**4.2**(2)	15/15
CMAmh	**6.1**(2)	5.4(4)	5.5(4)	5.6(4)	5.6(3)	5.6(3)	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	14(5)	11(3)	11(4)	12(4)	13(4)	37(46)	11/15
DE-BFGS	16(5)	19(11)	19(10)	20(10)	20(9)	41(48)	13/15
DE-ROLL	58(10)	43(7)	48(7)	51(8)	68(26)	1255(1394)	0/15
DE-SIMPLEX	78(18)	164(171)	166(173)	170(169)	177(165)	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	123(16)	146(85)	163(87)	291(226)	525(503)	2114(2263)	0/15
JADEctpb	100(6)	60(3)	62(3)	63(3)	64(3)	64(3)	15/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	6.3(0.7)	**4.6**(3)	**4.8**(3)	**4.8**(3)	**4.8**(3)	**4.9**(3)	15/15
NIPOPaCMA	6.3(0.8)	5.0(3)	5.1(3)	5.2(3)	5.2(3)	5.2(3)	15/15
PSO-BFGS	19(15)	20(18)	21(16)	22(16)	22(15)	43(31)	14/15
SNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNES	16(0.5)	10(0.4)	10(0.5)	10(0.5)	12(0.4)	13(0.4)	15/15
xNESas	16(2)	11(2)	11(2)	11(3)	12(2)	13(3)	15/15

Table 131: 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-3	1e-5	1e-7	#succ
f10	25890	30368	36796	56007	65128	70824	15/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.2**(0.1)	**1.1**(0.1)	**1.0**(0.1)	**0.77**(0.0)$_{\downarrow 4}$	**0.70**(0.0)$_{\downarrow 4}$	**0.66**(0.0)$_{\downarrow 4}$	15/15
CMA	**1.9**(0.2)	**1.8**(0.2)	**1.6**(0.2)	**1.2**(0.1)	**1.1**(0.0)	**1.0**(0.0)	15/15
CMAES	**1.9**(0.2)	**1.8**(0.2)	**1.7**(0.1)	**1.2**(0.1)	**1.1**(0.0)	**1.0**(0.0)	15/15
CMAa	**1.2**(0.1)	**1.2**(0.1)	**1.1**(0.1)	**0.79**(0.0)$_{\downarrow 4}$	**0.71**(0.0)$_{\downarrow 4}$	**0.67**(0.0)$_{\downarrow 4}$	15/15
CMAm	**1.8**(0.2)	**1.8**(0.2)	**1.6**(0.2)	**1.2**(0.1)	**1.1**(0.0)	**0.99**(0.0)	15/15
CMAma	**1.1**(0.1)	**1.1**(0.1)	**1.00**(0.0)	**0.73**(0.0)$_{\downarrow 4}$	**0.66**(0.0)$_{\downarrow 4}$	**0.62**(0.0)$_{\downarrow 4}$	15/15
CMAmah	**1.1**(0.1)	**1.1**(0.1)	**1.0**(0.1)	**0.76**(0.0)$_{\downarrow 4}$	**0.67**(0.0)$_{\downarrow 4}$	**0.63**(0.0)$_{\downarrow 4}$	15/15
CMAmh	**1.5**(0.2)	**1.5**(0.1)	**1.4**(0.1)	**1.0**(0.0)	**0.91**(0.0)	**0.84**(0.0)$_{\downarrow 4}$	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	135(109)	1962(2175)	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	32(46)	39(38)	62(74)	65(73)	57(63)	187(214)	0/15
DE-ROLL	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	64(43)	156(133)	813(842)	∞	∞	∞ *2e6*	0/15
JADEctpb	46(9)	97(73)	267(272)	∞	∞	∞ *2e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.1**(0.1)	**1.1**(0.1)	**1.0**(0.1)	**0.77**(0.0)$_{\downarrow 4}$	**0.71**(0.0)$_{\downarrow 4}$	**0.67**(0.0)$_{\downarrow 4}$	15/15
NIPOPaCMA	**1.1**(0.1)	**1.1**(0.1)	**1.0**(0.1)	**0.77**(0.0)$_{\downarrow 4}$	**0.70**(0.0)$_{\downarrow 4}$	**0.67**(0.0)$_{\downarrow 4}$	15/15
PSO-BFGS	113(138)	188(231)	155(180)	103(117)	89(108)	837(876)	0/15
SNES	∞	∞	∞	∞	∞	∞ *2e7*	0/15
xNES	**2.0**(0.0)	**2.1**(0.0)	**2.1**(0.0)	**1.8**(0.0)	**2.0**(0.0)	**2.2**(0.0)	15/15
xNESas	**1.9**(0.0)	**1.9**(0.1)	**1.7**(0.2)	**1.3**(0.3)	**1.2**(0.4)	**1.1**(0.5)	15/15

Table 132: 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-3	1e-5	1e-7	#succ
f11	2368	4855	11681	29749	38949	48211	15/15
ACOR	7811(8479)	2.9e4(3e4)	1.2e4(1e4)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	5.0(0.3)	**2.6**(0.1)	**1.2**(0.0)	**0.51**(0.0)$_{\downarrow 4}$	**0.42**(0.0)$_{\downarrow 4}$	**0.37**(1e-2)$_{\downarrow 4}$	15/15
CMA	15(2)	7.8(1)	3.4(0.4)	**1.5**(0.2)	**1.2**(0.1)	**1.00**(0.1)	15/15
CMAES	16(3)	8.2(2)	3.6(0.8)	**1.5**(0.3)	**1.2**(0.2)	**1.0**(0.2)	15/15
CMAa	5.0(0.2)	**2.7**(0.1)	**1.2**(0.0)	**0.51**(0.0)$_{\downarrow 4}$	**0.42**(9e-3)$_{\downarrow 4}$	**0.37**(6e-3)$_{\downarrow 4}$	15/15
CMAm	16(5)	8.6(2)	3.7(0.9)	**1.6**(0.4)	**1.3**(0.3)	**1.1**(0.3)	15/15
CMAma	**4.6**(0.3)	**2.4**(0.1)	**1.1**(0.0)	**0.46**(0.0)$_{\downarrow 4}$	**0.38**(0.0)$_{\downarrow 4}$	**0.33**(0.0)$_{\downarrow 4}$	15/15
CMAmah	5.4(0.3)	**2.8**(0.1)	**1.2**(0.1)	**0.52**(0.0)$_{\downarrow 4}$	**0.43**(0.0)$_{\downarrow 4}$	**0.36**(0.0)$_{\downarrow 4}$	15/15
CMAmh	17(2)	8.9(0.9)	3.9(0.4)	**1.7**(0.1)	**1.3**(0.1)	**1.1**(0.1)	15/15
DBRCGA	597(135)	443(22)	228(9)	112(2)	96(1)	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	**0.17**(0.0)$_{\downarrow 4}$	**0.10**(1e-2)$_{\downarrow 4}$	**0.05**(6e-3)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.04**(6e-3)$_{\downarrow 4}$	**0.07**(0.1)$_{\downarrow 4}$	15/15
DE-BFGS	**0.19**(0.2)$_{\downarrow 4}$	**0.11**(0.1)$_{\downarrow 4}$	**0.05**(0.0)$_{\downarrow 4}$	**0.03**(0.0)$_{\downarrow 4}$	**0.03**(0.0)$_{\downarrow 4}$	**0.03**(9e-3)$_{\downarrow 4}$	13/15
DE-ROLL	8089(8312)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	914(506)	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	470(844)	243(411)	107(172)	47(67)	40(29)	35(41)	10/15
JADEctpb	247(430)	130(210)	59(88)	27(35)	24(27)	22(22)	12/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	5.0(0.2)	**2.7**(0.1)	**1.2**(0.0)	**0.51**(0.0)$_{\downarrow 4}$	**0.43**(8e-3)$_{\downarrow 4}$	**0.37**(7e-3)$_{\downarrow 4}$	15/15
NIPOPaCMA	5.0(0.2)	**2.7**(0.1)	**1.2**(0.0)	**0.51**(9e-3)$_{\downarrow 4}$	**0.42**(9e-3)$_{\downarrow 4}$	**0.37**(9e-3)$_{\downarrow 4}$	15/15
PSO-BFGS	**0.35**(0.5)$_{\downarrow 2}$	**0.19**(0.2)$_{\downarrow 4}$	**0.09**(0.1)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	**0.04**(0.0)$_{\downarrow 4}$	12/15
SNES	∞	∞	∞	∞	∞	∞ *2e7*	0/11
xNES	7.6(0.3)	6.3(0.1)	3.7(0.1)	**2.3**(0.0)	**2.4**(0.0)	**2.5**(0.0)	15/15
xNESas	7.5(0.3)	5.8(0.3)	3.1(0.5)	**1.6**(0.5)	**1.4**(0.6)	**1.2**(0.5)	15/15

Table 133: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ 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-3	1e-5	1e-7	#succ
f12	4169	7452	9174	13146	22758	25192	15/15
ACOR	2104(3598)	8726(1e4)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.9**(1)	**1.9**(1)	**2.2**(1)	**2.1**(0.7)	**1.5**(0.4)	**1.5**(0.4)	15/15
CMA	**1.4**(1)	**1.7**(2)	**2.4**(1)	**2.4**(1)	**1.8**(0.6)	**1.9**(0.6)	15/15
CMAES	**2.0**(2)	**2.3**(2)	**2.6**(2)	**2.6**(1)	**1.9**(0.7)	**2.0**(0.6)	15/15
CMAa	**2.3**(1)	**2.0**(1)	**2.2**(1)	**2.1**(0.9)	**1.5**(0.5)	**1.5**(0.5)	15/15
CMAm	**1.8**(1)	**2.2**(2)	**2.5**(2)	**2.5**(2)	**1.9**(1.0)	**2.0**(0.9)	15/15
CMAma	**1.3**(1)	**1.9**(0.6)	**2.1**(0.6)	**1.9**(0.5)	**1.4**(0.3)	**1.4**(0.3)	15/15
CMAmah	**0.94**(1)	**1.2**(0.9)	**1.4**(0.5)	**1.4**(0.3)	**1.0**(0.2)*	**1.1**(0.2)*	15/15
CMAmh	**1.4**(2)	**1.8**(2)	**2.3**(2)	**2.4**(2)	**1.9**(1)	**2.0**(1)	15/15
DBRCGA	271(482)	1093(1341)	890(1090)	∞	∞	∞ *4e6*	0/15
DE	227(276)	233(286)	250(238)	715(688)	∞	∞ *2e6*	0/15
DE-AUTO	**1.3**(2)	**1.2**(1)	**1.3**(1)	4.3(4)	7.1(6)	54(80)	7/15
DE-BFGS	3.6(2)	**2.6**(1)	**2.8**(2)	8.4(8)	107(124)	∞ *4e6*	0/15
DE-ROLL	21(46)	13(26)	13(23)	12(15)	22(19)	132(127)	6/15
DE-SIMPLEX	26(22)	41(44)	51(41)	114(113)	∞	∞ *4e6*	0/15
DEctpb	209(241)	238(270)	508(545)	∞	∞	∞ *2e6*	0/15
JADEb	49(98)	101(150)	102(111)	93(81)	62(50)	61(47)	12/15
JADEctpb	29(46)	44(38)	56(18)	51(12)	35(6)	35(5)	15/15
MVDE	100(121)	395(470)	733(928)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.3**(1)	**2.2**(1)	**2.4**(1.0)	**2.2**(0.7)	**1.5**(0.4)	**1.5**(0.4)	15/15
NIPOPaCMA	**1.9**(2)	**2.0**(1)	**2.2**(1)	**2.1**(0.7)	**1.5**(0.4)	**1.5**(0.4)	15/15
PSO-BFGS	12(8)	11(10)	14(11)	30(23)	406(520)	∞ *4e6*	0/15
xNES	19(0.3)	13(0.2)	12(0.4)	11(0.3)	7.5(0.3)	7.7(0.2)	15/15
xNESas	7.4(5)	4.5(3)	7.8(4)	17(11)	14(12)	15(22)	15/15

Table 134: 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-3	1e-5	1e-7	#succ
f13	2029	6916	8734	71936	98467	1.2e5	15/15
ACOR	1801(2465)	2896(3976)	7446(9159)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**2.0**(0.2)	3.8(3)	5.3(4)	**1.3**(0.9)	**1.6**(1)	**2.0**(1)	15/15
CMA	**2.1**(0.1)	3.6(5)	8.6(11)	**2.5**(2)	**3.0**(2)	3.8(1)	15/15
CMAES	**2.7**(4)	3.8(3)	7.2(8)	5.9(4)	66(73)	∞ *2e6*	0/15
CMAa	**2.1**(0.3)	**2.8**(2)	**4.0**(4)	**1.2**(1)	**1.6**(0.7)	**1.8**(0.7)	15/15
CMAm	**1.7**(0.1)	3.3(4)	7.2(9)	3.3(2)	4.3(1)	4.1(0.8)	15/15
CMAma	**2.0**(3)	**2.2**(2)	**3.6**(2)	**0.93**(0.5)	**1.8**(1)	**1.9**(0.6)	15/15
CMAmah	**1.1**(0.2)	**2.7**(3)	5.9(3)	**1.4**(1)	**1.5**(0.9)	**1.9**(0.8)	15/15
CMAmh	**1.1**(0.1)	**1.9**(3)	5.6(6)	3.3(2)	**3.0**(1)	**2.8**(1)	15/15
DBRCGA	459(990)	408(516)	841(976)	∞	∞	∞ *4e6*	0/15
DE	54(7)	77(101)	386(420)	∞	∞	∞ *2e6*	0/15
DE-AUTO	**1.1**(0.2)	**1.3**(1)	**2.2**(2)	**1.3**(1.0)	12(14)	153(167)	1/15
DE-BFGS	9.4(4)	4.3(0.6)	6.5(0.7)	12(28)	120(123)	∞ *4e6*	0/15
DE-ROLL	15(20)	6.0(6)	7.1(5)	**2.3**(2)	31(41)	470(553)	0/15
DE-SIMPLEX	30(21)	21(20)	28(20)	∞	∞	∞ *4e6*	0/15
DEctpb	60(4)	27(3)	145(155)	201(215)	∞	∞ *2e6*	0/15
JADEb	29(47)	80(82)	258(271)	406(417)	∞	∞ *2e6*	0/15
JADEctpb	74(64)	77(145)	283(317)	73(76)	∞	∞ *2e6*	0/15
MVDE	67(4)	156(148)	487(573)	96(111)	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.5**(3)	3.2(2)	5.0(4)	**1.2**(0.9)	**2.0**(2)	**2.8**(2)	15/15
NIPOPaCMA	**2.4**(3)	**2.4**(3)	**4.1**(4)	**1.4**(1)	**1.6**(0.8)	**1.7**(0.8)	15/15
PSO-BFGS	26(2)	8.0(0.4)	9.1(3)	95(111)	574(630)	∞ *4e6*	0/15
xNES	24(0.4)	11(0.1)	11(0.1)	**2.1**(0.0)	**2.0**(0.0)	**2.1**(6e-3)	15/15
xNESas	13(6)	4.2(2)	9.0(3)	23(25)	64(69)	84(102)	0/15

Table 135: 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-3	1e-5	1e-7	#succ
f14	304	616	777	2207	4825	57711	15/15
ACOR	21(6)	16(3)	18(2)	107(28)	∞	∞ *1e7*	0/15
BIPOPaCMA	**2.5**(0.2)	**2.3**(0.3)	**2.9**(0.2)	3.5(0.2)	3.9(0.2)	**0.59**(0.0)$_{\downarrow 4}$	15/15
CMA	**2.5**(0.4)	**2.4**(0.3)	3.0(0.3)	4.4(0.3)	6.8(0.4)	**1.1**(0.1)	15/15
CMAES	**2.4**(0.4)	**2.4**(0.2)	**2.9**(0.2)	4.3(0.3)	6.7(0.5)	**1.1**(0.1)	15/15
CMAa	**2.5**(0.4)	**2.4**(0.3)	3.0(0.3)	3.4(0.3)	3.9(0.2)	**0.58**(0.0)$_{\downarrow 4}$	15/15
CMAm	**2.0**(0.4)	**1.9**(0.3)	**2.3**(0.2)	3.9(0.3)	6.6(0.4)	**1.1**(0.1)	15/15
CMAma	**1.9**(0.4)	**1.9**(0.2)	**2.3**(0.2)	3.0(0.2)	**3.6**(0.2)	**0.56**(0.0)$_{\downarrow 4}$	15/15
CMAmah	**1.5**(0.5)	**1.4**(0.3)	**1.6**(0.1)	**2.3**(0.2)	**3.5**(0.2)	**0.61**(0.0)$_{\downarrow 4}$	15/15
CMAmh	**1.5**(0.3)	**1.3**(0.2)	**1.6**(0.2)	**2.8**(0.2)	5.9(0.6)	**1.1**(0.1)	15/15
DBRCGA	34(11)	57(11)	81(14)	154(35)	∞	∞ *4e6*	0/15
DE	123(18)	100(10)	115(14)	∞	∞	∞ *2e6*	0/15
DE-AUTO	**0.92**(0.1)	**0.70**(0.1)$_{\downarrow 4}$	**0.77**(0.1)	**1.1**(0.2)	13(3)	∞ *4e6*	0/15
DE-BFGS	**0.91**(0.2)	**0.70**(0.1)$_{\downarrow 4}$	**0.83**(0.2)	**0.64**(0.1)$_{\downarrow 4}$	**2.0**(2)$^{\star 2}$	∞ *4e6*	0/15
DE-ROLL	4.1(4)	11(11)	12(13)	24(6)	∞	∞ *4e6*	0/15
DE-SIMPLEX	26(14)	31(9)	34(9)	31(11)	∞	∞ *4e6*	0/15
DEctpb	114(18)	100(10)	121(7)	∞	∞	∞ *2e6*	0/15
JADEb	20(2)	20(2)	25(2)	30(2)	153(27)	∞ *2e6*	0/15
JADEctpb	23(2)	23(1)	27(1)	30(2)	166(50)	∞ *2e6*	0/15
MVDE	78(10)	89(4)	114(7)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.5**(0.5)	**2.4**(0.2)	**3.0**(0.2)	3.5(0.3)	3.9(0.2)	**0.59**(0.0)$_{\downarrow 4}$	15/15
NIPOPaCMA	**2.5**(0.4)	**2.3**(0.3)	**3.0**(0.3)	3.4(0.1)	**3.8**(0.2)	**0.60**(0.0)$_{\downarrow 4}$	15/15
PSO-BFGS	**0.93**(0.2)	**0.72**(0.1)$_{\downarrow 4}$	**0.85**(0.2)	**0.66**(0.1)$_{\downarrow 4}$	6.4(4)	∞ *4e6*	0/15
xNES	**1.8**(0.7)	21(1)	37(1)	27(0.3)	19(0.2)	**2.1**(0.0)	15/15
xNESas	**1.8**(0.3)	20(1)	35(1)	26(0.7)	18(0.2)	**2.0**(0.0)	15/15

Table 136: 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-3	1e-5	1e-7	#succ
f15	1.9e5	7.9e5	1.0e6	1.1e6	1.1e6	1.1e6	15/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.2**(0.5)	**1.1**(0.5)	**1.1**(0.4)	**1.1**(0.4)	**1.1**(0.4)	**1.1**(0.4)	15/15
CMA	**0.97**(0.3)	**0.78**(0.3)	**0.71**(0.2)	**0.72**(0.2)	**0.74**(0.2)	**0.75**(0.2)	15/15
CMAES	∞	∞	∞	∞	∞	∞ *2e6*	0/15
CMAa	**0.75**(0.3)	**0.67**(0.2)	**0.66**(0.2)	**0.67**(0.2)	**0.68**(0.2)	**0.69**(0.2)	15/15
CMAm	**0.71**(0.3)	**0.64**(0.3)	**0.68**(0.5)	**0.69**(0.5)	**0.70**(0.5)	**0.71**(0.5)	15/15
CMAma	**0.72**(0.3)	**0.58**(0.2)$_{\downarrow 2}$	**0.60**(0.2)	**0.61**(0.2)	**0.62**(0.2)	**0.63**(0.2)	15/15
CMAmah	**0.79**(0.2)	**0.68**(0.2)	**0.69**(0.4)	**0.70**(0.4)	**0.72**(0.4)	**0.72**(0.4)	15/15
CMAmh	**0.86**(0.3)	**0.66**(0.3)$_{\downarrow}$	**0.71**(0.3)	**0.72**(0.3)	**0.74**(0.3)	**0.75**(0.3)	15/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.0**(0.4)	**0.71**(0.3)$_{\downarrow 2}$	**0.75**(0.3)	**0.76**(0.3)	**0.77**(0.3)	**0.77**(0.3)	15/15
NIPOPaCMA	**0.92**(0.3)	**0.61**(0.2)$_{\downarrow}$	**0.55**(0.2)	**0.56**(0.2)	**0.57**(0.2)	**0.58**(0.2)	15/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
xNES	∞	∞	∞	∞	∞	∞ *1e7*	0/2
xNESas	∞	∞	∞	∞	∞	∞ *2e7*	0/9

Table 137: 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-3	1e-5	1e-7	#succ
f16	5244	72122	3.2e5	1.4e6	2.0e6	2.0e6	15/15
ACOR	8740(9535)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.3**(0.4)	**0.96**(0.3)	**0.80**(0.4)	**0.54**(0.3)	**0.50**(0.3)	**0.51**(0.3)	15/15
CMA	**1.8**(3)	**1.2**(0.7)	**0.92**(0.6)	**0.64**(0.5)	**0.57**(0.5)	**0.58**(0.5)	15/15
CMAES	**1.1**(0.5)	47(47)	∞	∞	∞	∞ *2e6*	0/15
CMAa	**0.88**(0.3)	**0.94**(0.4)	**0.65**(0.5)	**0.59**(0.6)	**0.44**(0.4)$_{\downarrow}$	**0.45**(0.4)	15/15
CMAm	**0.72**(0.3)	**1.2**(0.9)	**1.2**(1.0)	**0.62**(0.6)	**0.61**(0.4)	**0.63**(0.4)	15/15
CMAma	**0.65**(0.3)$_{\downarrow}$	**0.72**(0.3)	**0.55**(0.2)	**0.52**(0.4)	**0.52**(0.5)	**0.56**(0.5)	15/15
CMAmah	**2.4**(2)	**1.00**(0.6)	**0.75**(0.6)	**0.55**(0.6)	**0.47**(0.4)	**0.48**(0.4)	15/15
CMAmh	**2.8**(2)	**1.9**(0.9)	**0.79**(0.4)	**0.73**(0.6)	**0.58**(0.4)	**0.60**(0.4)	15/15
DBRCGA	657(848)	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	329(274)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	2351(2446)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	415(460)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	1082(1292)	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	1211(1425)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	219(245)	∞	∞	∞	∞	∞ *2e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**0.97**(0.3)	**0.78**(0.4)	**0.34**(0.1)$_{\downarrow 3}$	**0.38**(0.3)$_{\downarrow 2}$	**0.46**(0.4)	**0.74**(1)	15/15
NIPOPaCMA	**1.2**(0.4)	**0.65**(0.2)	**0.23**(0.1)$^{\star}_{\downarrow 4}$	**0.21**(0.2)$_{\downarrow 3}$	**0.16**(0.1)$^{\star}_{\downarrow 3}$	**0.18**(0.1)$_{\downarrow 3}$	15/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15

Table 138: 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-3	1e-5	1e-7	#succ
f17	399	4220	14158	51958	1.3e5	2.7e5	14/15
ACOR	37(22)	9.3(5)	1064(1413)	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**1.1**(0.3)	**0.64**(0.2)	**1.6**(1)	**1.1**(0.4)	**1.4**(1)	**0.87**(0.4)	15/15
CMA	**0.98**(0.2)	**1.2**(0.3)	**1.1**(1)	**0.94**(0.4)	**0.98**(0.3)	**0.73**(0.3)$_{\downarrow}$	15/15
CMAES	**1.0**(0.3)	**1.0**(0.1)	**1.1**(1)	∞	∞	∞ *2e6*	0/15
CMAa	**0.88**(0.5)	**0.53**(0.1)	**1.0**(1)	**1.0**(0.3)	**1.00**(0.7)	**0.69**(0.2)$_{\downarrow}$	15/15
CMAm	**0.79**(0.3)	**0.42**(0.1)	**1.1**(0.9)	**0.96**(0.3)	**0.93**(0.6)	**0.80**(0.3)	15/15
CMAma	**0.89**(0.4)	**0.46**(0.2)	**0.96**(0.8)	**0.77**(0.3)	**0.77**(0.2)	**0.60**(0.2)$_{\downarrow 2}$	15/15
CMAmah	**0.82**(0.2)	11(7)	4.3(3)	**1.9**(0.8)	**1.1**(0.4)	**0.82**(0.3)	15/15
CMAmh	**1.0**(0.6)	7.6(6)	3.9(3)	**1.5**(0.7)	**1.2**(0.6)	**0.90**(0.3)	15/15
DBRCGA	5.6(2)	∞	∞	∞	∞	∞ *4e6*	0/15
DE	35(10)	24(6)	17(3)	26(21)	∞	∞ *2e6*	0/15
DE-AUTO	15(20)	636(565)	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	13(13)	422(493)	4118(4594)	∞	∞	∞ *4e6*	0/15
DE-ROLL	19(17)	1039(1402)	1986(2261)	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	25(24)	1894(2041)	∞	∞	∞	∞ *4e6*	0/15
DEctpb	28(8)	21(2)	15(1.0)	10(0.5)	∞	∞ *2e6*	0/15
JADEb	6.7(3)	115(239)	924(1059)	∞	∞	∞ *2e6*	0/15
JADEctpb	7.0(2)	5.4(0.9)	3.2(0.6)	13(19)	∞	∞ *2e6*	0/15
MVDE	17(4)	27(5)	21(4)	29(20)	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.0**(0.4)	**0.57**(0.2)	**1.2**(1)	**1.2**(0.5)	**1.0**(0.3)	**0.81**(0.3)	15/15
NIPOPaCMA	**0.97**(0.3)	**0.52**(0.1)	**0.97**(1)	**1.00**(0.4)	**1.1**(0.6)	**0.70**(0.2)$_{\downarrow}$	15/15
PSO-BFGS	24(22)	∞	∞	∞	∞	∞ *4e6*	0/15

Table 139: 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-3	1e-5	1e-7	#succ
f18	1442	16998	47068	1.9e5	6.7e5	9.5e5	15/15
ACOR	16(6)	397(589)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**0.94**(0.2)	**0.51**(0.8)	**1.0**(0.4)	**0.98**(0.4)	**0.88**(0.7)	**0.67**(0.5)	15/15
CMA	**0.94**(0.2)	**0.58**(0.9)	**1.1**(0.5)	**0.77**(0.2)$_{\downarrow}$	**0.53**(0.2)	**0.58**(0.2)	15/15
CMAES	**0.97**(0.2)	**1.2**(2)	68(74)	∞	∞	∞ *2e6*	0/15
CMAa	**0.95**(0.2)	**0.50**(0.8)	**1.2**(0.5)	**0.83**(0.3)	**0.54**(0.4)	**0.43**(0.2)	15/15
CMAm	**0.78**(0.2)	**0.62**(0.7)	**0.90**(0.4)	**0.68**(0.5)$_{\downarrow}$	**0.85**(0.8)	**0.67**(0.6)	15/15
CMAma	**0.77**(0.1)$_{\downarrow}$	**0.72**(0.7)	**0.93**(0.4)	**0.61**(0.2)$_{\downarrow 2}$	**0.46**(0.3)	**0.47**(0.2)	15/15
CMAmah	9.3(24)	3.5(2)	**1.7**(0.9)	**0.96**(0.3)	**0.58**(0.2)	**0.47**(0.2)	15/15
CMAmh	24(37)	3.4(4)	**2.0**(1)	**1.1**(0.4)	**0.68**(0.3)	**0.58**(0.2)	15/15
DBRCGA	1183(1733)	∞	∞	∞	∞	∞ *4e6*	0/15
DE	46(9)	24(13)	38(31)	∞	∞	∞ *2e6*	0/15
DE-AUTO	291(158)	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	229(206)	3493(3768)	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	442(268)	3530(4004)	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	638(406)	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	40(7)	14(3)	12(2)	10(6)	∞	∞ *2e6*	0/15
JADEb	16(6)	794(938)	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	10(1)	**2.8**(0.8)	16(21)	∞	∞	∞ *2e6*	0/15
MVDE	49(8)	29(12)	316(362)	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**1.0**(0.2)	**0.97**(1)	**1.1**(0.6)	**0.93**(0.4)	**0.57**(0.4)	**0.53**(0.3)	15/15
NIPOPaCMA	**0.95**(0.2)	**0.58**(0.8)	**0.75**(0.1)	**0.71**(0.2)$_{\downarrow}$	**0.50**(0.3)	**0.42**(0.2)	15/15
PSO-BFGS	1465(1605)	∞	∞	∞	∞	∞ *4e6*	0/15
xNES	**2.1**(0)	**2.2**(0)	**1.6**(0)	**0.80**(0)	**0.39**(0)	∞ *1e7*	0/1
xNESas	4.3(0)	**2.2**(0)	**1.6**(0)	**0.80**(0)	**0.36**(0)	**0.37**(0)	0/1

Table 140: 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-3	1e-5	1e-7	#succ
f19	1	1	1.4e6	2.6e7	4.5e7	4.5e7	8/15
ACOR	4435(1033)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	396(82)	**6.7e4**(5e4)	**0.87**(0.7)	**1.2**(1)	**1.0**(0.9)	**1.0**(0.9)	9/15
CMA	421(92)	6.9e5(8e5)	**1.5**(3)	∞	∞	∞ *8e6*	0/15
CMAES	407(116)	2.5e5(3e5)	∞	∞	∞	∞ *2e6*	0/15
CMAa	443(121)	**4.8e4**(3e4)	**1.8**(3)	∞	∞	∞ *8e6*	0/15
CMAm	**293**(90)	**5.5e4**(4e4)	**2.5**(3)	**4.5**(5)	**2.5**(3)	**2.5**(3)	1/15
CMAma	**323**(38)	**3.9e4**(3e4)	**2.3**(3)	∞	∞	∞ *8e6*	0/15
CMAmah	**338**(204)	1.6e6(4e6)	7.1(8)	∞	∞	∞ *8e6*	0/15
CMAmh	**305**(114)	1.2e6(2e6)	**2.3**(3)	∞	∞	∞ *8e6*	0/15
DBRCGA	1270(156)	2.5e6(2e6)	∞	∞	∞	∞ *4e6*	0/15
DE	1.4e4(4500)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	2.1e4(2e4)	2.1e6(2e6)	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	1.6e4(7636)	1.9e6(2e6)	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	2.1e4(1e4)	2.8e7(3e7)	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	2.7e4(9260)	5.8e7(6e7)	∞	∞	∞	∞ *4e6*	0/15
DEctpb	1.2e4(3772)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	3765(784)	8.9e6(9e6)	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	3064(499)	∞	∞	∞	∞	∞ *2e6*	0/15
MVDE	1.4e4(1661)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	424(90)	8.3e4(6e4)	**0.97**(0.6)	**0.81**(0.5)	**1.1**(1)	**1.1**(1)	9/15
NIPOPaCMA	436(102)	8.2e4(4e4)	**1.9**(6)	**0.48**(0.3)$_\downarrow$	**0.32**(0.2)$_\downarrow$	**0.32**(0.2)$_\downarrow$	15/15
PSO-BFGS	2.8e4(2e4)	1.2e5(6e4)	41(45)	∞	∞	∞ *4e6*	0/15

Table 141: 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-3	1e-5	1e-7	#succ
f20	222	1.3e5	1.6e8	∞	∞	∞	0
ACOR	26(4)	34(41)	∞	.	.	.	0/15
BIPOPaCMA	4.0(0.4)	9.0(4)	**0.34**(0.4)	.	.	.	0/15
CMA	3.9(0.7)	14(4)	∞	.	.	.	0/15
CMAES	4.0(0.5)	∞	∞	.	.	.	0/15
CMAa	4.1(0.5)	5.6(3)	**0.73**(0.8)	.	.	.	0/15
CMAm	3.1(0.4)	13(4)	∞	.	.	.	0/15
CMAma	**3.0**(0.5)	5.5(2)	**0.21**(0.2)	.	.	.	0/15
CMAmah	**2.1**(0.4)	5.1(2)	**0.35**(0.4)	.	.	.	0/15
CMAmh	**2.1**(0.4)	12(5)	∞	.	.	.	0/15
DBRCGA	28(6)	∞	∞	.	.	.	0/15
DE	106(23)	7.2(4)	∞	.	.	.	0/15
DE-AUTO	**1.5**(0.3)$^{\star 2}$	**3.9**(3)	∞	.	.	.	0/15
DE-BFGS	10(8)	**2.2**(1)	∞	.	.	.	0/15
DE-ROLL	30(30)	**0.94**(0.8)	∞	.	.	.	0/15
DE-SIMPLEX	36(18)	5.5(3)	∞	.	.	.	0/15
DEctpb	102(22)	∞	∞	.	.	.	0/15
JADEb	27(4)	11(12)	∞	.	.	.	0/15
JADEctpb	29(2)	**2.7**(0.4)	∞	.	.	.	0/15
MVDE	121(9)	∞	∞	.	.	.	0/15
NBIPOPaCMA	4.0(0.8)	8.5(3)	**0.39**(0.4)	.	.	.	0/15
NIPOPaCMA	4.0(0.6)	6.5(2)	**0.32**(0.3)	.	.	.	0/15
PSO-BFGS	8.0(1)	209(229)	∞	.	.	.	0/15

Table 142: 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-3	1e-5	1e-7	#succ
f21	1044	21144	1.0e5	1.0e5	1.0e5	1.0e5	26/30
ACOR	2675(4796)	3199(3547)	1410(1663)	1402(1629)	1393(1619)	1387(1514)	1/15
BIPOPaCMA	7.5(11)	60(19)	37(56)	37(56)	37(56)	37(55)	15/15
CMA	3.5(5)	63(124)	39(52)	39(52)	39(51)	39(52)	6/15
CMAES	5.6(9)	**2.2**(3)	**2.2**(1.0)	**2.2**(1.0)	**2.1**(1.0)	**2.1**(1.0)	14/15
CMAa	**2.0**(5)	63(120)	38(50)	38(50)	38(50)	37(50)	6/15
CMAm	7.0(10)	110(187)	30(39)	30(39)	30(40)	30(39)	7/15
CMAma	**1.6**(3)	61(121)	38(51)	38(51)	38(50)	38(50)	6/15
CMAmah	**1.3**(2)	30(58)	17(24)	16(24)	16(24)	16(24)	9/15
CMAmh	**2.3**(3)	44(61)	22(26)	22(26)	22(26)	22(25)	8/15
DBRCGA	15(9)	56(95)	26(33)	26(33)	27(35)	27(35)	11/15
DE	66(127)	30(47)	9.4(11)	11(11)	11(11)	**11**(13)	11/15
DE-AUTO	**1.4**(2)	162(210)	47(60)	47(59)	47(59)	46(58)	8/15
DE-BFGS	16(18)	60(95)	22(25)	22(25)	21(30)	∞ *4e6*	0/15
DE-ROLL	176(103)	99(134)	33(42)	33(40)	33(40)	66(80)	4/15
DE-SIMPLEX	606(1920)	522(663)	258(318)	257(277)	256(295)	548(625)	0/15
DEctpb	39(12)	112(143)	80(99)	80(89)	80(98)	80(88)	3/15
JADEb	16(3)	12(28)	**3.3**(6)	**3.4**(6)	**3.4**(6)	**3.5**(6)	15/15
JADEctpb	30(3)	25(35)	13(20)	13(17)	13(20)	13(20)	9/15
MVDE	40(15)	58(72)	21(25)	21(25)	22(25)	22(25)	5/15
NBIPOPaCMA	4.9(6)	**10**(20)	**5.1**(8)	**5.1**(8)	**5.1**(8)	**5.1**(8)	15/15
NIPOPaCMA	14(22)	440(890)	173(242)	172(227)	171(226)	171(225)	12/15
PSO-BFGS	**0.61**(0.9)	**1.7**(3)	**0.98**(1)	**0.97**(1)	**1.1**(1)	161(214)	1/15
xNES	10(7)	72(37)	15(8)	15(8)	15(8)	15(8)	2/3
xNESas	40(39)	**7.1**(7)	50(75)	50(74)	50(74)	49(73)	1/2

Table 143: 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-3	1e-5	1e-7	#succ
f22	3090	35442	6.5e5	6.5e5	6.5e5	6.5e5	8/30
ACOR	1184(1621)	1129(1552)	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	12(20)	343(565)	201(254)	200(215)	200(191)	**199**(202)	4/15
CMA	82(117)	149(186)	∞	∞	∞	∞ *3e6*	0/15
CMAES	**8.1**(16)	**35**(56)	**46**(46)	**46**(49)	**45**(48)	**45**(54)	1/15
CMAa	65(8)	197(232)	∞	∞	∞	∞ *3e6*	0/15
CMAm	71(59)	147(219)	∞	∞	∞	∞ *3e6*	0/15
CMAma	62(6)	144(180)	∞	∞	∞	∞ *3e6*	0/15
CMAmah	**1.2**(2)	102(135)	∞	∞	∞	∞ *2e6*	0/15
CMAmh	**8.6**(2)	141(177)	∞	∞	∞	∞ *2e6*	0/15
DBRCGA	167(345)	196(236)	∞	∞	∞	∞ *4e6*	0/15
DE	68(49)	98(116)	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	218(489)	315(396)	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	101(92)	136(177)	**87**(99)	**87**(102)	**87**(94)	∞ *4e6*	0/15
DE-ROLL	538(650)	254(309)	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	869(1298)	1582(1807)	∞	∞	∞	∞ *4e6*	0/15
DEctpb	128(324)	368(423)	∞	∞	∞	∞ *2e6*	0/15
JADEb	13(28)	**74**(100)	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	109(324)	119(144)	∞	∞	∞	∞ *2e6*	0/15
MVDE	95(164)	**83**(103)	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	12(6)	112(120)	**32**(39)	**32**(40)	**32**(40)	**32**(40)	12/15
NIPOPaCMA	179(468)	583(648)	∞	∞	∞	∞ *4e7*	0/15
PSO-BFGS	**0.79**(0.9)	**22**(57)	**6.6**(6)	**6.6**(6)	**9.4**(10)	∞ *4e6*	0/15

Table 144: 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-3	1e-5	1e-7	#succ
f23	7.1	11925	75453	1.3e6	3.2e6	3.4e6	15/15
ACOR	**1.3**(2)	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	8.4(9)	7.8(7)	**1.3**(1)	**1.9**(1)	**1.00**(0.4)	**0.99**(0.4)	15/15
CMA	4.1(3)	∞	∞	∞	∞	∞ *4e6*	0/15
CMAES	4.9(4)	2478(2600)	∞	∞	∞	∞ *2e6*	0/15
CMAa	4.8(4)	∞	∞	∞	∞	∞ *4e6*	0/15
CMAm	5.8(6)	4976(5633)	787(907)	∞	∞	∞ *4e6*	0/15
CMAma	3.3(3)	2196(2764)	760(798)	∞	∞	∞ *4e6*	0/15
CMAmah	7.4(10)	859(1004)	∞	∞	∞	∞ *4e6*	0/15
CMAmh	7.4(7)	4340(5028)	∞	∞	∞	∞ *4e6*	0/15
DBRCGA	**1.0**(0.8)	350(259)	∞	∞	∞	∞ *4e6*	0/15
DE	**2.0**(3)	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	**1.4**(2)	**6.7**(4)	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	**0.97**(1)	**7.0**(5)	748(849)	∞	∞	∞ *4e6*	0/15
DE-ROLL	**0.73**(0.7)	47(45)	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	**1.3**(1)	**0.43**(0.8)$^{\star 3}$	354(424)	∞	∞	∞ *4e6*	0/15
DEctpb	**1.1**(1)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	**1.4**(1.0)	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	**2.2**(2)	95(38)	∞	∞	∞	∞ *2e6*	0/15
MVDE	**1.1**(1)	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	8.6(11)	10(12)	**1.6**(2)	**1.3**(0.4)	**0.58**(0.2)	**0.59**(0.2)	15/15
NIPOPaCMA	5.9(7)	61(18)	**11**(3)	**0.72**(0.2)	**0.36**(0.2)	**0.38**(0.2)	15/15
PSO-BFGS	**1.4**(1)	**4.3**(2)	**84**(108)	∞	∞	∞ *4e6*	0/15

Table 145: 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-3	1e-5	1e-7	#succ
f24	5.8e6	9.8e7	3.0e8	3.0e8	3.0e8	3.0e8	1/15
ACOR	∞	∞	∞	∞	∞	∞ *1e7*	0/15
BIPOPaCMA	**3.6**(3)	**1.4**(1)	∞	∞	∞	∞ *4e7*	0/15
CMA	∞	∞	∞	∞	∞	∞ *8e6*	0/15
CMAES	∞	∞	∞	∞	∞	∞ *2e6*	0/15
CMAa	19(21)	∞	∞	∞	∞	∞ *8e6*	0/15
CMAm	∞	∞	∞	∞	∞	∞ *8e6*	0/15
CMAma	**9.0**(10)	∞	∞	∞	∞	∞ *8e6*	0/15
CMAmah	10(10)	**1.2**(1)	∞	∞	∞	∞ *8e6*	0/15
CMAmh	∞	∞	∞	∞	∞	∞ *8e6*	0/15
DBRCGA	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE	∞	∞	∞	∞	∞	∞ *2e6*	0/15
DE-AUTO	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-ROLL	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DE-SIMPLEX	∞	∞	∞	∞	∞	∞ *4e6*	0/15
DEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
JADEctpb	∞	∞	∞	∞	∞	∞ *2e6*	0/15
MVDE	∞	∞	∞	∞	∞	∞ *1e6*	0/15
NBIPOPaCMA	**2.1**(3)	**0.19**(0.2)	**0.97**(1)	**0.97**(1.0)	**0.97**(1.0)	**0.97**(1)	2/15
NIPOPaCMA	**1.2**(1)	**0.15**(0.2)	**0.44**(0.5)	**0.44**(0.4)	**0.44**(0.5)	**0.44**(0.5)	4/15
PSO-BFGS	∞	∞	∞	∞	∞	∞ *4e6*	0/15

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