

Table 1: Statistical results obtained from basic mathematical benchmark functions.

No		SA	VS	GA	DE	PSO	ABC	EFO
F1	Mean	0	0	0	0	0	0	0
	StdDev	0	0	0	0	0	0	0
	Best	0	0	0	0	0	0	0
F2	Mean	0	1.8333	687.3000	0	0	0	0
	StdDev	0	1.6833	155.2307	0	0	0	0
	Best	0	0	352	0	0	0	0
F3	Mean	3.457e-07	0	632.0983	0	0	4.439e-16	0
	StdDev	1.204e-07	0	102.5448	0	0	9.192e-17	0
	Best	1.714e-07	0	465.0500	0	0	2.834e-16	0
F4	Mean	4.739e-06	1.399e-15	81.4843	0	0	4.776e-16	0
	StdDev	1.733e-06	3.312e-15	18.9854	0	0	3.835e-17	0
	Best	2.174e-06	0	52.9660	0	0	3.240e-16	0
F5	Mean	0.0047	0.0054	0.2049	0.0068	0.0017	0.0151	0.0074
	StdDev	0.0016	0.0031	0.0552	0.0015	0.0005	0.0037	0.0029
	Best	0.0015	0.0011	0.1007	0.0030	0.0010	0.0090	0.0033
F6	Mean	0.0634	0	4.613e-18	0	0.0254	1.479e-15	0
	StdDev	0.1935	0	2.527e-17	0	0.1391	5.464e-16	0
	Best	1.011e-06	0	0	0	0	2.940e-16	0
F7	Mean	-0.2333	-1	-1	-1	-1	-1	-1
	StdDev	0.4302	0	0	0	0	0	0
	Best	-1	-1	-1	-1	-1	-1	-1
F8	Mean	7.874e-09	0	0	0	0	1.021e-16	0
	StdDev	6.638e-09	0	0	0	0	1.367e-16	0
	Best	1.629e-11	0	0	0	0	0	0
F9	Mean	0.1701	8.437e-16	0.0321	0	5.898e-16	0.0500	0.0021
	StdDev	0.0635	2.028e-15	0.0199	0	9.033e-16	0.0341	0.0024
	Best	0.0050	0	0.0002	0	0	0.0031	0.0001
F10	Mean	-50	-50	-50	-50	-50	-50	-50
	StdDev	0	0	0	0	0	0	0
	Best	-50	-50	-50	-50	-50	-50	-50
F11	Mean	-210	-210	-204.95	-210	-210	-210	-210
	StdDev	0	0	3.6774	0	0	0	0
	Best	-210	-210	-209.55	-210	-210	-210	-210
F12	Mean	0.0003	0	0.0045	0	0	0.0010	4.927e-12
	StdDev	9.767e-05	0	0.0037	0	0	0.0006	1.133e-11
	Best	0.0001	0	0.0007	0	0	9.358e-05	2.341e-14
F13	Mean	0.0083	0.0066	7.4194	0.1232	0.0002	0.0044	0.0053
	StdDev	0.0009	0.0014	3.4903	0.0369	0.0001	0.0008	0.0019
	Best	0.0065	0.0029	2.9513	0.0528	4.425e-05	0.0022	0.0019
F14	Mean	0.0023	2.988e-09	10.4613	0	0	1.097e-15	0
	StdDev	0.0004	1.521e-08	1.1376	0	0	1.466e-16	0
	Best	0.0014	7.257e-16	7.8711	0	0	7.597e-16	0
F15	Mean	0.3508	3.338e-11	5316.97	21818.87	3.628e-07	1563.01	559.1687
	StdDev	0.0827	7.658e-11	1288.39	3968.41	5.236e-07	555.4863	146.9192
	Best	0.2022	4.911e-13	2950	14441	1.144e-08	512.7200	298.4300
F16	Mean	32.3845	76.9647	43689.10	18.9494	24.0752	0.0818	0.0405
	StdDev	107.4193	103.3811	19298.28	1.5139	22.4560	0.0918	0.0687
	Best	0.0056	21.5240	22360	17.8930	0.3876	5.123e-05	0.0012
F17	Mean	0.5750	0.6717	297.3530	0.6667	0.6667	4.118e-14	0.0073
	StdDev	0.4738	0.0251	88.1190	0	0	5.684e-14	0.0231
	Best	0.0001	0.6667	181.0500	0.6667	0.6667	3.636e-15	1.696e-07
F18	Mean	500	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980
	StdDev	0	0	0	0	0	0.0001	0
	Best	500	0.9980	0.9980	0.9980	0.9980	0.9980	0.9980
F19	Mean	0.3979	0.3979	0.3979	0.3979	0.3979	0.3979	0.3979
	StdDev	2.008e-05	3.356e-05	2.791e-05	2.791e-05	2.791e-05	2.791e-05	2.791e-05
	Best	0.3979	0.3979	0.3979	0.3979	0.3979	0.3979	0.3979
F20	Mean	1.786e-09	0	2.598e-14	0	0	0	0
	StdDev	2.282e-09	0	0	0	0	0	0
	Best	2.903e-11	0	2.598e-14	0	0	0	0
F21	Mean	6.539e-09	0	0	0	0	0	0
	StdDev	8.292e-09	0	0	0	0	0	0
	Best	9.953e-11	0	0	0	0	0	0
F22	Mean	7.412e-05	78.1707	89.7375	62.1048	35.6859	0	0
	StdDev	4.082e-05	17.5042	11.8009	6.0202	13.3736	0	0
	Best	2.658e-05	44.7730	63.0320	43.9960	21.8890	0	0
F23	Mean	-7368.58	-10390.73	-10057.02	-12537.33	-6525.43	-12569	-12569
	StdDev	611.2959	650.5240	426.4736	61.3589	692.8547	0	0
	Best	-8956.50	-11346	-10906	-12569	-8206.90	-12569	-12569
F24	Mean	-1.9496	-1.8013	-1.8013	-1.8013	-1.8013	-1.8013	-1.8013
	StdDev	0.0760	0	0	0	0	0	0
	Best	-1.9975	-1.8013	-1.8013	-1.8013	-1.8013	-1.8013	-1.8013
F25	Mean	-4.8376	-4.5513	-4.6877	-4.6877	-4.5785	-4.6877	-4.6877
	StdDev	0.1038	0.1477	0	0	0.2180	0	0
	Best	-4.9909	-4.6877	-4.6877	-4.6877	-4.6877	-4.6877	-4.6877
F26	Mean	-9.7984	-8.3934	-9.4195	-9.6586	-9.0857	-9.6602	-9.6602
	StdDev	0.0973	0.6589	0.2065	0.0077	0.3153	0	0
	Best	-9.9496	-9.2768	-9.6591	-9.6602	-9.6176	-9.6602	-9.6602
F27	Mean	0.2285	0	0.0006	0.0006	0.0003	0	0
	StdDev	0.2019	0	0.0025	0.0025	0.0018	0	0
	Best	0.0097	0	1.110e-15	0	0	0	0

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Table 1 (continued)

No		SA	VS	GA	DE	PSO	ABC	EFO
F28	Mean	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316
	StdDev	0	0	0	0	0	0	0
	Best	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316	-1.0316
F29	Mean	0.1092	0	2.171e-14	0	0	0	0
	StdDev	0.1110	0	0	0	0	0	0
	Best	3.122e-11	0	2.171e-14	0	0	0	0
F30	Mean	4.286e-07	0	2.067e-14	0	0	2.350e-16	0
	StdDev	3.126e-07	0	2.855e-14	0	0	1.927e-16	0
	Best	1.212e-09	0	2.387e-15	0	0	0	0
F31	Mean	-186.73	-186.73	-186.73	-186.73	-186.73	-186.73	-186.73
	StdDev	0	0	0	0	0	0	0
	Best	-186.73	-186.73	-186.73	-186.73	-186.73	-186.73	-186.73
F32	Mean	29.1024	3	3	3	3	3	3
	StdDev	32.8689	0	0	0	0	0	0
	Best	3	3	3	3	3	3	3
F33	Mean	0.0018	0.0003	0.0003	0.0003	0.0004	0.0004	0.0003
	StdDev	0.0027	4.583e-07	2.137e-05	8.675e-05	0.0003	5.007e-05	2.151e-05
	Best	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
F34	Mean	-4.6950	-10.1521	-8.2243	-10.1515	-6.3987	-10.1520	-10.1511
	StdDev	1.8497	0.0014	3.0707	0.0015	3.6389	0.0014	0.0015
	Best	-10.1530	-10.1530	-10.1530	-10.1530	-10.1530	-10.1530	-10.1530
F35	Mean	-4.4887	-10.4016	-9.9710	-10.4014	-6.1178	-10.4021	-10.4013
	StdDev	2.6302	0.0015	1.6666	0.0015	3.4167	0.0014	0.0015
	Best	-10.4030	-10.4030	-10.4030	-10.4030	-10.4030	-10.4030	-10.4030
F36	Mean	-3.6041	-10.5348	-10.1772	-10.5346	-6.6036	-10.5348	-10.5348
	StdDev	2.2710	0.0024	1.3596	0.0026	3.7837	0.0024	0.0024
	Best	-10.5300	-10.5360	-10.5360	-10.5360	-10.5360	-10.5360	-10.5360
F37	Mean	18.4863	0.0056	0.0194	0.0013	0.0391	0.0542	0.0068
	StdDev	20.4309	0.0180	0.0293	0.0035	0.1200	0.0451	0.0062
	Best	0.0212	1.056e-06	0.0003	0	3.211e-05	0.0042	0.0008
F38	Mean	0.3354	0.0002	0.0004	0.0014	0.0002	0.0059	0.0012
	StdDev	0.8052	0.0001	0.0004	0.0013	0.0002	0.0048	0.0010
	Best	0.0001	6.473e-12	2.608e-05	4.299e-05	1.305e-09	0.0002	8.174e-05
F39	Mean	-1.3906	-3.8626	-3.8627	-3.8628	-3.8624	-3.8627	-3.8625
	StdDev	1.8639	0.0007	0.0005	0	0.0010	0.0005	0.0009
	Best	-3.8628	-3.8628	-3.8628	-3.8628	-3.8628	-3.8628	-3.8628
F40	Mean	0	-3.2785	-3.2666	-3.3222	-3.2746	-3.3222	-3.3222
	StdDev	0	0.0582	0.0603	0.0006	0.0593	0.0007	0.0007
	Best	0	-3.3224	-3.3224	-3.3224	-3.3224	-3.3224	-3.3224
F41	Mean	17.0635	0.0205	6.9721	0	0.0112	4.441e-17	3.235e-13
	StdDev	5.9715	0.0130	1.1482	0	0.0117	5.532e-17	1.733e-12
	Best	4.8239	2.220e-16	5.1798	0	0	0	0
F42	Mean	0.0004	2.481e-14	6.8954	5.950e-13	8.467e-15	3.203e-14	8.663e-14
	StdDev	7.822e-05	4.931e-15	0.4283	3.196e-12	1.803e-15	2.412e-15	2.500e-14
	Best	0.0003	1.510e-14	5.8907	4.441e-15	7.994e-15	2.931e-14	7.994e-15
F43	Mean	0.0035	11.2170	8.7674	0	0.0276	4.047e-16	0
	StdDev	0.0189	17.8617	2.9960	0	0.0717	8.097e-17	0
	Best	1.971e-09	0	3.3978	0	0	2.685e-16	0
F44	Mean	5.183e-08	0	27.7252	0	0	4.617e-16	0
	StdDev	3.106e-08	0	6.3277	0	0	7.453e-17	0
	Best	2.114e-08	0	13.2180	0	0	2.782e-16	0
F45	Mean	-0.8464	-1.0807	-1.0807	-1.0809	-1.0088	-1.0808	-1.0808
	StdDev	0.3481	0.0004	0.0004	0.0002	0.0686	0.0003	0.0003
	Best	-1.0809	-1.0809	-1.0809	-1.0809	-1.0809	-1.0809	-1.0809
F46	Mean	-0.1977	-1.5000	-1.3497	-1.5000	-1.2054	-1.5000	-1.5000
	StdDev	0.3480	0	0.2539	0	0.3300	0	0
	Best	-1.5000	-1.5000	-1.5000	-1.5000	-1.5000	-1.5000	-1.5000
F47	Mean	-0.0124	-0.8150	-0.5238	-0.9768	-0.5609	-0.8304	-0.8974
	StdDev	0.0484	0.4047	0.2123	0.2792	0.2809	0.1313	0.2415
	Best	-0.2268	-1.5000	-0.7977	-1.4857	-1.5000	-1.5000	-1.5000
F48	Mean	5.756e-07	0	1.409e-15	0	0	0	0
	StdDev	8.705e-07	0	5.587e-16	0	0	0	0
	Best	4.541e-09	0	9.608e-16	0	0	0	0
F49	Mean	484.8892	1.539e-08	0.1248	1.2935	2194.12	0.0054	4.525e-05
	StdDev	893.7955	3.312e-08	0.2818	4.2544	2187.08	0.0126	7.275e-05
	Best	0.0004	0	1.748e-06	0	0	1.425e-15	1.091e-08
F50	Mean	79.2333	17.1875	163.2478	77.9385	1581.13	4.9273	4.4496
	StdDev	103.6068	41.1373	123.3809	77.8566	2119.26	5.3044	3.2664
	Best	0.0749	4.124e-12	13.0890	5.8042	6.394e-09	0.2026	1.0696