1 Fitness means and standard deviations

Table 1: Averages and standard deviations for Thirty-six benchmark problems with 100.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.93066E-6	0E0	0E0	0E0	4.63924E-9	0E0	3.38218E-6	4.3202E-4
	±2.04174E-6	±0E0	±0E0	±0E0	±7.91031E-9	±0E0	±4.15411E-6	±3.76789E-4
f_2	-9.96098E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-8.094E-1
	±6.86823E-3	±0E0	±0E0	±0E0	±3.92281E-7	±0E0	±1.60367E-9	±1.649E-1
f_3	1.78454E-5	8.21455E-284	1.49378E-285	0E0	2.12395E-10	6.18242E-84	6.09334E-8	1.44255E-4
	±3.66086E-5	±0E0	±0E0	±0E0	±2.54804E-10	±1.54814E-83	±6.90648E-8	±1.54542E-4
f_4	0E0	0E0	0E0	0E0	9.69351E-7	0E0	4.56024E-8	6.28907E-1
	±0E0	±0E0	±0E0	±0E0	±1.53885E-6	±0E0	±8.36922E-8	±3.10524E-1
f_5	3.47188E-14	0E0	0E0	0E0	7.66673E-9	0E0	8.71627E-8	3.16944E-3
	±1.75E-13	±0E0	±0E0	±0E0	±9.22051E-9	±0E0	±8.81188E-8	±2.62437E-3
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80054E0
	±0E0	±0E0	±0E0	±0E0	±4.40662E-10	±0E0	±7.00796E-8	±8.05768E-4
f_7	0E0	0E0	0E0	0E0	7.03141E-17	0E0	2.08775E-4	8.30756E-4
	±0E0	±0E0	±0E0	±0E0	±2.87867E-16	±0E0	±5.41374E-4	±1.42424E-3
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03102E0
	±1.10639E-16	±0E0	±0E0	±0E0	±5.8919E-9	±0E0	±1.29547E-8	±6.43456E-4
f_9	0E0	0E0	0E0	0E0	1.89663E-6	0E0	3.89669E-8	4.5356E-1
	±0E0	±0E0	±0E0	±0E0	±3.09064E-6	±0E0	±5.50056E-8	±2.19903E-1
f_{10}	1.44256E-6	0E0	0E0	0E0	2.40094E-6	0E0	4.31245E-6	3.59242E-1
	±2.16808E-6	±0E0	±0E0	±0E0	±2.52746E-6	±0E0	±4.50154E-6	±2.08713E-1
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86543E2
	±1.07732E-14	±1.69383E-14	±2.36164E-11	±2.02353E-14	±1.30768E-5	±2.32262E-14	±3.84458E-6	±2.13937E-1
f_{12}	6.08171E-1	0E0	2.09853E-3	5.91646E-33	1.73839E-1	3.74316E-3	2.69272E-1	1.50376E1
	±5.03955E-1	±0E0	±4.99115E-3	±3.24058E-32	±1.39158E-1	±5.29167E-3	±1.46728E-1	±7.5733E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.53989E0	-4.67231E0	-4.55567E0	-4.68343E0	-3.70998E0
	±1.62158E-16	±1.05956E-2	±7.62481E-3	±1.85262E-1	±1.22212E-2	±3.06727E-1	±1.27407E-2	±1.91807E-1
f_{14}	2.98001E2	5.12453E-19	5.86293E1	4.24214E-24	1.3874E2	3.18773E2	1.36442E0	3.40161E2
	±4.03708E1	±2.54234E-18	±1.91011E1	±2.32351E-23	±1.88427E1	±1.09242E2	±2.29904E-1	±4.75691E1
f_{15}	-9.66015E0	-9.66015E0	-9.46735E0	-7.65611E0	-8.56808E0	-8.2148E0	-9.46201E0	-5.44624E0
	±3.48994E-12	±6.73326E-16	±1.53716E-1	±6.61462E-1	±2.4341E-1	±7.81092E-1	±1.16853E-1	±3.03607E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	4.87307E3	1.35517E3	0E0	-1.33357E3
	±0E0	±0E0	±5.04007E-1	±0E0	±7.61852E2	±3.45383E3	±0E0	±7.03899E1
f_{17}	4.25068E-16	5.25187E-62	1.16956E-21	4.37117E-172	4.80514E3	6.74637E2	3.95531E-1	3.69277E4
	±8.66061E-17	±2.87574E-61	±1.64724E-21	±0E0	±8.27391E2	±2.53624E3	±5.79905E-2	±2.29885E3
f_{18}	3.97096E-16	7.97742E-62	1.25033E-22	1.29293E-172	6.11961E2	6.30588E2	5.08604E0	4.77875E3
	±6.3762E-17	±4.36932E-61	±1.60361E-22	±0E0	±6.90504E1	±4.82844E2	±6.73829E-1	±4.19816E2
f_{19}	1.24185E-16	8.5529E-79	1.04503E-32	1.9E-322	1.11257E0	3.13431E0	2.27713E-1	3.52315E1
	±2.9789E-17	±4.67061E-78	±3.1168E-32	±0E0	±3.20809E-1	±5.37156E0	±4.59572E-2	±5.6683E0
f_{20}	6.87922E-14	1.00459E-11	3.17077E-12	2.71856E-85	4.71283E16	1.68509E6	2.27784E0	6.35575E34
	±2.86633E-14	±5.52611E-12	±7.03593E-12	±7.6679E-85	±1.43937E17	±9.22494E6	±1.78263E-1	±2.06719E35
f_{21}	8.36169E-24	0E0	0E0	0E0	6.81741E-20	1.70909E-135	2.56726E-10	1.51232E-6
	±1.34414E-23	±0E0	±0E0	±0E0	±1.17765E-19	±9.25867E-135	±4.66692E-10	±2.12431E-6
f_{22}	4.38082E-1	7.97325E-1	2.18596E1	2.88284E1	2.02695E4	1.107E5	1.15746E2	3.3034E5
	±4.96995E-1	±1.62191E0	±2.99135E1	±8.15531E-2	±5.10706E3	±5.66658E4	±4.28929E1	±6.89751E4
f_{23}	3.10407E-2	6.66667E-1	6.78789E-1	7.17169E-1	1.71332E4	2.4162E4	8.21049E0	5.08544E5
	±1.22118E-1	±5.11961E-17	±6.63947E-2	±5.55783E-2	±6.36219E3	±5.25871E4	±1.25124E0	±1.16568E5
f_{24}	2.84217E-14	0E0	3.22808E1	0E0	1.63405E2	1.70014E2	7.66338E1	3.21309E2
	±3.57956E-14	±0E0	±1.4253E1	±0E0	±1.19914E1	±2.69807E1	±6.72321E0	±1.47593E1
f_{25}	2.46547E-4	2.46535E-4	5.73635E-3	6.77319E-4	4.14885E1	7.06348E0	6.20956E-2	3.25851E2
	±1.35038E-3	±1.35033E-3	±1.1988E-2	±2.63939E-3	±6.14688E0	±2.28215E1	±4.39821E-2	±3.13196E1
f_{26}	5.74563E-13	7.07582E-15	6.71176E-12	4.82577E-15	1.29845E1	7.36842E0	9.49081E-1	1.95868E1
	±2.48402E-13	±1.22834E-15	±3.20046E-12	±1.52832E-15	±6.24893E-1	±7.41812E0	±1.10908E-1	±2.03434E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-9.99998E-1	-1E0	-1E0	-9.91309E-1
	±0E0	±0E0	±0E0	±0E0	±3.7335E-6	±0E0	±1.01113E-7	±6.75669E-3
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86048E0
	±2.23824E-16	±0E0	±0E0	±8.10792E-17	±2.54075E-7	±1.99961E-3	±5.26305E-7	±1.35788E-3
f_{29}	-3.322E0	-3.27444E0	-3.32152E0	-3.2674E0	-3.31895E0	-3.24097E0	-3.29025E0	-3.14662E0
	±1.80672E-16	±5.92412E-2	±1.68979E-3	±6.03808E-2	±2.16462E-3	±8.31124E-2	±5.34576E-2	±5.14792E-2
f_{30}	-1.01532E1	-1.01532E1	-5.40418E0	-9.98327E0	-1.00778E1	-6.13908E0	-5.49734E0	-5.0924E0
	±5.42758E-16	±0E0	±3.47842E0	±9.30764E-1	±6.77304E-2	±3.2573E0	±3.62976E0	±1.59579E0
f_{31}	-1.04029E1	-1.04029E1	-8.68484E0	-1.02258E1	-1.03504E1	-9.87278E0	-6.17013E0	-5.12734E0
	±1.05177E-15	±4.50676E-16	±3.13807E0	±9.70431E-1	±3.72024E-2	±1.61767E0	±3.77567E0	±1.09667E0
f_{32}	-1.05363E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.04547E1	-9.99875E0	-7.74608E0	-5.86498E0
	±4.89476E-4	±4.50676E-16	±2.90551E0	±1.88857E0	±1.64057E0	±3.75215E0	±1.57968E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.98263E-1
	±0E0	±0E0	±0E0	±0E0	±6.39677E-8	±0E0	±5.24961E-8	±3.02924E-4
f_{34}	3.00018E0	3E0	3E0	3E0	3E0	3E0	3E0	3.02194E0
	±5.43727E-4	±0E0	±0E0	±0E0	±2.79371E-8	±2.53729E-16	±1.01899E-6	±2.13025E-2
f_{35}	8.90008E-2	9.98733E-2	9.98733E-2	9.65442E-2	2.08174E-1	9.98733E-2	9.72778E-2	1.80472E0
	±2.9892E-2	±3.98632E-12	±4.93967E-10	±1.82343E-2	±6.85168E-2	±4.05396E-17	±1.14383E-2	±3.0891E-1
f_{36}	1.03207E-1	9.98733E-2	9.98733E-2	9.98733E-2	3.47202E-1	9.98733E-2	9.98733E-2	2.70515E0
	±1.82573E-2	±1.33691E-11	±3.68435E-10	±0E0	±6.73784E-2	±2.53373E-18	±1.07525E-9	±4.23084E-1

Table 2: Averages and standard deviations for Thirty-six benchmark problems with 300.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	3.99982E-7	0E0	0E0	0E0	1.36961E-24	0E0	5.67871E-7	1.55321E-4
	±3.7913E-7	±0E0	±0E0	±0E0	±2.72685E-24	±0E0	±5.23808E-7	±1.55424E-4
f_2	-9.99829E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.35472E-1
	±3.29757E-4	±0E0	±0E0	±0E0	±0E0	±0E0	±3.62077E-10	±6.56479E-2
f_3	2.32442E-6	0E0	0E0	0E0	5.82942E-26	3.92286E-228	6.50398E-9	4.51734E-5
	±3.01421E-6	±0E0	±0E0	±0E0	±1.19665E-25	±0E0	±5.80521E-9	±3.84524E-5
f_4	0E0	0E0	0E0	0E0	0E0	0E0	3.85988E-9	3.67644E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±7.20176E-9	±1.60588E-1
f_5	6.62291E-17	0E0	0E0	0E0	1.54536E-24	0E0	1.07842E-8	1.5957E-3
	±1.60415E-16	±0E0	±0E0	±0E0	±2.61028E-24	±0E0	±1.24631E-8	±1.91743E-3
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80109E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.08063E-9	±2.19177E-4
f_7	0E0	0E0	0E0	0E0	0E0	0E0	1.56582E-4	1.1057E-5
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.77775E-4	±2.67924E-5
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03137E0
	±9.03362E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±8.97948E-10	±3.04713E-4
f_9	0E0	0E0	0E0	0E0	0E0	0E0	3.67969E-9	2.65166E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±5.13211E-9	±1.36825E-1
f_{10}	1.85049E-7	0E0	0E0	0E0	0E0	0E0	6.48471E-7	1.99746E-1
	±3.30486E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±6.82699E-7	±1.05806E-1
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.8668E2
	±8.67228E-15	±1.44216E-14	±1.38623E-13	±2.41666E-14	±9.09045E-15	±2.28026E-14	±4.1998E-7	±5.46608E-2
f_{12}	2.07915E-1	0E0	2.04631E-6	0E0	1.40138E-5	1.40795E-5	1.26444E-1	7.69736E0
	±1.64254E-1	±0E0	±6.23962E-6	±0E0	±1.72911E-5	±2.25785E-5	±6.34545E-2	±3.77093E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54212E0	-4.68766E0	-4.55567E0	-4.68626E0	-3.91429E0
	±0E0	±1.05956E-2	±7.62481E-3	±1.84967E-1	±9.3829E-9	±3.06727E-1	±7.62326E-3	±2.1283E-1
f_{14}	2.36423E2	1.1559E-64	1.19248E-1	1.05323E-92	1.31434E1	2.60163E2	7.77258E-1	3.01749E2
	±3.46835E1	±6.26083E-64	±3.01178E-1	±5.76878E-92	±2.25446E0	±1.15912E2	±6.99363E-2	±3.85487E1
f_{15}	-9.66015E0	-9.66015E0	-9.49268E0	-7.75107E0	-9.62469E0	-8.24895E0	-9.58014E0	-5.66686E0
	±4.50676E-16	±9.03362E-16	±1.21362E-1	±6.44443E-1	±2.10653E-2	±7.94128E-1	±9.34006E-2	±3.30664E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	4.14667E1	1.33353E3	0E0	-1.40583E3
	±0E0	±0E0	±5.04007E-1	±0E0	±8.04613E0	±3.45738E3	±0E0	±5.51431E1
f_{17}	3.56707E-16	3.05219E-120	5.6155E-72	0E0	4.02873E1	6.66667E2	2.9912E-1	3.43173E4
	±5.38706E-17	±1.67175E-119	±1.20372E-71	±0E0	±7.02861E0	±2.53708E3	±4.15172E-2	±2.35903E3
f_{18}	3.35281E-16	6.49564E-117	6.64927E-73	0E0	5.5732E0	6.16668E2	3.6756E0	4.50412E3
	±6.5218E-17	±3.55781E-116	±1.58266E-72	±0E0	±9.90095E-1	±4.82152E2	±4.82832E-1	±3.8079E2
f_{19}	8.99847E-17	8.28629E-175	4.72655E-99	0E0	4.13217E-4	3.13175E0	1.37735E-1	3.10545E1
	±2.44415E-17	±0E0	±2.35818E-98	±0E0	±1.57899E-4	±5.37256E0	±2.75808E-2	±4.70714E0
f_{20}	1.03004E-15	5.46424E-40	5.22055E-44	1.53431E-262	1.11181E1	7.3E2	1.95738E0	2.81787E33
	±7.56065E-17	±3.95141E-40	±8.21984E-44	±0E0	±1.39741E0	±2.38023E2	±1.35165E-1	±4.01109E33
f_{21}	4.56893E-25	0E0	0E0	0E0	3.06603E-55	0E0	1.50802E-11	2.20997E-7
	±7.95014E-25	±0E0	±0E0	±0E0	±8.18127E-55	±0E0	±1.98253E-11	±3.17551E-7
f_{22}	1.35624E-1	7.97325E-1	7.83541E0	2.88195E1	2.36257E2	1.10567E5	9.7731E1	2.80822E5
	±2.58484E-1	±1.62191E0	±1.81267E1	±1.01234E-1	±2.67507E2	±5.67114E4	±3.88941E1	±6.37775E4
f_{23}	2.66725E-5	6.66667E-1	6.66667E-1	7.17149E-1	1.94138E1	2.41289E4	5.84928E0	4.36214E5
	±1.16173E-4	±2.02698E-17	±8.55018E-17	±5.55727E-2	±4.40509E0	±5.25973E4	±6.80568E-1	±8.65189E4
f_{24}	0E0	0E0	2.8632E1	0E0	3.98923E1	1.25986E2	6.24846E1	3.07004E2
	±0E0	±0E0	±8.56603E0	±0E0	±3.29471E0	±2.9307E1	±5.6042E0	±1.22535E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	1.34304E0	6.04438E0	5.1516E-2	3.10267E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±5.93258E-2	±2.29166E1	±3.91987E-2	±2.34269E1
f_{26}	3.12343E-14	5.89158E-15	8.73375E-15	4.4705E-15	2.97502E0	5.71837E0	7.78557E-1	1.94165E1
	±2.85033E-15	±1.8027E-15	±1.7034E-15	±1.22834E-15	±1.62549E-1	±8.38013E0	±6.14936E-2	±1.93924E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.97299E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±7.12525E-9	±2.92377E-3
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.8617E0
	±1.12669E-16	±0E0	±0E0	±0E0	±2.17663E-16	±1.99961E-3	±6.72241E-8	±7.00984E-4
f_{29}	-3.322E0	-3.27444E0	-3.32163E0	-3.26794E0	-3.322E0	-3.24097E0	-3.29029E0	-3.19885E0
	±0E0	±5.92412E-2	±1.31857E-3	±6.06186E-2	±1.39651E-8	±8.31124E-2	±5.34746E-2	±4.389E-2
f_{30}	-1.01532E1	-1.01532E1	-5.51592E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49734E0	-6.3402E0
	±7.35129E-16	±0E0	±3.52191E0	±9.30764E-1	±7.64847E-9	±3.18774E0	±3.62977E0	±1.42299E0
f_{31}	-1.04029E1	-1.04029E1	-9.01242E0	-1.02258E1	-1.04029E1	-9.87279E0	-6.17013E0	-6.42573E0
	±8.7065E-16	±0E0	±2.91642E0	±9.70431E-1	±9.25563E-9	±1.61767E0	±3.77568E0	±1.30211E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.05364E1	-1.01775E1	-7.74608E0	-6.43344E0
	±1.29307E-15	±7.98963E-16	±2.90551E0	±1.88857E0	±2.75985E-8	±1.36607E0	±3.75216E0	±1.39411E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.98028E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±3.37E-9	±9.54573E-5
f_{34}	3E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00553E0
	±4.62024E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±1.48134E-7	±5.88191E-3
f_{35}	6.70083E-2	9.65442E-2	9.6847E-2	9.65442E-2	9.98733E-2	8.98861E-2	9.08783E-2	1.46475E0
	±4.40701E-2	±1.82343E-2	±1.16924E-2	±1.82343E-2	±1.66049E-11	±3.0474E-2	±1.93192E-2	±2.87226E-1
f_{36}	9.34579E-2	9.98733E-2	9.98733E-2	9.98733E-2	9.69507E-2	9.98733E-2	9.96566E-2	2.13105E0
	±2.4415E-2	±9.38958E-13	±2.26709E-11	±0E0	±1.60081E-2	±2.53373E-18	±8.78494E-4	±4.41078E-1

Table 3: Averages and standard deviations for Thirty-six benchmark problems with 500.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	2.80884E-7	0E0	0E0	0E0	0E0	0E0	2.48291E-7	9.06951E-5
	±3.35781E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±1.99756E-7	±7.80528E-5
f_2	-9.99952E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.56848E-1
	±1.35715E-4	±0E0	±0E0	±0E0	±0E0	±0E0	±1.2547E-10	±3.78807E-2
f_3	1.34138E-6	0E0	0E0	0E0	1.35021E-41	0E0	2.55216E-9	2.78494E-5
	±2.31447E-6	±0E0	±0E0	±0E0	±1.68859E-41	±0E0	±2.35122E-9	±2.73274E-5
f_4	0E0	0E0	0E0	0E0	0E0	0E0	1.54115E-9	3.18495E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.9323E-9	±1.78524E-1
f_5	2.99662E-17	0E0	0E0	0E0	0E0	0E0	4.7417E-9	6.94096E-4
	±4.62482E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±5.72791E-9	±5.08044E-4
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80118E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±3.43725E-9	±1.18125E-4
f_7	0E0	0E0	0E0	0E0	0E0	0E0	0E0	4.73094E-6
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.182E-5
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03148E0
	±5.63345E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±4.33564E-10	±2.0744E-4
f_9	0E0	0E0	0E0	0E0	0E0	0E0	1.15721E-9	2.06366E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.5563E-9	±1.03374E-1
f_{10}	1.0229E-7	0E0	0E0	0E0	0E0	0E0	1.91495E-7	1.3892E-1
	±1.73501E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±1.45811E-7	±8.6492E-2
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86701E2
	±1.1563E-14	±1.44216E-14	±1.29856E-13	±2.20575E-14	±1.31062E-14	±2.76601E-14	±1.85313E-7	±3.30055E-2
f_{12}	1.8472E-1	0E0	5.86311E-8	0E0	2.83471E-10	7.65191E-8	8.53743E-2	6.28079E0
	±1.44512E-1	±0E0	±3.1706E-7	±0E0	±3.38781E-10	±1.17241E-7	±4.23166E-2	±2.6539E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54226E0	-4.68766E0	-4.55567E0	-4.68766E0	-4.03641E0
	±1.62158E-16	±1.05956E-2	±7.62481E-3	±1.84937E-1	±8.643E-15	±3.06727E-1	±5.18263E-6	±1.92063E-1
f_{14}	2.06648E2	3.22496E-113	1.62471E-6	7.73306E-184	1.18133E0	2.50684E2	6.4082E-1	2.89252E2
	±3.40646E1	±1.21168E-112	±3.59209E-6	±0E0	±2.67873E-1	±1.19983E2	±8.28264E-2	±3.12786E1
f_{15}	-9.66015E0	-9.66015E0	-9.49616E0	-7.88266E0	-9.63996E0	-8.26123E0	-9.60221E0	-5.78341E0
	±6.73326E-16	±7.98963E-16	±1.18847E-1	±6.24721E-1	±2.18664E-2	±7.90216E-1	±8.79466E-2	±2.89081E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33333E3	0E0	-1.44567E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45746E3	±0E0	±5.9479E1
f_{17}	3.37925E-16	8.44744E-176	3.67237E-122	0E0	4.63596E-1	6.66667E2	2.65892E-1	3.26057E4
	±5.32868E-17	±0E0	±1.08591E-121	±0E0	±9.55689E-2	±2.53708E3	±3.13303E-2	±2.39624E3
f_{18}	3.06168E-16	2.39188E-170	1.04711E-123	0E0	5.72763E-2	6.16667E2	3.33205E0	4.39887E3
	±5.53599E-17	±0E0	±3.77003E-123	±0E0	±1.43182E-2	±4.82153E2	±3.45142E-1	±3.20973E2
f_{19}	7.57925E-17	1.88256E-268	1.15292E-163	0E0	3.07961E-7	3.13175E0	1.10588E-1	2.97459E1
	±1.78395E-17	±0E0	±0E0	±0E0	±2.11456E-7	±5.37256E0	±2.16045E-2	±4.80876E0
f_{20}	1.02473E-15	2.39322E-68	1.51444E-75	2.5654E-319	7.05393E-1	7.3E2	1.79798E0	1.71977E33
	±7.11435E-17	±1.93759E-68	±2.72074E-75	±0E0	±7.04322E-2	±2.38023E2	±1.17346E-1	±3.15681E33
f_{21}	2.12993E-25	0E0	0E0	0E0	1.27732E-90	0E0	7.12375E-12	1.1227E-7
	±3.2404E-25	±0E0	±0E0	±0E0	±2.574E-90	±0E0	±1.18642E-11	±2.02115E-7
f_{22}	1.08121E-1	7.97325E-1	2.26261E0	2.88171E1	9.64095E1	1.1056E5	9.08744E1	2.68021E5
	±1.87387E-1	±1.62191E0	±3.92976E0	±1.03006E-1	±2.26221E1	±5.67132E4	±3.78164E1	±5.40261E4
f_{23}	2.40513E-7	6.66667E-1	6.66667E-1	7.17149E-1	1.91284E0	2.41282E4	5.0026E0	4.16953E5
	±8.30419E-7	±2.02698E-17	±6.06928E-17	±5.55727E-2	±7.54942E-1	±5.25973E4	±6.0732E-1	±8.75889E4
f_{24}	0E0	0E0	2.76861E1	0E0	1.03951E1	1.11232E2	5.76929E1	3.02179E2
	±0E0	±0E0	±7.73535E0	±0E0	±2.48218E0	±3.04576E1	±6.11872E0	±1.08895E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	5.11957E-1	6.04112E0	4.87796E-2	2.98117E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±7.03374E-2	±2.29175E1	±3.80065E-2	±2.37493E1
f_{26}	3.005E-14	5.29946E-15	7.54952E-15	4.35207E-15	1.6336E-1	5.69108E0	7.01274E-1	1.93562E1
	±2.52654E-15	±1.7413E-15	±1.61598E-15	±1.08403E-15	±2.10016E-2	±8.36028E0	±7.11575E-2	±1.8776E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.98419E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.60252E-9	±1.26607E-3
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86201E0
	±8.10792E-17	±0E0	±0E0	±0E0	±0E0	±1.99961E-3	±2.33731E-8	±4.80966E-4
f_{29}	-3.322E0	-3.27444E0	-3.32168E0	-3.26823E0	-3.322E0	-3.24097E0	-3.29029E0	-3.21536E0
	±0E0	±5.92412E-2	±1.2057E-3	±6.08649E-2	±1.61637E-13	±8.31124E-2	±5.34755E-2	±4.06683E-2
f_{30}	-1.01532E1	-1.01532E1	-5.51592E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49734E0	-6.8551E0
	±4.50676E-16	±0E0	±3.52191E0	±9.30764E-1	±9.78526E-16	±3.18774E0	±3.62977E0	±1.22835E0
f_{31}	-1.04029E1	-1.04029E1	-9.04433E0	-1.02258E1	-1.04029E1	-9.87279E0	-6.17013E0	-6.93948E0
	±7.64159E-16	±0E0	±2.89816E0	±9.70431E-1	±1.59793E-15	±1.61767E0	±3.77568E0	±1.35682E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.05364E1	-1.01775E1	-7.74608E0	-7.02982E0
	±8.60173E-16	±8.95296E-16	±2.90551E0	±1.88857E0	±1.03614E-15	±1.36607E0	±3.75216E0	±1.2095E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97983E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±5.52687E-10	±8.47094E-5
f_{34}	3E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00362E0
	±2.14299E-9	±0E0	±0E0	±0E0	±0E0	±0E0	±3.17726E-8	±3.82281E-3
f_{35}	4.74686E-2	9.65442E-2	9.16499E-2	9.32151E-2	9.68797E-2	8.9886E-2	8.22912E-2	1.30435E0
	±4.44608E-2	±1.82343E-2	±2.27575E-2	±2.53387E-2	±1.56472E-2	±3.04742E-2	±2.67134E-2	±2.70263E-1
f_{36}	9.06155E-2	9.98733E-2	9.98733E-2	9.98733E-2	9.67609E-2	9.98733E-2	9.96566E-2	1.97406E0
	±2.82973E-2	±9.38958E-13	±1.49272E-11	±0E0	±1.70476E-2	±2.53373E-18	±8.78494E-4	±4.10539E-1

Table 4: Averages and standard deviations for Thirty-six benchmark problems with 2.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.93056E-6	0E0	0E0	0E0	0E0	0E0	4.20804E-4	2.78964E-2
	±2.04184E-6	±0E0	±0E0	±0E0	±0E0	±0E0	±4.72581E-4	±2.56014E-2
f_2	-9.96209E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-4.77167E-1	-7.46811E-2
	±6.90499E-3	±0E0	±0E0	±0E0	±0E0	±0E0	±4.9652E-1	±1.93322E-1
f_3	1.78334E-5	2.91057E-284	2.44251E-286	0E0	1.25542E-80	6.17397E-84	1.85858E-4	7.31256E-3
	±3.66134E-5	±0E0	±0E0	±0E0	±1.54219E-80	±1.54846E-83	±7.39723E-4	±7.1915E-3
f_4	0E0	0E0	0E0	0E0	0E0	0E0	1.51672E-1	1.26167E1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±8.23211E-1	±1.58045E1
f_5	3.47188E-14	0E0	0E0	0E0	0E0	0E0	1.89976E-4	1.98901E-1
	±1.75E-13	±0E0	±0E0	±0E0	±0E0	±0E0	±2.72772E-4	±1.85782E-1
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80096E0	-1.75298E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±5.21598E-4	±3.58716E-2
f_7	0E0	0E0	0E0	0E0	0E0	0E0	1.41678E-1	1.70678E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.7011E-1	±1.02395E-1
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03157E0	-9.80211E-1
	±1.10639E-16	±0E0	±0E0	±0E0	±0E0	±0E0	±6.77912E-5	±4.34183E-2
f_9	0E0	0E0	0E0	0E0	0E0	0E0	6.11899E-1	1.33411E1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.69377E0	±1.30562E1
f_{10}	1.44256E-6	0E0	0E0	0E0	0E0	0E0	5.94978E-3	1.14142E1
	±2.16808E-6	±0E0	±0E0	±0E0	±0E0	±0E0	±2.50011E-2	±9.55429E0
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86706E2	-1.76831E2
	±1.07732E-14	±1.69383E-14	±2.36164E-11	±2.13081E-14	±1.22265E-14	±2.32262E-14	±2.79093E-2	±1.31343E1
f_{12}	6.08171E-1	0E0	2.0903E-3	0E0	3.07563E-22	3.73226E-3	6.9376E0	1.45099E2
	±5.03955E-1	±0E0	±4.97352E-3	±0E0	±7.93029E-22	±5.29465E-3	±1.26627E1	±1.0607E2
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54054E0	-4.68766E0	-4.55567E0	-4.5328E0	-2.90477E0
	±1.62158E-16	±1.05956E-2	±7.62481E-3	±1.85369E-1	±3.99482E-16	±3.06727E-1	±7.83473E-2	±2.21829E-1
f_{14}	2.98001E2	4.79622E-19	5.86044E1	5.28697E-60	3.58118E-3	3.18772E2	3.38398E2	9.42608E3
	±4.03708E1	±2.37125E-18	±1.91352E1	±2.89579E-59	±1.15946E-3	±1.09242E2	±5.62602E1	±3.0541E4
f_{15}	-9.66015E0	-9.66015E0	-9.46753E0	-7.723E0	-9.64002E0	-8.21481E0	-7.6554E0	-4.36336E0
	±3.48962E-12	±6.73326E-16	±1.53567E-1	±6.41586E-1	±2.18608E-2	±7.81092E-1	±3.5483E-1	±3.27595E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.35513E3	1.7244E3	-1.07817E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45384E3	±5.37113E2	±1.0347E2
f_{17}	4.25068E-16	5.2517E-62	1.11832E-21	0E0	6.37852E-6	6.74478E2	1.69947E3	4.93448E4
	±8.66061E-17	±2.87574E-61	±1.60262E-21	±0E0	±2.1748E-6	±2.53629E3	±4.33026E2	±3.99058E3
f_{18}	3.97096E-16	7.97741E-62	1.15783E-22	0E0	9.492E-7	6.30586E2	6.35204E1	6.77379E3
	±6.3762E-17	±4.36932E-61	±1.53037E-22	±0E0	±3.21888E-7	±4.82843E2	±1.86746E1	±6.95587E2
f_{19}	1.24185E-16	8.01885E-79	9.84712E-33	0E0	1.40339E-14	3.13431E0	2.98884E0	6.16682E1
	±2.9789E-17	±4.37811E-78	±2.98627E-32	±0E0	±1.09766E-14	±5.37155E0	±9.15548E-1	±9.468E0
f_{20}	6.87922E-14	9.67094E-12	3.06088E-12	4.5984E-174	8.88994E-4	1.68509E6	1.57859E2	2.54783E38
	±2.86633E-14	±4.94385E-12	±6.84783E-12	±0E0	±1.19202E-4	±9.22494E6	±5.52176E1	±6.41564E38
f_{21}	8.36169E-24	0E0	0E0	0E0	8.32775E-176	9.18626E-137	1.01188E-6	4.3922E-3
	±1.34414E-23	±0E0	±0E0	±0E0	±0E0	±4.32973E-136	±2.18912E-6	±7.83882E-3
f_{22}	4.38082E-1	7.97325E-1	2.18563E1	2.88241E1	2.86691E1	1.107E5	1.31389E3	6.81447E5
	±4.96995E-1	±1.62191E0	±2.99142E1	±8.81054E-2	±1.71778E1	±5.66657E4	±4.05118E2	±1.31922E5
f_{23}	3.10407E-2	6.66667E-1	6.78789E-1	7.17149E-1	6.83807E-1	2.4162E4	5.42436E2	9.53274E5
	±1.22118E-1	±5.11961E-17	±6.63947E-2	±5.55727E-2	±6.18316E-2	±5.25871E4	±2.81213E2	±1.79674E5
f_{24}	2.84217E-14	0E0	3.22789E1	0E0	7.44533E-1	1.70013E2	1.71928E2	3.709E2
	±3.57956E-14	±0E0	±1.42547E1	±0E0	±6.42161E-1	±2.69804E1	±1.28965E1	±1.78135E1
f_{25}	2.46547E-4	2.46535E-4	5.73635E-3	0E0	1.76234E-5	7.06326E0	1.77621E1	4.34267E2
	±1.35038E-3	±1.35033E-3	±1.1988E-2	±0E0	±6.69164E-6	±2.28211E1	±4.49758E0	±3.41597E1
f_{26}	5.74563E-13	7.07582E-15	6.44519E-12	4.58892E-15	4.56931E-4	7.36458E0	8.28621E0	2.01594E1
	±2.48402E-13	±1.22834E-15	±2.97232E-12	±1.34665E-15	±7.37661E-5	±7.42052E0	±9.0899E-1	±1.73812E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.86777E-1	-9.37032E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.12924E-2	±1.48545E-2
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86199E0	-3.83721E0
	±2.23824E-16	±0E0	±0E0	±0E0	±0E0	±1.99961E-3	±7.33142E-4	±1.69965E-2
f_{29}	-3.322E0	-3.27444E0	-3.32152E0	-3.26773E0	-3.322E0	-3.24097E0	-3.1771E0	-2.86853E0
	±1.80672E-16	±5.92412E-2	±1.68979E-3	±6.04807E-2	±0E0	±8.31124E-2	±7.28783E-2	±1.5204E-1
f_{30}	-1.01532E1	-1.01532E1	-5.40418E0	-9.98327E0	-1.01532E1	-6.13908E0	-5.45549E0	-2.23799E0
	±5.42758E-10	±0E0	±3.47842E0	±9.30764E-1	±0E0	±3.2573E0	±3.58362E0	±8.20131E-1
f_{31}	-1.04029E1	-1.04029E1	-8.68484E0	-1.02258E1	-1.04029E1	-9.87278E0	-5.91286E0	-2.30363E0
	±1.05177E-15	±4.50676E-16	±3.13807E0	±9.70431E-1	±0E0	±1.61767E0	±3.65766E0	±6.94009E-1
f_{32}	-1.05363E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.05364E1	-9.99875E0	-7.66104E0	-2.21453E0
	±4.89476E-4	±4.50676E-16	±2.90551E0	±1.88857E0	±0E0	±1.64057E0	±3.69159E0	±6.08353E-1
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97925E-1	4.20893E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.55255E-5	±1.78542E-2
f_{34}	3.00018E0	3E0	3E0	3E0	3E0	3E0	3.00383E0	3.80503E0
	±5.43727E-4	±0E0	±0E0	±0E0	±0E0	±2.53729E-16	±5.53623E-3	±7.1302E-1
f_{35}	8.90008E-2	9.98733E-2	9.98733E-2	9.65442E-2	7.72212E-2	9.98733E-2	9.01937E-1	3.71609E0
	±2.9892E-2	±3.98632E-12	±4.93967E-10	±1.82343E-2	±4.1772E-2	±4.05396E-17	±3.33242E-1	±6.58918E-1
f_{36}	1.03207E-1	9.98733E-2	9.98733E-2	9.98733E-2	9.65759E-2	9.98733E-2	1.3571E0	4.5866E0
	±1.82573E-2	±1.33691E-11	±3.68435E-10	±0E0	±1.80606E-2	±2.53373E-18	±4.62228E-1	±8.84717E-1

Table 5: Averages and standard deviations for Thirty-six benchmark problems with 6.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	3.99152E-7	0E0	0E0	0E0	0E0	0E0	1.16899E-4	9.56718E-3
	±3.79516E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±1.58902E-4	±8.722E-3
f_2	-9.99829E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-8.6665E-1	-2.55604E-1
	±3.29757E-4	±0E0	±0E0	±0E0	±0E0	±0E0	±3.45739E-1	±3.2395E-1
f_3	2.32024E-6	0E0	0E0	0E0	1.25542E-80	3.79154E-228	4.55082E-6	2.67334E-3
	±3.01408E-6	±0E0	±0E0	±0E0	±1.54219E-80	±0E0	±8.79026E-6	±1.91347E-3
f_4	0E0	0E0	0E0	0E0	0E0	0E0	1.86846E-5	3.25486E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.50928E-5	±2.33766E0
f_5	6.62291E-17	0E0	0E0	0E0	0E0	0E0	2.97207E-5	5.48471E-2
	±1.60415E-16	±0E0	±0E0	±0E0	±0E0	±0E0	±4.90338E-5	±6.7157E-2
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80129E0	-1.78842E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.70249E-5	±1.14123E-2
f_7	0E0	0E0	0E0	0E0	0E0	0E0	2.38459E-2	9.00041E-2
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±7.98525E-2	±8.68108E-2
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03162E0	-1.01933E0
	±9.03362E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.84568E-5	±8.50494E-3
f_9	0E0	0E0	0E0	0E0	0E0	0E0	1.75823E-5	3.91122E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.42889E-5	±4.52711E0
f_{10}	1.85049E-7	0E0	0E0	0E0	0E0	0E0	2.57412E-4	5.03487E0
	±3.30486E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±4.81273E-4	±4.30796E0
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.8673E2	-1.84515E2
	±8.67228E-15	±1.44216E-14	±1.38623E-13	±2.3306E-14	±1.22265E-14	±2.28026E-14	±1.58432E-3	±1.85892E0
f_{12}	2.07915E-1	0E0	2.04212E-6	0E0	3.07563E-22	1.40659E-5	1.48943E0	8.09883E1
	±1.64254E-1	±0E0	±6.23699E-6	±0E0	±7.93029E-22	±2.25792E-5	±1.69424E0	±4.85105E1
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54236E0	-4.68766E0	-4.55567E0	-4.64643E0	-3.23994E0
	±0E0	±1.05956E-2	±7.62481E-3	±1.8491E-1	±3.99482E-16	±3.06727E-1	±4.1748E-2	±1.63777E-1
f_{14}	2.36423E2	1.03554E-64	1.19217E-1	1.97775E-225	3.58118E-3	2.60163E2	2.60583E2	6.32962E2
	±3.46835E1	±5.60582E-64	±3.0119E-1	±0E0	±1.15946E-3	±1.15912E2	±5.81173E1	±2.45713E2
f_{15}	-9.66015E0	-9.66015E0	-9.49268E0	-7.9271E0	-9.64002E0	-8.24895E0	-8.6368E0	-4.65046E0
	±4.50676E-16	±9.03362E-16	±1.21362E-1	±6.16012E-1	±2.18608E-2	±7.94128E-1	±2.78152E-1	±3.33664E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33353E3	4.35E1	-1.13363E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45738E3	±2.77299E1	±7.66503E1
f_{17}	3.56707E-16	3.04047E-120	5.31063E-72	0E0	6.37852E-6	6.66667E2	2.1506E1	4.51838E4
	±5.38706E-17	±1.66533E-119	±1.15748E-71	±0E0	±2.1748E-6	±2.53708E3	±2.23148E1	±3.82797E3
f_{18}	3.35281E-16	6.49564E-117	6.28641E-73	0E0	9.4912E-7	6.16668E2	1.46955E1	6.12534E3
	±6.5218E-17	±3.55781E-116	±1.4669E-72	±0E0	±3.21888E-7	±4.82152E2	±2.29496E0	±6.34448E2
f_{19}	8.99847E-17	5.95126E-175	4.72423E-99	0E0	1.40339E-14	3.13175E0	1.0994E0	5.12697E1
	±2.44415E-17	±0E0	±2.35822E-98	±0E0	±1.09766E-14	±5.37256E0	±2.33326E-1	±9.7271E0
f_{20}	1.03004E-15	5.30001E-40	5.05945E-44	2.13303E-319	8.88994E-4	7.3E2	2.61327E1	1.28288E37
	±7.56065E-17	±3.93729E-40	±8.01377E-44	±0E0	±1.19202E-4	±2.38023E2	±1.98037E1	±1.93915E37
f_{21}	4.56893E-25	0E0	0E0	0E0	8.32775E-176	0E0	4.40753E-8	6.50022E-4
	±7.95014E-25	±0E0	±0E0	±0E0	±0E0	±0E0	±8.89088E-8	±1.02359E-3
f_{22}	1.35624E-1	7.97325E-1	7.83374E0	2.88159E1	2.86691E1	1.10567E5	3.28663E2	5.56634E5
	±2.58484E-1	±1.62191E0	±1.81221E1	±1.03746E-1	±1.71778E1	±5.67114E4	±1.28074E2	±1.29654E5
f_{23}	2.66725E-5	6.66667E-1	6.66667E-1	7.17149E-1	6.83807E-1	2.41289E4	3.19725E1	7.95749E5
	±1.16173E-4	±2.02698E-17	±8.55018E-17	±5.55727E-2	±6.18316E-2	±5.25973E4	±9.89824E0	±1.58032E5
f_{24}	0E0	0E0	2.8632E1	0E0	7.44533E-1	1.25985E2	1.3413E2	3.53231E2
	±0E0	±0E0	±8.56603E0	±0E0	±6.42161E-1	±2.93068E1	±9.6981E0	±1.54284E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	1.76234E-5	6.04438E0	3.37305E0	3.96561E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±6.69164E-6	±2.29166E1	±8.40074E-1	±4.02002E1
f_{26}	3.12343E-14	5.89158E-15	8.73375E-15	4.35207E-15	4.56931E-4	5.71837E0	1.85641E0	2.002E1
	±2.85033E-15	±1.8027E-15	±1.7034E-15	±1.08403E-15	±7.37661E-5	±8.38013E0	±1.55167E-1	±2.17093E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.99929E-1	-9.50574E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.01175E-4	±2.17969E-2
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86269E0	-3.8501E0
	±1.12669E-16	±0E0	±0E0	±0E0	±0E0	±1.99961E-3	±1.13116E-4	±8.05986E-3
f_{29}	-3.322E0	-3.27444E0	-3.32163E0	-3.26824E0	-3.322E0	-3.24097E0	-3.27068E0	-2.9602E0
	±0E0	±5.92412E-2	±1.31857E-3	±6.08679E-2	±0E0	±8.31124E-2	±4.62318E-2	±1.03924E-1
f_{30}	-1.01532E1	-1.01532E1	-5.51592E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49585E0	-2.94646E0
	±7.35129E-16	±0E0	±3.52191E0	±9.30764E-1	±0E0	±3.18774E0	±3.62833E0	±1.04775E0
f_{31}	-1.04029E1	-1.04029E1	-9.01242E0	-1.02258E1	-1.04029E1	-9.87279E0	-5.95835E0	-3.18474E0
	±8.7065E-16	±0E0	±2.91642E0	±9.70431E-1	±0E0	±1.61767E0	±3.70494E0	±1.04661E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.05364E1	-1.01775E1	-7.74006E0	-2.63661E0
	±1.29307E-15	±7.98963E-16	±2.90551E0	±1.88857E0	±0E0	±1.36607E0	±3.74768E0	±4.89499E-1
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97889E-1	4.04967E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.10243E-6	±6.44574E-3
f_{34}	3E0	3E0	3E0	3E0	3E0	3E0	3.00024E0	3.32937E0
	±2.23646E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±2.33538E-4	±3.20771E-1
f_{35}	6.66666E-2	9.65442E-2	9.6847E-2	9.32151E-2	7.72212E-2	8.98861E-2	4.93312E-1	2.89585E0
	±4.45125E-2	±1.82343E-2	±1.16924E-2	±2.53387E-2	±3.0474E-2	±2.02925E-1	±2.09925E-1	±7.33744E-1
f_{36}	9.34579E-2	9.98733E-2	9.98733E-2	9.98733E-2	9.65759E-2	9.98733E-2	7.02107E-1	3.85228E0
	±2.4415E-2	±9.38958E-13	±2.26709E-11	±0E0	±1.80606E-2	±2.53373E-18	±3.80737E-1	±5.44903E-1

Table 6: Averages and standard deviations for Thirty-six benchmark problems with 10.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	2.80884E-7	0E0	0E0	0E0	0E0	0E0	5.22981E-5	4.69944E-3
	±3.35781E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±5.67097E-5	±4.25902E-3
f_2	-9.99952E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-9.66188E-1	-3.1176E-1
	±1.35715E-4	±0E0	±0E0	±0E0	±0E0	±0E0	±1.82503E-1	±3.22936E-1
f_3	1.34138E-6	0E0	0E0	0E0	1.25542E-80	0E0	2.05941E-6	1.42874E-3
	±2.31447E-6	±0E0	±0E0	±0E0	±1.54219E-80	±0E0	±2.96627E-6	±1.30063E-3
f_4	0E0	0E0	0E0	0E0	0E0	0E0	7.11283E-6	2.19936E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.37428E-5	±1.43433E0
f_5	2.99662E-17	0E0	0E0	0E0	0E0	0E0	1.07369E-5	2.91202E-2
	±4.62482E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.96857E-5	±2.73215E-2
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.79221E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±6.57274E-6	±8.05412E-3
f_7	0E0	0E0	0E0	0E0	0E0	0E0	9.40463E-4	5.32826E-2
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±7.81017E-4	±6.1833E-2
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.02402E0
	±5.63345E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.44063E-6	±6.14459E-3
f_9	0E0	0E0	0E0	0E0	0E0	0E0	4.93077E-6	1.77117E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±5.1279E-6	±1.83689E0
f_{10}	1.0229E-7	0E0	0E0	0E0	0E0	0E0	1.07445E-4	2.30129E0
	±1.73501E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±2.50598E-4	±2.00281E0
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.85699E2
	±1.1563E-14	±1.44216E-14	±1.29856E-13	±2.32262E-14	±1.22265E-14	±2.76601E-14	±3.02589E-4	±7.08757E-1
f_{12}	1.8472E-1	0E0	5.86283E-8	0E0	3.07563E-22	7.62137E-8	1.36326E0	6.22678E1
	±1.44512E-1	±0E0	±3.17061E-7	±0E0	±7.93029E-22	±1.17203E-7	±1.64249E0	±3.86777E1
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54242E0	-4.68766E0	-4.55567E0	-4.66369E0	-3.32057E0
	±1.62158E-16	±1.05956E-2	±7.62481E-3	±1.84905E-1	±3.99482E-16	±3.06727E-1	±3.92544E-2	±1.3914E-1
f_{14}	2.06648E2	3.15747E-113	1.62466E-6	0E0	3.58118E-3	2.50684E2	2.0893E2	4.84805E2
	±3.40646E1	±1.18643E-112	±3.59211E-6	±0E0	±1.15946E-3	±1.19983E2	±4.23994E1	±1.12231E2
f_{15}	-9.66015E0	-9.66015E0	-9.49616E0	-8.02075E0	-9.64002E0	-8.26123E0	-8.90263E0	-4.7947E0
	±6.73326E-16	±7.98963E-16	±1.18847E-1	±6.44323E-1	±2.18608E-2	±7.90216E-1	±2.25139E-1	±3.22078E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33333E3	0E0	-1.1931E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45746E3	±0E0	±8.7747E1
f_{17}	3.37925E-16	8.44742E-176	3.19731E-122	0E0	6.37852E-6	6.66667E2	1.0686E0	4.35608E4
	±5.32868E-17	±0E0	±9.00427E-122	±0E0	±2.1748E-6	±2.53708E3	±1.61374E-1	±3.26683E3
f_{18}	3.06168E-16	2.19998E-170	1.03305E-123	0E0	9.4912E-7	6.16667E2	1.12965E1	5.8984E3
	±5.53599E-17	±0E0	±3.76979E-123	±0E0	±3.21888E-7	±4.82153E2	±1.32062E0	±5.93683E2
f_{19}	7.57925E-17	1.88255E-268	1.15285E-163	0E0	1.40339E-14	3.13175E0	7.14926E-1	4.82419E1
	±1.78395E-17	±0E0	±0E0	±0E0	±1.09766E-14	±5.37256E0	±1.8475E-1	±8.56777E0
f_{20}	1.02473E-15	2.30965E-68	1.49142E-75	4.3784E-320	8.88994E-4	7.3E2	5.25295E0	8.07196E36
	±7.11435E-17	±1.87484E-68	±2.7222E-75	±0E0	±1.19202E-4	±2.38023E2	±1.85197E0	±1.77479E37
f_{21}	2.12993E-25	0E0	0E0	0E0	8.32775E-176	0E0	1.772E-8	1.88313E-4
	±3.2404E-25	±0E0	±0E0	±0E0	±0E0	±0E0	±3.44907E-8	±3.60855E-4
f_{22}	1.08121E1	7.97325E-1	2.26204E0	2.88109E1	2.86691E1	1.1056E5	2.39929E2	5.05329E5
	±1.87387E-1	±1.62191E0	±3.9287E0	±1.09302E-1	±1.71778E1	±5.67132E4	±1.00135E2	±1.104E5
f_{23}	2.40513E-7	6.66667E-1	6.66667E-1	7.17149E-1	6.83807E-1	2.41282E4	2.23795E1	7.54917E5
	±8.30419E-7	±2.02698E-17	±6.06928E-17	±5.55727E-2	±6.18316E-2	±5.25973E4	±7.63432E0	±1.58449E5
f_{24}	0E0	0E0	2.76861E1	0E0	7.44533E-1	1.11232E2	1.21413E2	3.47599E2
	±0E0	±0E0	±7.73535E0	±0E0	±6.42161E-1	±3.04578E1	±7.95741E0	±1.39765E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	1.76234E-5	6.04112E0	1.47276E0	3.84815E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±6.69164E-6	±2.29175E1	±2.47403E-1	±4.53254E1
f_{26}	3.005E-14	5.29946E-15	7.54952E-15	4.35207E-15	4.56931E-14	5.69107E0	1.51971E0	1.98968E1
	±2.52654E-15	±1.7413E-15	±1.61598E-15	±1.08403E-15	±7.37661E-15	±8.36028E0	±1.08486E-1	±2.44291E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.99989E-1	-9.5624E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.46119E-5	±2.30865E-2
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86274E0	-3.85244E0
	±8.10792E-17	±0E0	±0E0	±0E0	±0E0	±1.99961E-3	±1.0184E-4	±6.30159E-3
f_{29}	-3.322E0	-3.27444E0	-3.32168E0	-3.26855E0	-3.322E0	-3.24097E0	-3.28125E0	-2.99537E0
	±0E0	±5.92412E-2	±1.2057E-3	±6.10998E-2	±0E0	±8.31124E-2	±4.9218E-2	±9.42146E-2
f_{30}	-1.01532E1	-1.01532E1	-5.51592E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49703E0	-3.0836E0
	±4.50676E-16	±0E0	±3.52191E0	±9.30764E-1	±0E0	±3.18774E0	±3.62952E0	±1.04358E0
f_{31}	-1.04029E1	-1.04029E1	-9.04433E0	-1.02258E1	-1.04029E1	-9.87279E0	-5.95963E0	-3.4398E0
	±7.64159E-16	±0E0	±2.89816E0	±9.70431E-1	±0E0	±1.61767E0	±3.70623E0	±9.74935E-1
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00543E1	-1.05364E1	-1.01775E1	-7.74505E0	-3.01426E0
	±8.60173E-16	±8.95296E-16	±2.90551E0	±1.84008E0	±0E0	±1.36607E0	±3.75141E0	±5.36907E-1
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97888E-1	4.02918E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.46189E-7	±4.22376E-3
f_{34}	3E0	3E0	3E0	3E0	3E0	3E0	3.00008E0	3.1771E0
	±2.14299E-9	±0E0	±0E0	±0E0	±0E0	±0E0	±1.20535E-4	±1.61276E-1
f_{35}	4.74686E-2	9.65442E-2	9.16499E-2	9.32151E-2	7.72212E-2	8.9886E-2	2.57281E-1	2.67584E0
	±4.44608E-2	±1.82343E-2	±2.27575E-2	±2.53387E-2	±4.1772E-2	±3.04742E-2	±1.47229E-1	±6.00166E-1
f_{36}	9.06155E-2	9.98733E-2	9.98733E-2	9.98733E-2	9.65759E-2	9.98733E-2	4.07428E-1	3.55954E0
	±2.82973E-2	±9.38958E-13	±1.49272E-11	±0E0	±1.80606E-2	±2.53373E-18	±3.39426E-1	±4.66585E-1

6

Table 7: Averages and standard deviations for Thirty-six benchmark problems with 100.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.87178E-7	0E0	0E0	0E0	1.21199E-3	0E0	2.06543E-7	1.16234E-4
	±2.99666E-7	±0E0	±0E0	±0E0	±6.63834E-3	±0E0	±1.46091E-7	±1.29044E-4
f_2	-9.88218E-1	-1E0	-1E0	-1E0	-1E0	-9.99999E-1	-1E0	-9.10823E-1
	±6.40291E-2	±0E0	±0E0	±0E0	±8.68517E-7	±3.41948E-6	±3.63063E-10	±7.7394E-2
f_3	1.84452E-6	0E0	0E0	0E0	3.72331E-6	3.99531E-54	3.8728E-9	3.91297E-5
	±2.96715E-6	±0E0	±0E0	±0E0	±2.01811E-5	±2.18832E-53	±3.61477E-9	±3.55944E-5
f_4	0E0	0E0	0E0	0E0	6.57846E-5	0E0	4.17227E-9	4.3614E-1
	±0E0	±0E0	±0E0	±0E0	±3.60317E-4	±0E0	±7.59376E-9	±1.30845E-1
f_5	3.12766E-17	0E0	0E0	0E0	3.81824E-22	0E0	8.16839E-9	1.48488E-3
	±4.8206E-17	±0E0	±0E0	±0E0	±2.09134E-21	±0E0	±9.17525E-9	±1.78158E-3
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80085E0
	±8.10792E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.27235E-8	±5.23185E-4
f_7	0E0	0E0	0E0	0E0	0E0	0E0	0E0	3.8274E-4
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.12892E-3
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.02984E0	-1.03163E0	-1.03163E0	-1.03103E0
	±9.55198E-17	±0E0	±0E0	±0E0	±9.78683E-3	±0E0	±2.68308E-9	±6.48655E-4
f_9	0E0	0E0	0E0	0E0	9.76811E-15	0E0	5.94021E-9	3.56288E-1
	±0E0	±0E0	±0E0	±0E0	±5.35022E-14	±0E0	±9.58416E-9	±1.73602E-1
f_{10}	1.29441E-7	0E0	0E0	0E0	0E0	0E0	7.39342E-7	2.22093E-1
	±1.84863E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±7.75884E-7	±1.36746E-1
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86606E2
	±9.82669E-15	±1.44216E-14	±2.20005E-11	±2.43007E-14	±1.26277E-9	±2.65817E-14	±3.72384E-6	±1.2479E-1
f_{12}	2.16666E-1	0E0	1.30779E-7	0E0	2.44236E-4	9.67036E-8	1.04509E-1	7.23226E0
	±2.19496E-1	±0E0	±3.87774E-7	±0E0	±1.32514E-3	±1.39766E-7	±5.74878E-2	±3.78195E0
f_{13}	-4.68766E0	-4.67331E0	-4.68627E0	-4.54212E0	-4.68657E0	-4.55567E0	-4.68345E0	-3.74758E0
	±0E0	±6.36838E-2	±7.62481E-3	±1.84967E-1	±5.87248E-3	±3.06727E-1	±1.27356E-2	±1.79987E-1
f_{14}	2.11979E2	3.09532E-7	7.41028E-2	8.90994E-45	4.73613E0	2.76388E2	7.35239E-1	2.95647E2
	±3.68291E1	±1.69538E-6	±3.7958E-1	±4.88017E-44	±1.08338E1	±1.47336E2	±8.39476E-2	±3.71103E1
f_{15}	-9.66015E0	-9.66015E0	-9.4771E0	-7.75117E0	-9.59167E0	-8.24965E0	-9.50597E0	-5.49691E0
	±6.48634E-16	±9.01352E-16	±1.48738E-1	±6.4443E-1	±2.06122E-1	±7.88432E-1	±1.1465E-1	±3.49437E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	8.9E0	2.27117E3	0E0	-1.40583E3
	±0E0	±0E0	±5.04007E-1	±0E0	±4.80911E0	±5.97856E3	±0E0	±5.51431E1
f_{17}	3.33538E-16	2.19349E-51	4.34129E-126	8.35861E-152	1.09361E3	6.68156E2	2.6846E-1	3.26057E4
	±5.95881E-17	±1.20143E-50	±2.06284E-125	±4.53659E-151	±5.94573E3	±2.53669E3	±3.06308E-2	±2.39624E3
f_{18}	2.98799E-16	9.01666E-6	3.5302E-119	0E0	4.03391E2	6.16675E2	3.37916E0	4.39887E3
	±5.33183E-17	±4.93863E-5	±1.46627E-118	±0E0	±1.33967E3	±4.82162E2	±3.90786E-1	±3.20973E2
f_{19}	8.31192E-17	1.51605E-166	7.36214E-37	0E0	5.46548E-4	3.13175E0	2.08044E-1	3.17722E1
	±2.38275E-17	±0E0	±3.55472E-36	±0E0	±2.88038E-3	±5.37256E0	±4.76485E-2	±4.89461E0
f_{20}	1.02727E-15	8.1658E-4	7.38352E-45	1.18128E-98	1.53514E30	7.36968E2	1.79168E0	1.47646E33
	±7.3183E-17	±4.47259E-3	±4.04412E-44	±6.47012E-98	±8.40833E30	±2.40152E2	±1.58558E-1	±3.0517E33
f_{21}	2.26951E-25	0E0	0E0	0E0	1.00934E-33	0E0	1.36339E-11	2.15292E-7
	±3.22622E-25	±0E0	±0E0	±0E0	±5.52839E-33	±0E0	±1.97932E-11	±3.18208E-7
f_{22}	4.89068E0	3.55593E0	2.10646E0	2.8816E1	3.931E3	1.10558E5	9.16243E1	2.67832E5
	±2.62582E1	±1.50458E1	±3.65682E0	±1.04461E-1	±2.11271E4	±5.67159E4	±3.78311E1	±5.39579E4
f_{23}	4.02119E-3	6.66667E-1	6.66667E-1	7.17149E-1	1.98865E2	2.41286E4	5.00592E0	4.11912E5
	±2.20199E-2	±0E0	±6.06928E-17	±5.55727E-2	±7.21102E2	±5.2598E4	±6.09216E-1	±8.48489E4
f_{24}	0E0	1.99331E-12	3.03365E1	0E0	2.52177E1	1.15123E2	6.98119E1	3.15102E2
	±0E0	±1.09178E-11	±1.16989E1	±0E0	±2.36002E1	±3.11521E1	±6.39396E0	±1.33925E1
f_{25}	1.72825E-15	2.46535E-4	5.73635E-3	0E0	1.71307E0	6.08774E0	5.15203E-2	3.18298E2
	±9.466E-15	±1.35033E-3	±1.1988E-2	±0E0	±1.37548E0	±2.29058E1	±3.91717E-2	±2.57079E1
f_{26}	3.01685E-14	5.41789E-15	7.90479E-15	4.35207E-15	2.27352E0	5.69837E0	8.36406E-1	1.9548E1
	±2.55225E-15	±1.77022E-15	±1.70765E-15	±1.08403E-15	±3.9865E0	±8.35945E0	±7.90883E-2	±2.0466E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.9674E-1
	±0E0	±0E0	±0E0	±0E0	±4.05396E-17	±0E0	±8.81554E-9	±3.60236E-3
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86124E0
	±1.12669E-16	±0E0	±0E0	±0E0	±1.12669E-16	±1.99961E-3	±9.48547E-8	±9.00599E-4
f_{29}	-3.322E0	-3.27444E0	-3.32163E0	-3.26794E0	-3.322E0	-3.24097E0	-3.29028E0	-3.18162E0
	±0E0	±5.92412E-2	±1.31857E-3	±6.06364E-2	±1.7878E-8	±8.31124E-2	±5.34747E-2	±5.14526E-2
f_{30}	-1.01532E1	-1.01532E1	-5.40418E0	-9.98327E0	-9.93435E0	-6.71873E0	-5.49734E0	-5.69063E0
	±7.35129E-16	±0E0	±3.47842E0	±9.30764E-1	±1.18834E0	±3.18812E0	±3.62977E0	±1.48215E0
f_{31}	-1.04029E1	-1.04029E1	-8.91907E0	-1.02258E1	-1.03337E1	-9.87279E0	-6.17013E0	-5.67107E0
	±8.95296E-16	±0E0	±3.01061E0	±9.70431E-1	±3.79137E-1	±1.61767E0	±3.77567E0	±1.44733E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.02619E1	-1.01775E1	-7.74608E0	-6.02234E0
	±1.37859E-15	±7.98963E-16	±2.90551E0	±1.88857E0	±1.49231E0	±1.36607E0	±3.75216E0	±1.49202E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.98072E-1
	±0E0	±0E0	±0E0	±0E0	±1.07653E-9	±0E0	±3.35874E-9	±1.32948E-4
f_{34}	3.00013E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00533E0
	±6.85399E-4	±0E0	±0E0	±0E0	±1.61314E-9	±0E0	±1.34971E-7	±5.82236E-3
f_{35}	5.02559E-2	9.65442E-2	9.62937E-2	9.32151E-2	1.36557E-1	8.9886E-2	9.14309E-2	1.46475E0
	±4.50536E-2	±1.82343E-2	±1.20552E-2	±2.53387E-2	±2.00926E-1	±3.04742E-2	±1.83446E-2	±2.87226E-1
f_{36}	9.06155E-2	9.98733E-2	9.98733E-2	9.98733E-2	1.67631E-1	9.98733E-2	9.97266E-2	2.13105E0
	±2.82973E-2	±7.97749E-11	±2.26203E-11	±0E0	±3.86137E-1	±2.53373E-18	±8.03751E-4	±4.41078E-1

Table 8: Averages and standard deviations for Thirty-six benchmark problems with 300.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	8.0266E-8	0E0	0E0	0E0	1.61114E-20	0E0	6.6696E-8	4.08162E-5
	±1.0053E-7	±0E0	±0E0	±0E0	±8.82458E-20	±0E0	±4.99501E-8	±3.4569E-5
f_2	-9.88236E-1	-1E0	-1E0	-1E0	-1E0	-9.99999E-1	-1E0	-9.5759E-1
	±6.40325E-2	±0E0	±0E0	±0E0	±8.68517E-7	±3.41948E-6	±3.65525E-11	±3.74493E-2
f_3	6.11462E-7	0E0	0E0	0E0	3.72331E-6	3.99531E-54	5.44517E-10	1.32675E-5
	±2.03076E-6	±0E0	±0E0	±0E0	±2.01811E-5	±2.18832E-53	±4.38387E-10	±1.62787E-5
f_4	0E0	0E0	0E0	0E0	6.57846E-5	0E0	4.11107E-10	2.81794E-1
	±0E0	±0E0	±0E0	±0E0	±3.60317E-4	±0E0	±4.94554E-10	±1.78676E-1
f_5	1.28984E-17	0E0	0E0	0E0	0E0	0E0	1.03314E-9	3.92366E-4
	±1.89589E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.57598E-9	±2.84662E-4
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80113E0
	±8.10792E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±3.39393E-9	±1.87831E-4
f_7	0E0	0E0	0E0	0E0	0E0	0E0	0E0	8.29302E-6
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±2.55612E-5
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.02984E0	-1.03163E0	-1.03163E0	-1.0314E0
	±5.63345E-17	±0E0	±0E0	±0E0	±9.78683E-3	±0E0	±3.76832E-10	±3.05455E-4
f_9	0E0	0E0	0E0	0E0	9.76811E-15	0E0	4.83989E-10	1.8063E-1
	±0E0	±0E0	±0E0	±0E0	±5.35022E-14	±0E0	±6.53892E-10	±9.59839E-2
f_{10}	2.12216E-8	0E0	0E0	0E0	0E0	0E0	7.91715E-8	1.18991E-1
	±3.39041E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±7.16606E-8	±7.60087E-2
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86698E2
	±1.41618E-14	±1.44216E-14	±1.30938E-13	±2.32262E-14	±1.26278E-9	±2.86008E-14	±2.09114E-7	±3.40453E-2
f_{12}	1.46872E-1	0E0	8.05056E-12	0E0	2.44235E-4	5.13705E-12	4.40684E-2	4.33916E0
	±1.98613E-1	±0E0	±4.40804E-11	±0E0	±1.32514E-3	±2.61722E-11	±2.6098E-2	±2.24583E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54242E0	-4.68766E0	-4.55567E0	-4.68765E0	-3.99807E0
	±2.25338E-16	±1.05956E-2	±7.62481E-3	±1.84905E-1	±2.17741E-9	±3.06727E-1	±4.49753E-5	±2.08882E-1
f_{14}	1.65527E2	3.21136E-104	8.44994E-18	6.793E-321	4.24373E-2	2.40641E2	5.36196E-1	2.74735E2
	±3.17665E1	±1.75894E-103	±2.62367E-17	±0E0	±1.41222E-1	±1.26446E2	±8.75153E-2	±2.84117E1
f_{15}	-9.66015E0	-9.66015E0	-9.49608E0	-8.01701E0	-9.64002E0	-8.29047E0	-9.59466E0	-5.74111E0
	±8.51698E-16	±7.2269E-16	±1.18965E-1	±6.4061E-1	±2.18604E-2	±7.95536E-1	±8.93235E-2	±3.03079E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33333E3	0E0	-1.4789E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45746E3	±0E0	±5.80109E1
f_{17}	3.01252E-16	3.03972E-281	1.22706E-248	0E0	6.13495E-1	6.66667E2	2.35983E-1	3.15089E4
	±6.07838E-17	±0E0	±0E0	±0E0	±2.63915E0	±2.53708E3	±2.45349E-2	±2.61829E3
f_{18}	2.80337E-16	2.31993E-282	9.42761E-251	0E0	9.13597E-3	6.16667E2	2.82874E0	4.12515E3
	±5.42648E-17	±0E0	±0E0	±0E0	±2.66594E-2	±4.82153E2	±3.55018E-1	±2.8442E2
f_{19}	6.68483E-17	3.54205E-252	7.3298E-73	0E0	2.1855E-10	3.13175E0	1.54569E-1	2.99435E1
	±1.78448E-17	±0E0	±3.89288E-72	±0E0	±4.80709E-10	±5.37256E0	±3.59121E-2	±4.94406E0
f_{20}	9.47248E-16	2.41097E-47	2.99109E-153	4.3784E-320	8.31858E-2	7.3E2	1.61748E0	6.24562E32
	±8.46238E-17	±1.32054E-46	±1.54889E-152	±0E0	±3.33264E-1	±2.38023E2	±1.21007E-1	±1.09299E33
f_{21}	6.1886E-26	0E0	0E0	0E0	1.00934E-33	0E0	1.6221E-12	1.37415E-8
	±1.07071E-26	±0E0	±0E0	±0E0	±5.52839E-33	±0E0	±3.01022E-12	±2.51931E-8
f_{22}	7.34652E-2	7.97325E-1	1.1486E0	2.88109E1	3.27662E1	1.10552E5	8.50391E1	2.50746E5
	±1.35276E-1	±1.62191E0	±1.90036E0	±1.09302E-1	±1.8338E1	±5.67204E4	±3.6468E1	±4.63841E4
f_{23}	9.38395E-9	6.66667E-1	6.66667E-1	7.17149E-1	7.44167E-1	2.4128E4	4.10845E0	3.69817E5
	±3.97254E-8	±0E0	±5.93951E-17	±5.55727E-2	±1.96545E-1	±5.25973E4	±6.22756E-1	±7.17718E4
f_{24}	0E0	0E0	2.75344E1	0E0	7.5359E-1	1.00453E2	5.83579E1	3.02179E2
	±0E0	±0E0	±7.73253E0	±0E0	±6.49092E-1	±3.16109E1	±5.57679E0	±1.08895E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	4.60633E-3	6.03958E0	4.59521E-2	2.99963E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±9.67593E-3	±2.29179E1	±3.72612E-2	±2.40398E1
f_{26}	2.92211E-14	4.94419E-15	7.31267E-15	4.35207E-15	1.14086E-3	5.65822E0	6.99524E-1	1.93674E1
	±2.15801E-15	±1.59793E-15	±1.59793E-15	±1.08403E-15	±2.54391E-3	±8.32582E0	±7.0609E-2	±1.98155E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.9894E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±8.78584E-10	±9.68521E-4
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86211E0
	±0E0	±0E0	±0E0	±0E0	±8.10792E-17	±1.99961E-3	±2.02538E-8	±4.45876E-4
f_{29}	-3.322E0	-3.27444E0	-3.32177E0	-3.2685E0	-3.322E0	-3.24097E0	-3.29029E0	-3.22374E0
	±0E0	±5.92412E-2	±8.12468E-4	±6.10973E-2	±3.81006E-12	±8.31124E-2	±5.34755E-2	±3.59355E-2
f_{30}	-1.01532E1	-1.01532E1	-5.51592E0	-9.98327E0	-9.936E0	-6.71945E0	-5.49734E0	-6.85792E0
	±4.50676E-16	±0E0	±3.52191E0	±9.30764E-1	±1.18861E0	±3.18774E0	±3.62977E0	±1.23095E0
f_{31}	-1.04029E1	-1.04029E1	-9.0371E0	-1.02258E1	-1.03337E1	-9.87279E0	-6.17013E0	-6.90533E0
	±6.73326E-16	±0E0	±2.90138E0	±9.70431E-1	±3.79137E-1	±1.61767E0	±3.77568E0	±1.3998E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00426E1	-1.03237E1	-1.01775E1	-7.74608E0	-6.84476E0
	±9.01352E-16	±8.95296E-16	±2.90551E0	±1.88857E0	±1.16514E0	±1.36607E0	±3.75216E0	±1.2483E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97954E-1
	±0E0	±0E0	±0E0	±0E0	±1.07653E-9	±0E0	±7.9412E-11	±5.67369E-5
f_{34}	3.00013E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00151E0
	±6.85399E-4	±0E0	±0E0	±0E0	±1.61314E-9	±0E0	±8.6365E-9	±1.35192E-3
f_{35}	3.16793E-2	9.65442E-2	8.31657E-2	9.32151E-2	1.17078E-1	8.65569E-2	6.96489E-2	1.22237E0
	±4.11374E-2	±1.82343E-2	±3.45744E-2	±2.53387E-2	±2.08375E-1	±3.45308E-2	±3.86796E-2	±2.45238E-1
f_{36}	8.09937E-2	9.98733E-2	9.98733E-2	9.98733E-2	1.66937E-1	9.98733E-2	9.88194E-2	1.71656E0
	±3.84585E-2	±7.98017E-11	±5.62668E-12	±0E0	±3.86427E-1	±2.53373E-18	±4.62831E-3	±4.13067E-1

Table 9: Averages and standard deviations for Thirty-six benchmark problems with 500.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	8.0266E-8	0E0	0E0	0E0	0E0	0E0	6.6696E-8	4.08162E-5
	±1.0053E-7	±0E0	±0E0	±0E0	±0E0	±0E0	±4.99501E-8	±3.4569E-5
f_2	-9.99997E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.77803E-1
	±5.35253E-6	±0E0	±0E0	±0E0	±0E0	±0E0	±2.89746E-11	±2.25403E-2
f_3	3.39482E-7	0E0	0E0	0E0	3.72331E-6	3.99531E-54	5.15681E-10	1.32675E-5
	±6.62122E-7	±0E0	±0E0	±0E0	±2.01811E-5	±2.18832E-53	±4.19494E-10	±1.62787E-5
f_4	0E0	0E0	0E0	0E0	6.57846E-5	0E0	3.02961E-10	2.18746E-1
	±0E0	±0E0	±0E0	±0E0	±3.60317E-4	±0E0	±4.25068E-10	±1.6297E-1
f_5	1.28984E-17	0E0	0E0	0E0	0E0	0E0	9.33749E-10	3.65231E-4
	±1.89589E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.25274E-9	±2.81578E-4
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80121E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.92871E-10	±9.93348E-5
f_7	0E0	0E0	0E0	0E0	0E0	0E0	0E0	1.73892E-6
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±5.36017E-6
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.02984E0	-1.03163E0	-1.03163E0	-1.03154E0
	±5.63345E-17	±0E0	±0E0	±0E0	±9.78683E-3	±0E0	±1.2593E-10	±9.11849E-5
f_9	0E0	0E0	0E0	0E0	9.76811E-15	0E0	2.70683E-10	1.44724E-1
	±0E0	±0E0	±0E0	±0E0	±5.35022E-14	±0E0	±4.35884E-10	±8.56088E-2
f_{10}	2.12216E-8	0E0	0E0	0E0	0E0	0E0	6.79403E-8	9.69389E-2
	±3.39041E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±5.96346E-8	±7.13019E-2
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86705E2
	±1.41618E-14	±1.44216E-14	±1.20618E-13	±2.32262E-14	±1.37628E-14	±2.86008E-14	±5.6808E-8	±3.01372E-2
f_{12}	1.46872E-1	0E0	8.04803E-12	0E0	2.44235E-4	5.13705E-12	4.30464E-2	4.33219E0
	±1.98613E-1	±0E0	±4.40809E-11	±0E0	±1.32514E-3	±2.61722E-11	±2.54221E-2	±2.24942E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54242E0	-4.68766E0	-4.55567E0	-4.68766E0	-4.05708E0
	±2.25338E-16	±1.05956E-2	±7.62481E-3	±1.84905E-1	±3.67565E-16	±3.06727E-1	±1.91969E-6	±1.66608E-1
f_{14}	1.60489E2	2.56634E-230	8.44994E-18	0E0	3.58118E-3	2.40561E2	5.33905E-1	2.74735E2
	±2.93857E1	±0E0	±2.62367E-17	±0E0	±1.15946E-3	±1.26423E2	±7.87096E-2	±2.84117E1
f_{15}	-9.66015E0	-9.66015E0	-9.49616E0	-8.02075E0	-9.64002E0	-8.29047E0	-9.60638E0	-5.84734E0
	±8.8511E-16	±7.2269E-16	±1.18847E-1	±6.44323E-1	±2.18608E-2	±7.95536E-1	±8.81541E-2	±2.99768E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33333E3	0E0	-1.48557E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45746E3	±0E0	±5.81613E1
f_{17}	3.00328E-16	3.4626E-312	1.22706E-248	0E0	8.85906E-5	6.66667E2	2.35983E-1	3.15089E4
	±5.95744E-17	±0E0	±0E0	±0E0	±4.50104E-4	±2.53708E3	±2.45349E-2	±2.61829E3
f_{18}	2.80337E-16	2.63566E-307	9.42761E-251	0E0	9.4912E-7	6.16667E2	2.82874E0	4.12515E3
	±5.42648E-17	±0E0	±0E0	±0E0	±3.21888E-7	±4.82153E2	±3.55018E-1	±2.8442E2
f_{19}	6.37721E-17	0E0	1.04734E-125	0E0	1.40339E-14	3.13175E0	1.22782E-1	2.76786E1
	±1.51696E-17	±0E0	±5.64979E-125	±0E0	±1.09766E-14	±5.37256E0	±2.66313E-2	±4.42249E0
f_{20}	9.41294E-16	5.51019E-139	2.99109E-153	4.3784E-320	8.88994E-4	7.3E2	1.61748E0	6.24562E32
	±8.07611E-17	±4.55809E-139	±1.54889E-152	±0E0	±1.19202E-4	±2.38023E2	±1.21007E-1	±1.09299E33
f_{21}	6.1886E-26	0E0	0E0	0E0	1.00934E-33	0E0	1.6221E-12	1.37415E-8
	±1.07071E-25	±0E0	±0E0	±0E0	±5.52839E-33	±0E0	±3.01022E-12	±2.51931E-8
f_{22}	7.33769E-2	7.97325E-1	1.1486E0	2.88109E1	2.86691E1	1.10552E5	8.50391E1	2.50746E5
	±1.35321E-1	±1.62191E0	±1.90036E0	±1.09302E-1	±1.71778E1	±5.67204E4	±3.6468E1	±4.63841E4
f_{23}	2.45995E-9	6.66667E-1	6.66667E-1	7.17149E-1	6.84112E-1	2.4128E4	4.10845E0	3.69817E5
	±1.32322E-8	±0E0	±5.93951E-17	±5.55727E-2	±6.27289E-2	±5.25973E4	±6.22756E-1	±1.77718E4
f_{24}	0E0	0E0	2.74963E1	0E0	7.44533E-1	1.00453E2	5.2589E1	2.96332E2
	±0E0	±0E0	±7.64665E0	±0E0	±6.42161E-1	±3.16109E1	±5.8763E0	±1.32535E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	1.76234E-5	6.03957E0	4.57021E-2	2.91909E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±6.69164E-6	±2.29179E1	±3.74183E-2	±2.28624E1
f_{26}	2.92211E-14	4.94419E-15	7.31267E-15	4.35207E-15	4.56931E-4	5.65822E0	6.60572E-1	1.93055E1
	±2.15801E-15	±1.59793E-15	±1.59793E-15	±1.08403E-15	±7.37661E-5	±8.32582E0	±6.69525E-2	±2.13643E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.99297E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.31776E-10	±6.99793E-4
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86233E0
	±0E0	±0E0	±0E0	±0E0	±8.10792E-17	±1.99961E-3	±7.20123E-9	±3.57789E-4
f_{29}	-3.322E0	-3.27444E0	-3.32177E0	-3.26855E0	-3.322E0	-3.24097E0	-3.29029E0	-3.23346E0
	±0E0	±5.92412E-2	±8.12468E-4	±6.11017E-2	±2.02414E-12	±8.31124E-2	±5.34754E-2	±3.47474E-2
f_{30}	-1.01532E1	-1.01532E1	-5.55601E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49734E0	-7.38684E0
	±4.50676E-16	±0E0	±3.5631E0	±9.30764E-1	±8.30316E-12	±3.18774E0	±3.62977E0	±1.32978E0
f_{31}	-1.04029E1	-1.04029E1	-9.12777E0	-1.02258E1	-1.04029E1	-9.87279E0	-6.17013E0	-7.49049E0
	±5.42017E-16	±0E0	±2.90011E0	±9.70431E-1	±4.31753E-7	±1.61767E0	±3.77568E0	±1.31956E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00543E1	-1.05364E1	-1.01775E1	-7.74608E0	-7.30773E0
	±8.7065E-16	±8.51698E-16	±2.90551E0	±1.84008E0	±4.50676E-16	±1.36607E0	±3.75216E0	±1.13693E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97947E-1
	±0E0	±0E0	±0E0	±0E0	±1.07653E-9	±0E0	±7.41339E-11	±5.82261E-5
f_{34}	3.00013E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00144E0
	±6.85399E-4	±0E0	±0E0	±0E0	±0E0	±0E0	±7.59165E-9	±1.32935E-3
f_{35}	3.01537E-2	9.65442E-2	8.17415E-2	9.32151E-2	1.17078E-1	8.65569E-2	6.24301E-2	1.17774E0
	±3.93302E-2	±1.82343E-2	±3.69659E-2	±2.53387E-2	±2.08375E-1	±3.45308E-2	±3.90515E-2	±2.43999E-1
f_{36}	8.09937E-2	9.98733E-2	9.98733E-2	9.98733E-2	1.66937E-1	9.98733E-2	9.88194E-2	1.65815E0
	±3.84585E-2	±0E0	±5.61822E-12	±0E0	±3.86427E-1	±2.53373E-18	±4.62831E-3	±3.62469E-1

9

Table 10: Averages and standard deviations for Thirty-six benchmark problems with 1.000.000 evaluations or hitting a bound.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	7.62519E-8	0E0	0E0	0E0	0E0	0E0	6.6696E-8	4.08162E-5
	±9.95558E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±4.99501E-8	±3.4569E-5
f_2	-9.99997E-1	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.77803E-1
	±5.35253E-6	±0E0	±0E0	±0E0	±0E0	±0E0	±2.89746E-11	±2.25403E-2
f_3	2.40964E-7	0E0	0E0	0E0	1.25542E-80	0E0	5.15681E-10	1.32675E-5
	±4.45425E-7	±0E0	±0E0	±0E0	±1.54219E-80	±0E0	±4.19494E-10	±1.62787E-5
f_4	0E0	0E0	0E0	0E0	0E0	0E0	3.02961E-10	2.18746E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.25068E-10	±1.6297E-1
f_5	1.26857E-17	0E0	0E0	0E0	0E0	0E0	9.33749E-10	3.65231E-4
	±1.90206E-17	±0E0	±0E0	±0E0	±0E0	±0E0	±1.25274E-9	±2.81578E-4
f_6	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.8013E0	-1.80124E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.29342E-10	±7.17784E-5
f_7	0E0	0E0	0E0	0E0	0E0	0E0	0E0	3.4292E-7
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±1.25274E-6
f_8	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03163E0	-1.03156E0
	±4.25849E-16	±4.25849E-16	±4.13973E-16	±4.50676E-16	±4.35325E-16	±4.50676E-16	±1.2593E-10	±5.35465E-5
f_9	0E0	0E0	0E0	0E0	0E0	0E0	2.70683E-10	1.4418E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.35884E-10	±8.61814E-2
f_{10}	2.12216E-8	0E0	0E0	0E0	0E0	0E0	6.59961E-8	9.69389E-2
	±3.39041E-8	±0E0	±0E0	±0E0	±0E0	±0E0	±5.98473E-8	±7.13019E-2
f_{11}	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86731E2	-1.86715E2
	±1.43247E-14	±1.44216E-14	±1.21259E-13	±2.32262E-14	±1.22265E-14	±2.86008E-14	±3.02688E-8	±1.29734E-2
f_{12}	1.15479E-1	0E0	8.04803E-12	0E0	3.07563E-22	3.48218E-13	4.30464E-2	4.33219E0
	±8.65954E-2	±0E0	±4.40809E-11	±0E0	±7.93029E-22	±6.4077E-13	±2.54221E-2	±2.24942E0
f_{13}	-4.68766E0	-4.68487E0	-4.68627E0	-4.54242E0	-4.68766E0	-4.55567E0	-4.68766E0	-4.11861E0
	±2.25338E-16	±1.05956E-2	±7.62481E-3	±1.84905E-1	±3.99482E-16	±3.06727E-1	±8.65463E-7	±1.49082E-1
f_{14}	1.60489E2	2.56634E-230	8.44994E-18	0E0	3.58118E-3	2.40561E2	5.21817E-1	2.74735E2
	±2.93857E1	±0E0	±2.62367E-17	±0E0	±1.15946E-3	±1.26423E2	±5.45327E-2	±2.84117E1
f_{15}	-9.66015E0	-9.66015E0	-9.49621E0	-8.02075E0	-9.64002E0	-8.29047E0	-9.6179E0	-5.89408E0
	±8.8511E-16	±7.2269E-16	±1.18775E-1	±6.44323E-1	±2.18608E-2	±7.95536E-1	±7.35073E-2	±2.7332E-1
f_{16}	0E0	0E0	2.33333E-1	0E0	0E0	1.33333E3	0E0	-1.48557E3
	±0E0	±0E0	±5.04007E-1	±0E0	±0E0	±3.45746E3	±0E0	±5.81613E1
f_{17}	3.00182E-16	3.4626E-312	1.22706E-248	0E0	6.37852E-6	6.66667E2	2.35983E-1	3.15089E4
	±5.93785E-17	±0E0	±0E0	±0E0	±2.1748E-6	±2.53708E3	±2.45349E-2	±2.61829E3
f_{18}	2.80337E-16	2.63566E-307	9.42761E-251	0E0	9.4912E-7	6.16667E2	2.82874E0	4.12515E3
	±5.42648E-17	±0E0	±0E0	±0E0	±3.21888E-7	±4.82153E2	±3.55018E-1	±2.8442E2
f_{19}	6.37721E-17	0E0	0E0	0E0	1.40339E-14	3.13175E0	8.16925E-2	2.66582E1
	±1.51696E-17	±0E0	±0E0	±0E0	±1.09766E-14	±5.37256E0	±1.48989E-2	±4.2015E0
f_{20}	9.41294E-16	5.51019E-139	2.99109E-153	4.3784E-320	8.88994E-4	7.3E2	1.61748E0	6.24562E32
	±8.07611E-17	±4.55809E-139	±1.54889E-152	±0E0	±1.19202E-4	±2.38023E2	±1.21007E-1	±1.09299E33
f_{21}	4.62933E-26	0E0	0E0	0E0	8.32775E-176	0E0	1.6221E-12	1.37415E-8
	±8.65982E-26	±0E0	±0E0	±0E0	±0E0	±0E0	±3.01022E-12	±2.51931E-8
f_{22}	7.33769E-2	7.97325E-1	1.1486E0	2.88109E1	2.86691E1	1.10552E5	8.50391E1	2.50746E5
	±1.35321E-1	±1.62191E0	±1.90036E0	±1.09302E-1	±1.71778E1	±5.67204E4	±3.6468E1	±4.63841E4
f_{23}	2.45995E-9	6.66667E-1	6.66667E-1	7.17149E-1	6.83807E-1	2.4128E4	4.0795E0	3.69817E5
	±1.32322E-8	±0E0	±5.93951E-17	±5.55727E-2	±6.18316E-2	±5.25973E4	±5.30115E-1	±7.71718E4
f_{24}	0E0	0E0	2.73751E1	0E0	7.44533E-1	1.00453E2	5.03657E1	2.95563E2
	±0E0	±0E0	±7.33203E0	±0E0	±6.42161E-1	±3.16109E1	±5.59835E0	±1.30952E1
f_{25}	0E0	2.46535E-4	5.73635E-3	0E0	1.76234E-5	6.03957E0	4.57021E-2	2.8654E2
	±0E0	±1.35033E-3	±1.1988E-2	±0E0	±6.69164E-6	±2.29179E1	±3.74183E-2	±2.20556E1
f_{26}	2.92211E-14	4.94419E-15	7.31267E-15	4.35207E-15	4.56931E-4	5.65822E0	6.46274E-1	1.9264E1
	±2.15801E-15	±1.59793E-15	±1.59793E-15	±1.08403E-15	±7.37661E-5	±8.32582E0	±6.37506E-2	±1.86831E-1
f_{27}	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-1E0	-9.99297E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±4.31776E-10	±6.99793E-4
f_{28}	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86278E0	-3.86226E0	-3.86278E0	-3.86233E0
	±0E0	±0E0	±0E0	±0E0	±0E0	±1.99961E-3	±7.20307E-9	±3.57789E-4
f_{29}	-3.322E0	-3.27444E0	-3.32177E0	-3.26855E0	-3.322E0	-3.24097E0	-3.29029E0	-3.23346E0
	±0E0	±5.92412E-2	±8.12468E-4	±6.10998E-2	±0E0	±8.31124E-2	±5.34754E-2	±3.47474E-2
f_{30}	-1.01532E1	-1.01532E1	-5.61061E0	-9.98327E0	-1.01532E1	-6.71945E0	-5.49734E0	-7.56249E0
	±4.50676E-16	±0E0	±3.56275E0	±9.30764E-1	±0E0	±3.18774E0	±3.62977E0	±1.34539E0
f_{31}	-1.04029E1	-1.04029E1	-9.12777E0	-1.02258E1	-1.04029E1	-9.87279E0	-6.17013E0	-7.62736E0
	±4.50676E-16	±0E0	±2.90011E0	±9.70431E-1	±0E0	±1.61767E0	±3.77568E0	±1.14284E0
f_{32}	-1.05364E1	-1.05364E1	-9.25887E0	-1.00543E1	-1.05364E1	-1.01775E1	-7.74609E0	-7.68476E0
	±8.7065E-16	±8.51698E-16	±2.90551E0	±1.84008E0	±0E0	±1.36607E0	±3.75216E0	±1.00366E0
f_{33}	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97887E-1	3.97947E-1
	±0E0	±0E0	±0E0	±0E0	±0E0	±0E0	±7.43423E-11	±5.82261E-5
f_{34}	3E0	3E0	3E0	3E0	3E0	3E0	3E0	3.00144E0
	±5.42134E-15	±1.75131E-14	±1.75131E-14	±1.75131E-14	±2.43365E-14	±0E0	±7.59165E-9	±1.32935E-3
f_{35}	3.00161E-2	9.65442E-2	8.17415E-2	9.32151E-2	7.72212E-2	8.65569E-2	6.24301E-2	1.17774E0
	±3.94309E-2	±1.82343E-2	±3.69659E-2	±2.53387E-2	±4.1772E-2	±3.45308E-2	±3.90515E-2	±2.43999E-1
f_{36}	7.46745E-2	9.98733E-2	9.98733E-2	9.98733E-2	9.65759E-2	9.98733E-2	9.88194E-2	1.65815E0
	±4.25523E-2	±0E0	±5.61822E-12	±0E0	±1.80606E-2	±2.53373E-18	±4.62831E-3	±3.62469E-1

Table 11: Averages and standard deviations for Soil model benchmark problems with 100.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.89266E-1	1.09023E0	1.1068E0	1.10444E0	1.18237E0	2.40375E0	1.22919E0	1.74181E0
	±6.06686E-2	±3.65564E-2	±1.27414E-2	±4.02242E-1	±3.21294E-2	±9.99313E-1	±3.6721E-1	±4.01653E-1
f_2	2.33203E0	5.37032E0	6.58825E0	4.31605E0	3.05827E0	6.61505E0	6.19989E0	7.86387E0
	±1.66592E-1	±1.99692E0	±2.35048E-1	±2.30268E0	±7.0351E-1	±1.38749E0	±1.62809E0	±6.96585E-1
f_3	1.99881E0	2.00524E0	4.4779E0	2.04121E0	5.64199E0	1.56752E1	2.06476E0	4.11306E1
	±3.17603E-3	±2.58076E-2	±8.3421E0	±5.32541E-2	±1.6024E0	±1.68146E1	±7.07992E-2	±1.07852E1

Table 12: Averages and standard deviations for Soil model benchmark problems with 300.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.48211E-1	1.09023E0	1.10239E0	1.02966E0	1.08363E0	2.39967E0	1.16353E0	1.4922E0
	±3.85973E-2	±3.65564E-2	±7.66707E-3	±1.33812E-1	±6.81847E-2	±9.98713E-1	±1.3575E-1	±1.7383E-1
f_2	2.22692E0	5.35907E0	6.52689E0	4.29896E0	2.067E0	6.61498E0	6.03238E0	7.15786E0
	±9.19896E-2	±2.01389E0	±2.55296E-1	±2.2995E0	±1.49749E-1	±1.38771E0	±1.48135E0	±3.9166E-1
f_3	1.99756E0	2.00524E0	3.39697E0	2.03185E0	2.00044E0	1.56752E1	2.05881E0	3.6193E1
	±4.55714E-4	±2.58057E-2	±6.55955E0	±4.71739E-2	±1.13441E-3	±1.68146E1	±6.76056E-2	±1.10771E1

Table 13: Averages and standard deviations for Soil model benchmark problems with 500.000 evaluations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.34533E-1	1.09023E0	1.10176E0	1.02941E0	1.07689E0	2.39958E0	1.15595E0	1.43746E0
	±2.72172E-2	±3.65564E-2	±6.88421E-3	±1.33924E-1	±6.81983E-2	±9.98835E-1	±1.29755E-1	±1.31095E-1
f_2	2.16791E0	5.33624E0	6.46463E0	4.13327E0	1.95554E0	6.61493E0	6.03042E0	6.80408E0
	±8.63778E-2	±2.05174E0	±4.009E-1	±2.30861E0	±7.01167E-2	±1.38787E0	±1.48053E0	±9.48392E-1
f_3	1.9974E0	2.00524E0	2.13723E0	2.02471E0	1.99686E0	1.56752E1	2.05761E0	3.17311E1
	±3.33789E-4	±2.58057E-2	±3.07021E-1	±4.4233E-2	±3.29661E-5	±1.68146E1	±6.63674E-2	±1.05044E1

Table 14: Averages and standard deviations for Soil model benchmark problems with 2.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.89266E-1	1.09023E0	1.1068E0	1.03051E0	1.06844E0	2.40375E0	1.05921E1	7.66196E0
	±6.06686E-2	±3.65564E-2	±1.27426E-2	±1.32974E-1	±8.01954E-2	±9.99313E-1	±1.0538E1	±2.95851E0
f_2	2.33203E0	5.37032E0	6.58825E0	4.3063E0	1.93306E0	6.61505E0	9.48828E0	1.35921E1
	±1.66592E-1	±1.99692E0	±2.35048E-1	±2.30446E0	±5.02781E-2	±1.38749E0	±2.7839E0	±3.03411E0
f_3	1.99881E0	2.00524E0	4.4776E0	2.04121E0	1.99678E0	1.56752E1	7.25801E1	6.09063E1
	±3.17603E-3	±2.58076E-2	±8.34214E0	±5.32509E-2	±3.54084E-9	±1.68146E1	±4.5524E1	±6.55571E0

Table 15: Averages and standard deviations for Soil model benchmark problems with 6.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.48211E-1	1.09023E0	1.10239E0	1.0294E0	1.06844E0	2.39967E0	5.15782E0	4.83725E0
	±3.85973E-2	±3.65564E-2	±7.66714E-3	±1.33935E-1	±8.01954E-2	±9.98713E-1	±5.68845E0	±1.77742E0
f_2	2.22692E0	5.35907E0	6.52689E0	4.11964E0	1.93306E0	6.61498E0	7.77596E0	1.13416E1
	±9.19896E-2	±2.0139E0	±2.55296E-1	±2.32101E0	±5.02781E-2	±1.38771E0	±1.81212E0	±2.12232E0
f_3	1.99756E0	2.00524E0	3.39697E0	2.02062E0	1.99678E0	1.56752E1	3.31596E1	5.5627E1
	±4.55714E-4	±2.58057E-2	±6.55955E0	±4.07126E-2	±3.54084E-9	±1.68146E1	±2.03889E1	±7.19464E0

Table 16: Averages and standard deviations for Soil model benchmark problems with 10.000 generations.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.34533E-1	1.09023E0	1.10176E0	1.028E0	1.06844E0	2.39958E0	2.99542E0	4.24715E0
	±2.72172E-2	±3.65564E-2	±6.88421E-3	±1.33992E-1	±8.01954E-2	±9.98835E-1	±3.05145E0	±1.56439E0
f_2	2.16791E0	5.33621E0	6.46463E0	4.11605E0	1.93306E0	6.61493E0	7.04675E0	1.08355E1
	±8.63778E-2	±2.05179E0	±4.009E-1	±2.32245E0	±5.02781E-2	±1.38787E0	±1.53822E0	±1.80529E0
f_3	1.9974E0	2.00524E0	2.13723E0	2.01656E0	1.99678E0	1.56752E1	1.66543E1	5.43479E1
	±3.33789E-4	±2.58057E-2	±3.07021E-1	±3.64606E-2	±3.54084E-9	±1.68146E1	±1.93346E1	±7.12059E0

Table 17: Averages and standard deviations for Soil model benchmark problems with 100.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.20075E0	1.09023E0	1.1069E0	1.31779E0	1.20975E0	2.41945E0	1.24613E0	1.94876E0
	±2.25715E-1	±3.65564E-2	±1.27561E-2	±6.39491E-1	±4.19799E-2	±9.88181E-1	±3.82014E-1	±5.71349E-1
f_2	3.16235E0	5.37096E0	6.56754E0	4.43087E0	2.94513E0	6.61507E0	6.05702E0	8.1283E0
	±9.1735E-1	±1.99463E0	±2.33836E-1	±2.21111E0	±5.25655E-1	±1.38744E0	±1.4381E0	±8.45963E-1
f_3	2.07956E0	2.00524E0	4.40092E0	2.649E0	5.50088E0	1.56754E1	5.15909E0	4.51497E1
	±1.3175E-1	±2.58093E-2	±8.32E0	±1.74363E0	±2.7947E0	±1.68145E1	±1.15718E1	±9.25277E0

Table 18: Averages and standard deviations for Soil model benchmark problems with 300.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.05607E0	1.09023E0	1.10247E0	1.24855E0	1.09031E0	2.40273E0	1.22927E0	1.55185E0
	±1.47221E-1	±3.65564E-2	±7.76451E-3	±5.67177E-1	±6.75171E-2	±1.00072E0	±3.61227E-1	±2.45073E-1
f_2	2.41382E0	5.35916E0	6.49134E0	4.30625E0	2.06781E0	6.61502E0	6.03083E0	7.41005E0
	±1.92781E-1	±2.01375E0	±3.12357E-1	±2.28989E0	±1.21912E-1	±1.38758E0	±1.48034E0	±4.07502E-1
f_3	2.02184E0	2.00524E0	2.20419E0	2.23992E0	1.99992E0	1.56752E1	2.08606E0	3.76957E1
	±8.48638E-2	±2.58057E-2	±4.8459E-1	±8.92012E-1	±1.70151E-3	±1.68146E1	±1.35929E-1	±1.19035E1

Table 19: Averages and standard deviations for Soil model benchmark problems with 500.000 evaluations in CPU time.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	1.01463E0	1.09023E0	1.10181E0	1.22727E0	1.07869E0	2.40249E0	1.21896E0	1.49271E0
	±9.84471E-2	±3.65564E-2	±6.92553E-3	±5.49875E-1	±6.67707E-2	±1.00099E0	±3.44898E-1	±1.7409E-1
f_2	2.32987E0	5.35908E0	6.45455E0	4.16157E0	1.97267E0	6.61498E0	6.02903E0	7.15786E0
	±1.67695E-1	±2.01388E0	±4.28818E-1	±2.28282E0	±6.95081E-2	±1.3877E0	±1.47976E0	±3.9166E-1
f_3	2.01026E0	2.00524E0	2.1131E0	2.04788E0	1.99686E0	1.56752E1	2.06586E0	3.69202E1
	±6.34193E-2	±2.58057E-2	±2.83721E-1	±7.13469E-2	±8.12788E-5	±1.68146E1	±8.34966E-2	±1.13239E1

Table 20: Averages and standard deviations for Soil model benchmark problems with 1.000.000 evaluations or hitting a bound.

Function	ABC	JADE	LaF	TLBO	SOMA	PSO	HSA	RW
f_1	9.17023E-1	1.09023E0	1.10118E0	1.028E0	1.06844E0	2.3994E0	1.15118E0	1.38731E0
	±2.50764E-2	±3.65564E-2	±6.71967E-3	±1.33992E-1	±8.01954E-2	±9.99075E-1	±1.34276E-1	±8.79993E-2
f_2	2.11594E0	5.31788E0	6.44769E0	4.11605E0	1.93306E0	6.61492E0	6.02731E0	6.19046E0
	±6.49716E-2	±2.08173E0	±4.42535E-1	±2.32245E0	±5.02781E-2	±1.3879E0	±1.47917E0	±1.11614E0
f_3	1.99718E0	2.00524E0	2.11239E0	2.01656E0	1.99678E0	1.56752E1	2.05556E0	2.51339E1
	±2.28612E-4	±2.58057E-2	±2.83295E-1	±3.64606E-2	±3.54084E-9	±1.68146E1	±6.4569E-2	±7.40111E0