

HNCO

Comparison of various black box optimization algorithms

September 6, 2018

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1 Rankings

algorithm	rank distribution									
	1	2	3	4	5	6	7	8	9	10
pbil	10	0	1	0	3	0	2	0	1	2
hc	7	3	0	2	2	1	1	0	0	3
umda	7	2	0	0	2	1	2	1	2	2
ga	5	4	2	0	3	2	0	0	1	2
sa	5	3	2	3	1	0	1	1	2	1
ea-10p1	5	3	1	5	3	1	0	1	0	0
ea-1c10	5	2	2	4	3	1	1	1	0	0
rls	4	6	0	2	2	2	0	1	1	1
ea-1p10	4	3	1	4	0	1	2	2	2	0
ea-1p1	4	3	1	3	1	1	1	2	2	1

2 Function one-max

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	100	100	100	100	100	1	0.000	0.000
hc	100	100	100	100	100	1	0.000	0.000
sa	100	100	100	100	100	1	0.002	0.004
ea-1p1	100	100	100	100	100	1	0.000	0.000
ea-1p10	100	100	100	100	100	1	0.000	0.000
ea-10p1	100	100	100	100	100	1	0.004	0.005
ea-1c10	100	100	100	100	100	1	0.000	0.000
ga	100	100	100	100	100	1	0.011	0.002
pbil	100	100	100	100	100	1	0.063	0.005
umda	100	100	100	100	100	1	0.001	0.002

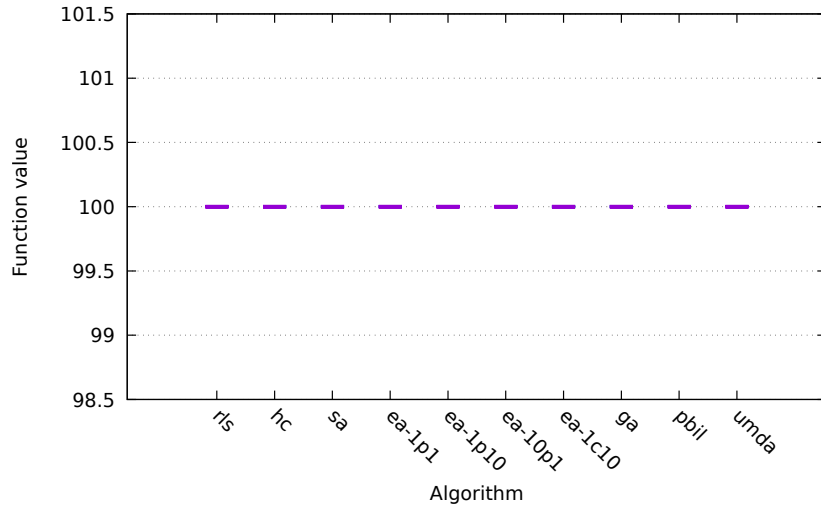


Figure 1: one-max

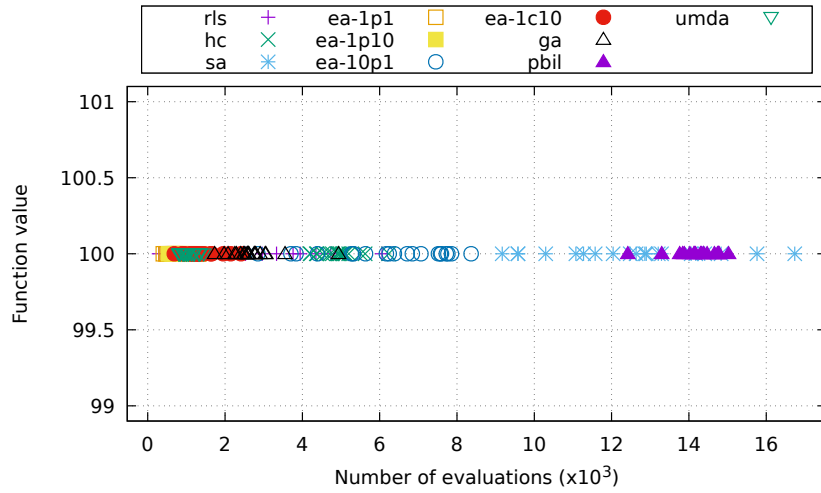


Figure 2: one-max

3 Function lin

algorithm	function value					time (s)		
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	45.03	45.03	45.03	45.03	45.03	1	0.184	0.006
hc	45.03	45.03	45.03	45.03	45.03	1	0.153	0.004
sa	26.93	45.03	45.03	45.03	45.03	10	0.183	0.005
ea-1p1	45.03	45.03	45.03	45.03	45.03	1	0.297	0.011
ea-1p10	45.03	45.03	45.03	45.03	45.03	1	0.309	0.007
ea-10p1	45.03	45.03	45.03	45.03	45.03	1	0.375	0.009
ea-1c10	45.03	45.03	45.03	45.03	45.03	1	0.263	0.006
ga	45.03	45.03	45.03	45.03	45.03	1	1.228	0.017
pbil	45.03	45.03	45.03	45.03	45.03	1	1.239	0.020
umda	45.03	45.03	45.03	45.03	45.03	1	1.216	0.017

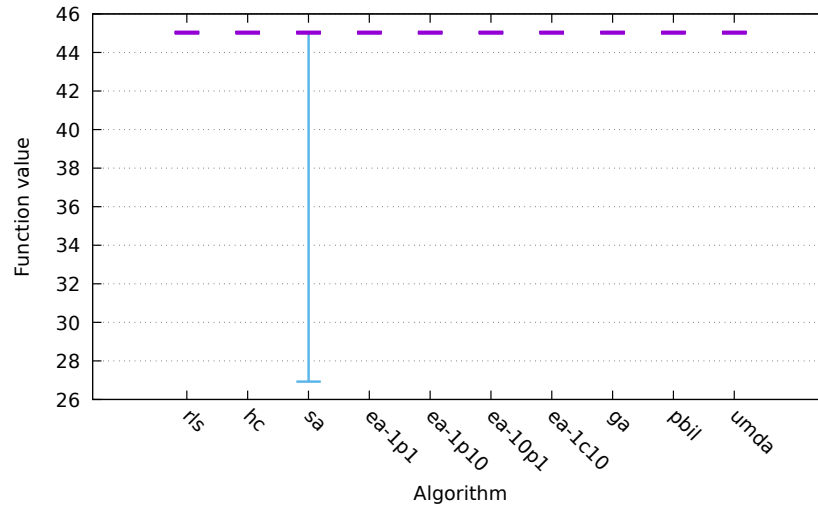


Figure 3: lin

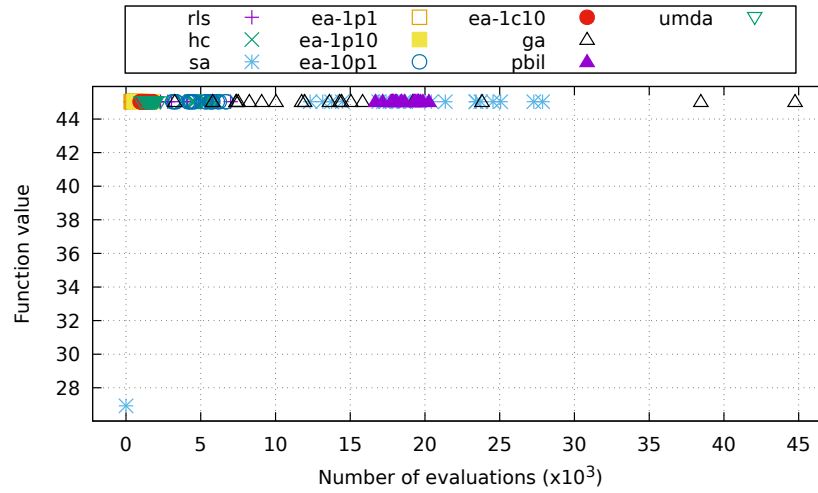


Figure 4: lin

4 Function leading-ones

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	100	100	100	100	100	1	0.007	0.007
hc	100	100	100	100	100	1	0.001	0.002
sa	3	100	100	100	100	9	0.033	0.052
ea-lp1	100	100	100	100	100	1	0.001	0.003
ea-lp10	100	100	100	100	100	1	0.000	0.000
ea-10p1	100	100	100	100	100	1	0.044	0.006
ea-lc10	100	100	100	100	100	1	0.007	0.006
ga	93	95	97	98	100	10	1.172	0.041
pbil	100	100	100	100	100	1	0.324	0.021
umda	100	100	100	100	100	1	0.050	0.009

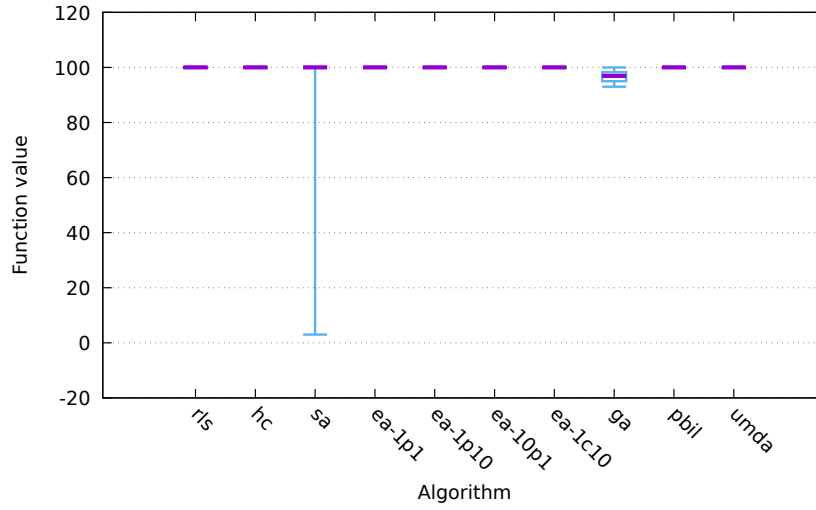


Figure 5: leading-ones

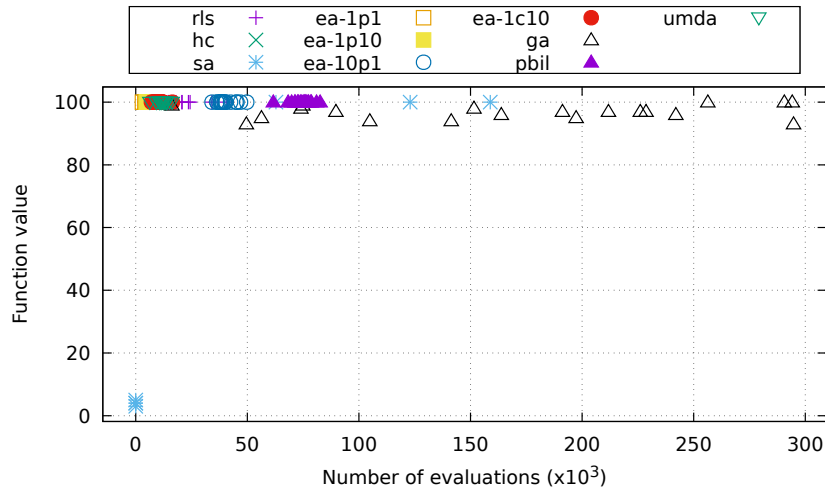


Figure 6: leading-ones

5 Function ridge

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	104	105	106	106	109	9	0.155	0.008
hc	200	200	200	200	200	1	0.003	0.004
sa	200	200	200	200	200	1	0.013	0.005
ea-lp1	200	200	200	200	200	1	0.015	0.005
ea-lp10	200	200	200	200	200	1	0.016	0.005
ea-10p1	200	200	200	200	200	1	0.205	0.018
ea-1c10	117	124	127	134	143	8	0.243	0.007
ga	102	103	103	103	104	10	1.187	0.017
pbil	153	154	154	155	156	7	1.222	0.018
umda	200	200	200	200	200	1	0.191	0.015

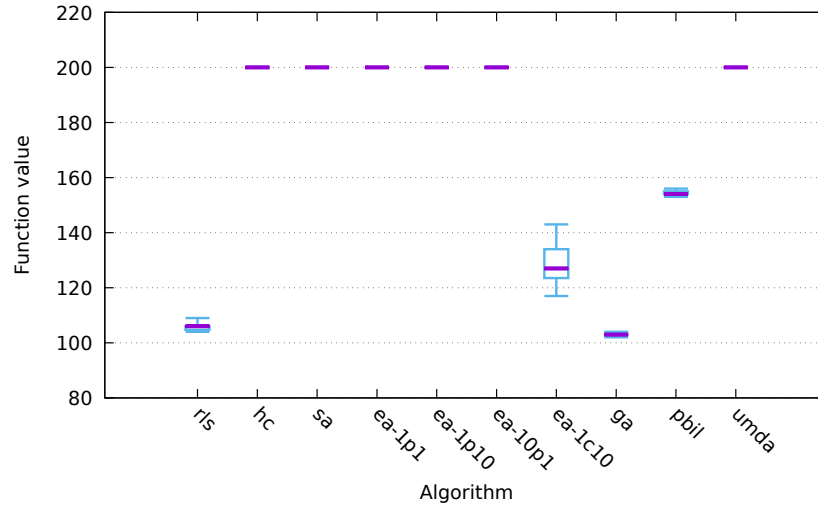


Figure 7: ridge

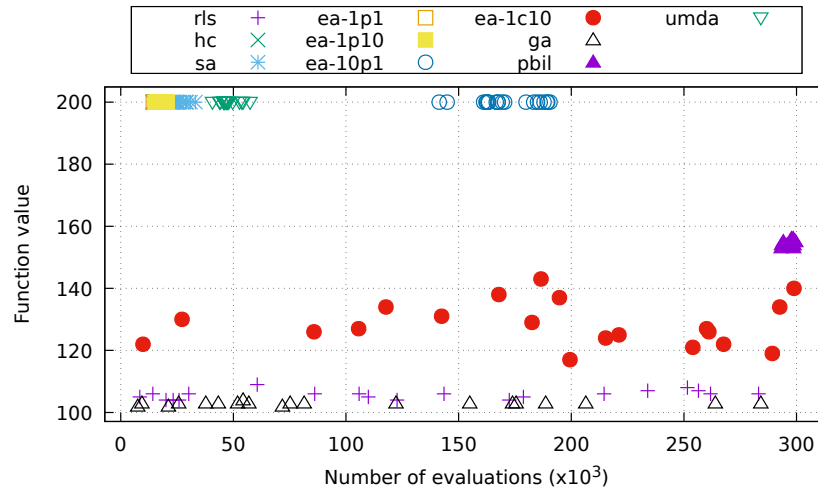


Figure 8: ridge

6 Function jmp-5

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	95	95	95	95	95	4	0.151	0.006
hc	95	95	95	95	95	4	0.115	0.005
sa	95	95	95	95	95	4	0.151	0.003
ea-lp1	95	95	95	95	95	4	0.266	0.008
ea-lp10	95	95	95	95	95	4	0.272	0.005
ea-10p1	95	95	95	95	95	4	0.340	0.008
ea-1c10	95	95	95	95	95	4	0.227	0.005
ga	100	100	100	100	100	1	0.421	0.264
pbil	100	100	100	100	100	1	0.068	0.005
umda	100	100	100	100	100	1	0.125	0.236

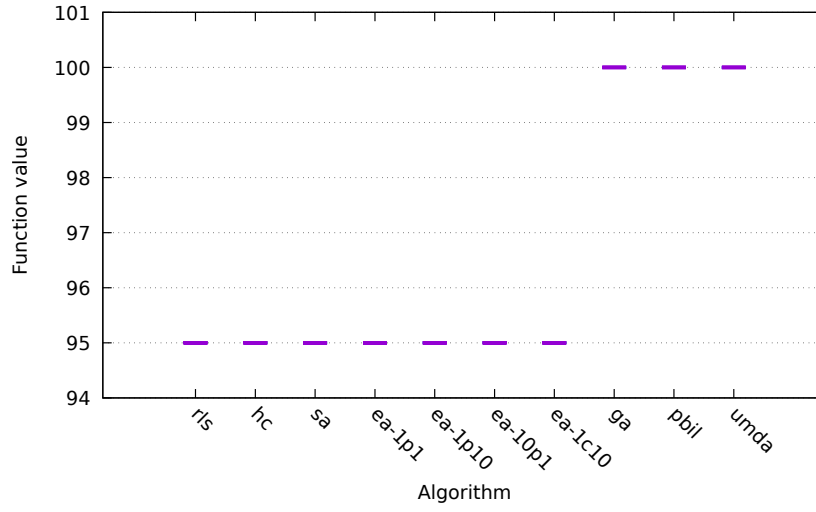


Figure 9: jmp-5

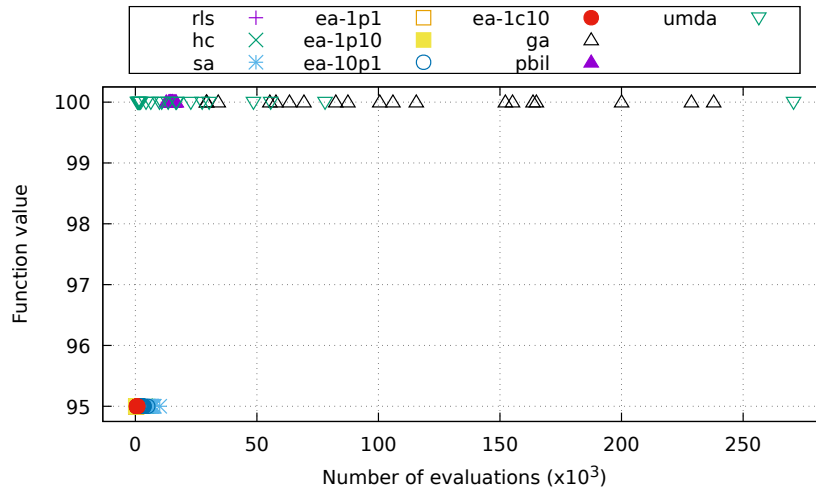


Figure 10: jmp-5

7 Function jmp-10

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	90	90	90	90	90	2	0.155	0.008
hc	90	90	90	90	90	2	0.118	0.005
sa	90	90	90	90	90	2	0.153	0.006
ea-lp1	90	90	90	90	90	2	0.264	0.008
ea-lp10	90	90	90	90	90	2	0.273	0.007
ea-10p1	90	90	90	90	90	2	0.343	0.021
ea-1c10	90	90	90	90	90	2	0.227	0.007
ga	90	90	90	90	90	2	1.178	0.017
pbil	90	90	90	100	100	1	0.836	0.539
umda	90	90	90	90	90	2	1.232	0.017

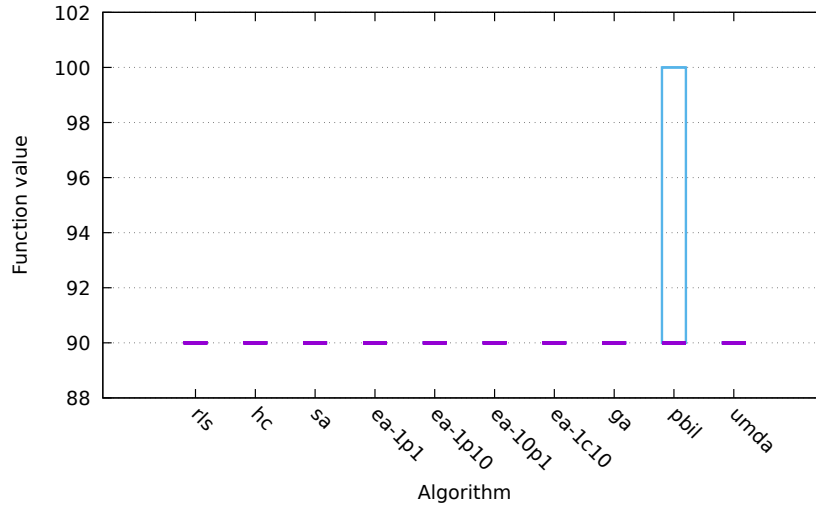


Figure 11: jmp-10

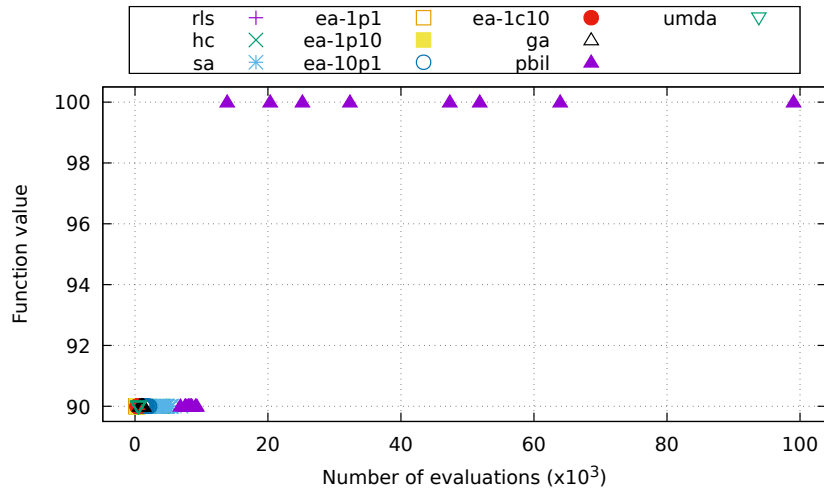


Figure 12: jmp-10

8 Function djmp-5

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	100	100	100	100	100	4	0.151	0.004
hc	100	100	100	100	100	4	0.122	0.004
sa	100	100	100	100	100	4	0.154	0.005
ea-lp1	100	100	100	100	100	4	0.265	0.006
ea-lp10	100	100	100	100	100	4	0.274	0.007
ea-10p1	100	100	100	100	100	4	0.338	0.010
ea-lc10	100	100	100	100	100	4	0.227	0.006
ga	105	105	105	105	105	1	0.319	0.343
pbil	105	105	105	105	105	1	0.068	0.004
umda	105	105	105	105	105	1	0.200	0.278

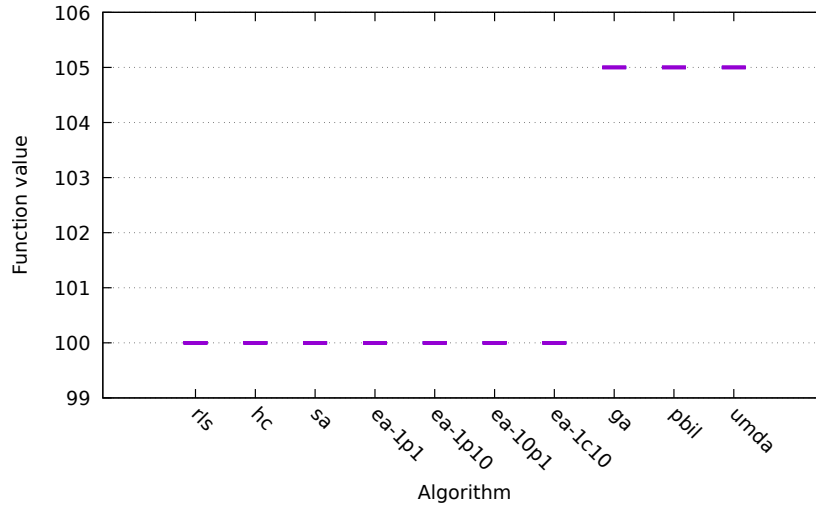


Figure 13: djmp-5

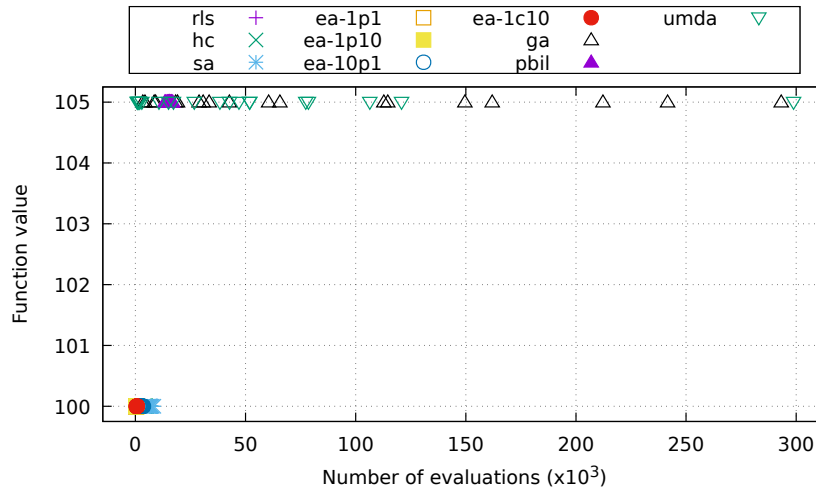


Figure 14: djmp-5

9 Function djmp-10

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	100	100	100	100	100	2	0.156	0.008
hc	100	100	100	100	100	2	0.122	0.004
sa	100	100	100	100	100	2	0.153	0.004
ea-lp1	100	100	100	100	100	2	0.266	0.007
ea-lp10	100	100	100	100	100	2	0.275	0.005
ea-10p1	100	100	100	100	100	2	0.347	0.019
ea-lc10	100	100	100	100	100	2	0.227	0.005
ga	100	100	100	100	100	2	1.177	0.013
pbil	100	100	100	110	110	1	0.850	0.529
umda	100	100	100	100	100	2	1.236	0.024

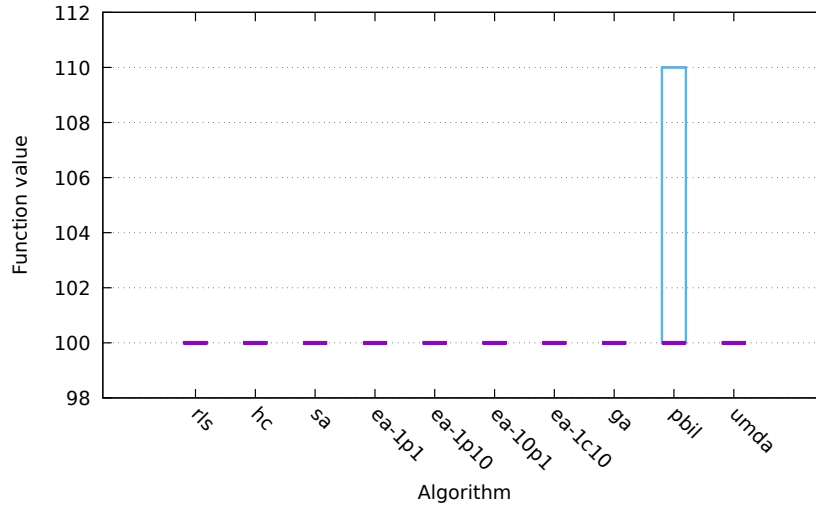


Figure 15: djmp-10

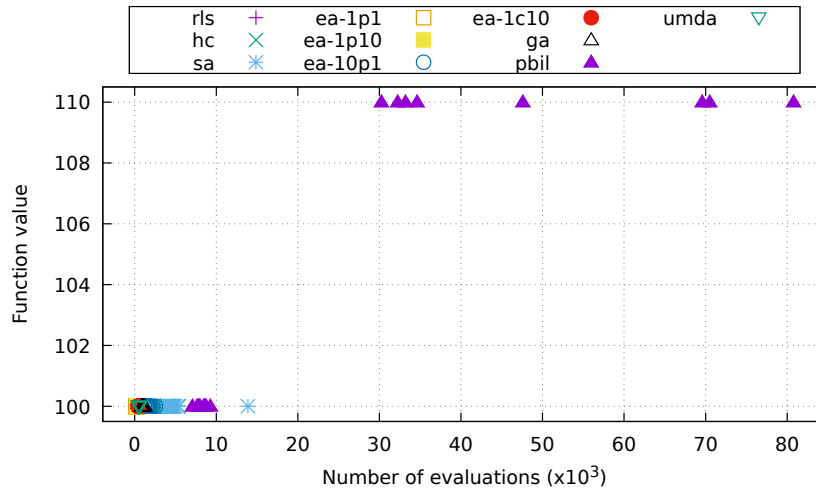


Figure 16: djmp-10

10 Function fp-5

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	194	194	194	194	194	1	0.009	0.008
hc	100	100	147	194	194	10	0.079	0.049
sa	6	194	194	194	194	8	0.022	0.042
ea-lp1	100	194	194	194	194	6	0.015	0.058
ea-lp10	100	194	194	194	194	6	0.031	0.087
ea-10p1	194	194	194	194	194	1	0.043	0.007
ea-1c10	194	194	194	194	194	1	0.009	0.006
ga	186	189	190	191	194	9	1.120	0.223
pbil	194	194	194	194	194	1	0.384	0.056
umda	194	194	194	194	194	1	0.044	0.009

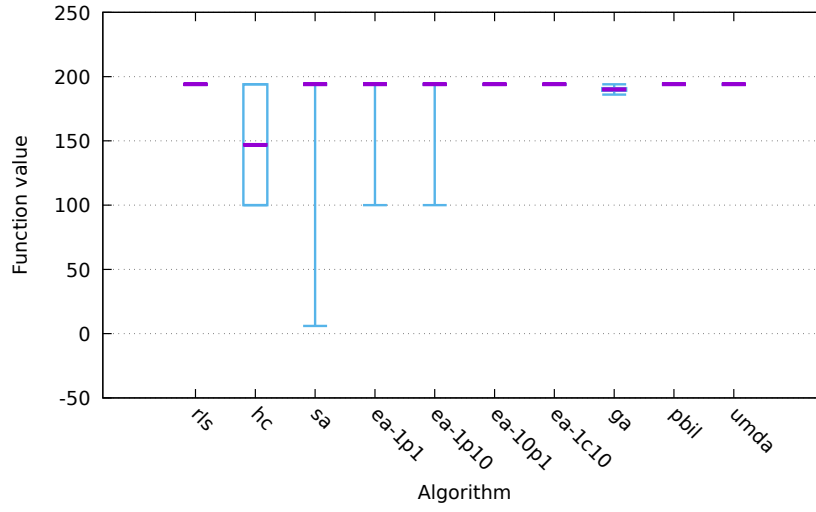


Figure 17: fp-5

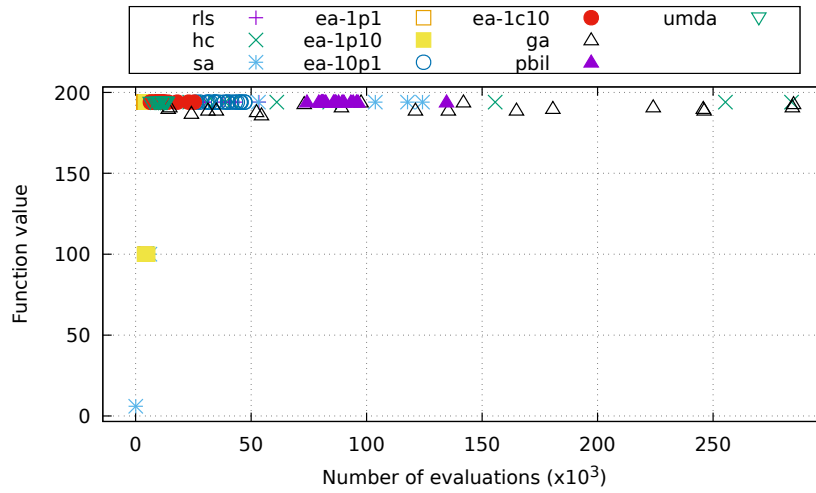


Figure 18: fp-5

11 Function fp-10

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	188	189	189	189	189	2	0.055	0.047
hc	100	100	100	100	100	10	0.120	0.003
sa	100	100	100	122	189	7	0.117	0.067
ea-lp1	100	100	100	100	189	9	0.257	0.061
ea-lp10	100	100	100	122	189	7	0.211	0.123
ea-10p1	100	167	189	189	189	4	0.119	0.135
ea-1c10	100	189	189	189	189	3	0.091	0.088
ga	182	184	185	187	189	5	1.168	0.115
pbil	189	189	189	189	189	1	0.307	0.023
umda	100	100	159	189	189	6	0.625	0.595

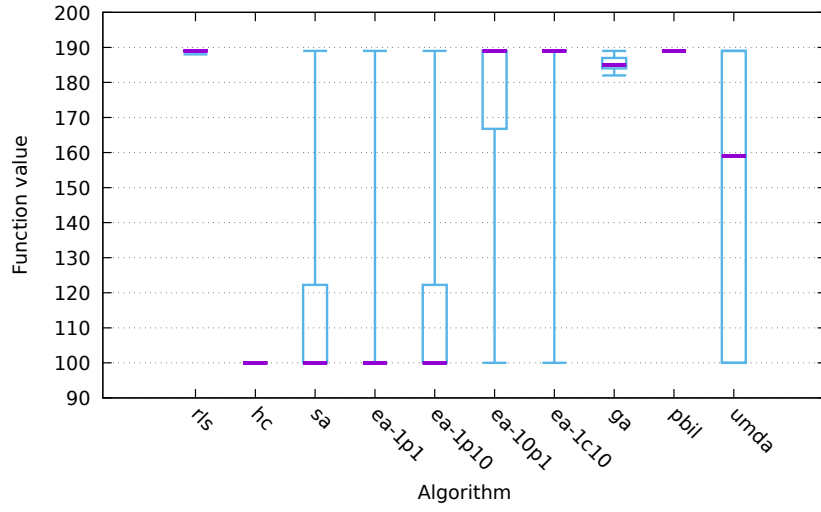


Figure 19: fp-10

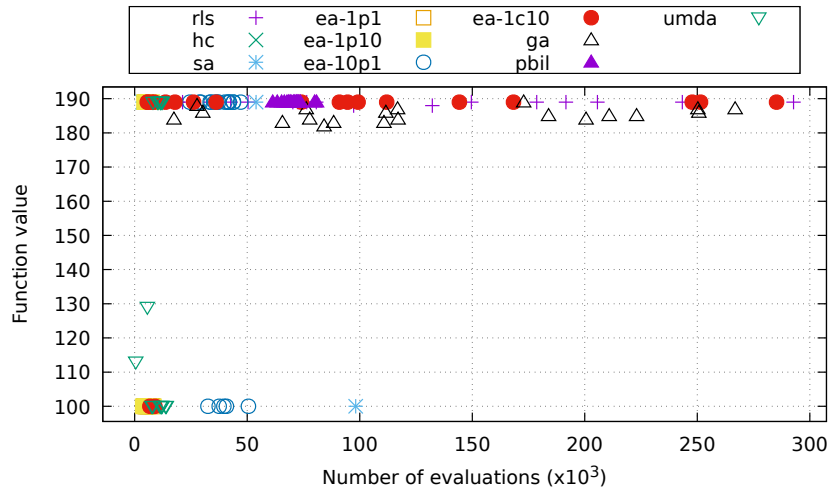


Figure 20: fp-10

12 Function nk

algorithm	function value					time (s)		
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	0.96	0.98	0.99	1.01	1.03	6	0.627	0.014
hc	0.97	0.98	0.99	1.01	1.06	5	0.558	0.012
sa	1.03	1.05	1.06	1.07	1.10	1	0.581	0.012
ea-1p1	0.80	0.90	0.93	0.96	1.06	10	0.731	0.018
ea-1p10	0.84	0.93	0.97	0.99	1.04	8	0.746	0.017
ea-10p1	0.90	0.99	1.02	1.04	1.06	4	0.842	0.026
ea-1c10	0.95	1.01	1.03	1.05	1.10	3	0.650	0.013
ga	1.00	1.03	1.05	1.06	1.07	2	1.771	0.019
pbil	0.94	0.97	0.99	1.01	1.02	7	1.678	0.014
umda	0.81	0.90	0.95	1.00	1.05	9	1.597	0.013

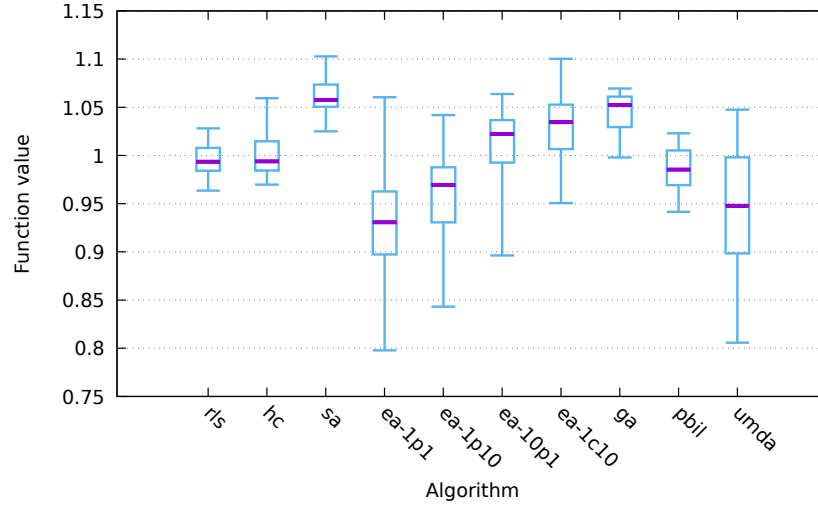


Figure 21: nk

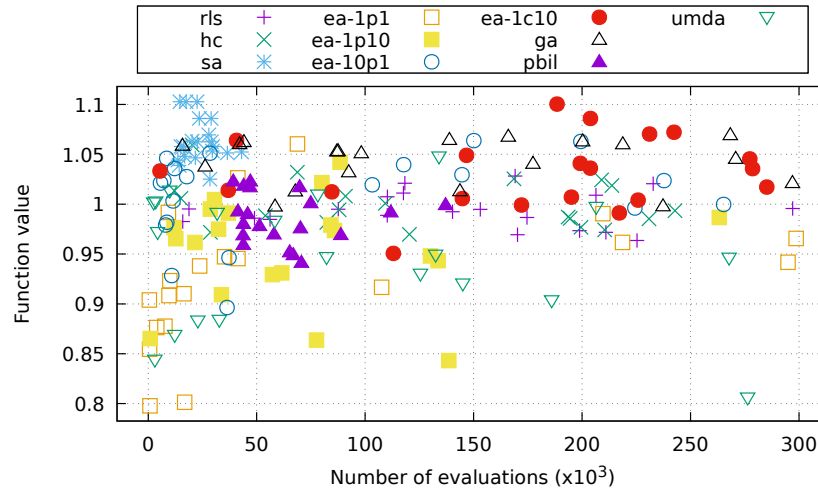


Figure 22: nk

13 Function max-sat

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	970	971	972	972	972	2	3.421	0.047
hc	961	966	968	968	972	7	2.746	0.079
sa	967	972	972	972	972	1	2.940	0.043
ea-1p1	960	964	971	972	972	3	3.166	0.118
ea-1p10	957	968	968	971	972	4	3.171	0.121
ea-10p1	962	964	968	971	972	8	4.047	0.104
ea-1c10	964	967	968	972	972	5	2.792	0.098
ga	964	967	968	968	971	6	5.238	0.107
pbil	964	967	967	967	968	9	4.194	0.072
umda	961	965	967	968	971	10	3.964	0.078

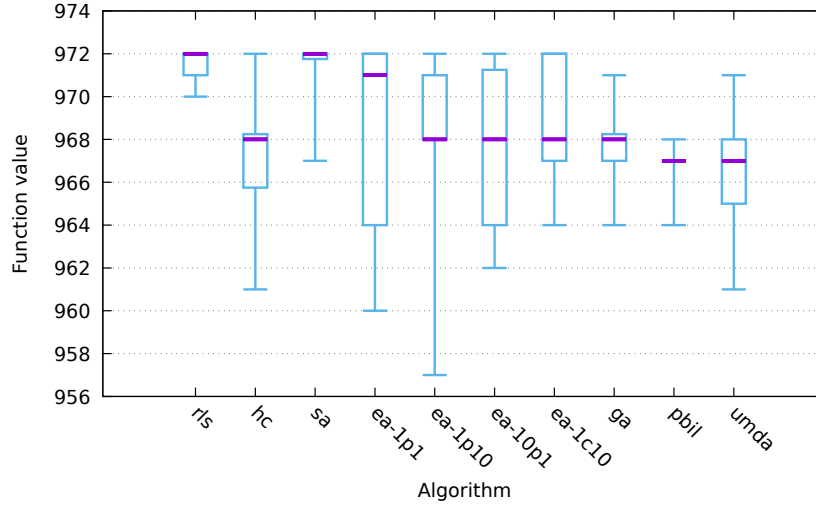


Figure 23: max-sat

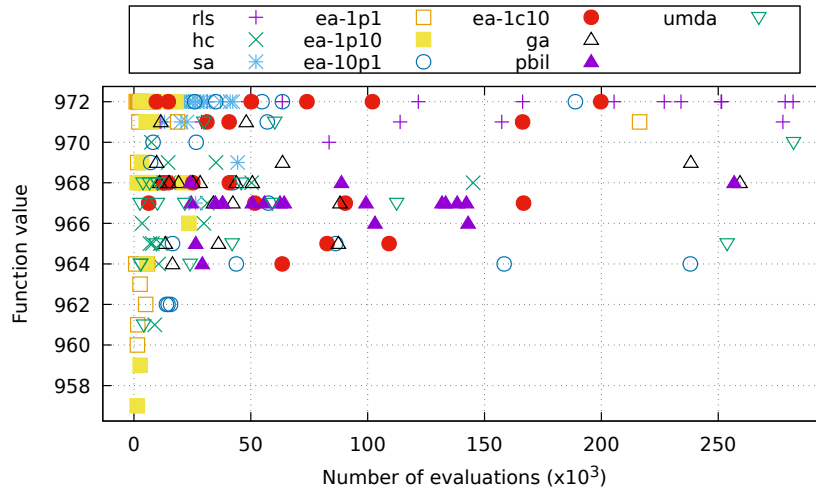


Figure 24: max-sat

14 Function labs

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	4.29	4.36	4.51	4.62	5.26	6	3.253	0.008
hc	4.47	4.62	4.68	4.81	5.62	5	3.207	0.008
sa	4.35	4.57	4.74	4.95	5.33	3	3.245	0.008
ea-1p1	3.45	3.95	4.24	4.46	4.89	7	3.362	0.024
ea-1p10	3.47	3.98	4.11	4.35	4.60	8	3.365	0.007
ea-10p1	4.15	4.47	4.68	4.82	5.47	4	3.426	0.009
ea-1c10	4.62	4.86	5.02	5.15	5.42	1	3.467	0.274
ga	4.60	4.85	4.99	5.07	5.35	2	4.262	0.010
pbil	3.41	3.66	3.91	4.11	4.44	10	4.339	0.017
umda	3.55	3.75	3.94	4.21	4.54	9	4.265	0.016

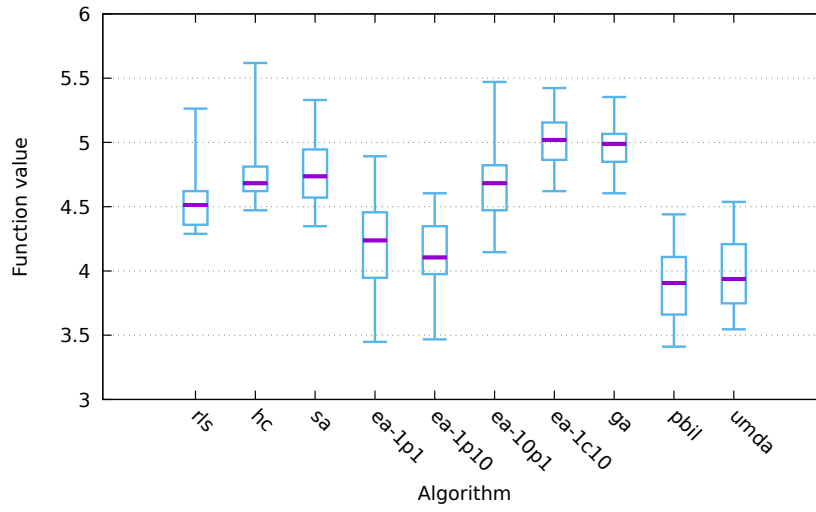


Figure 25: labs

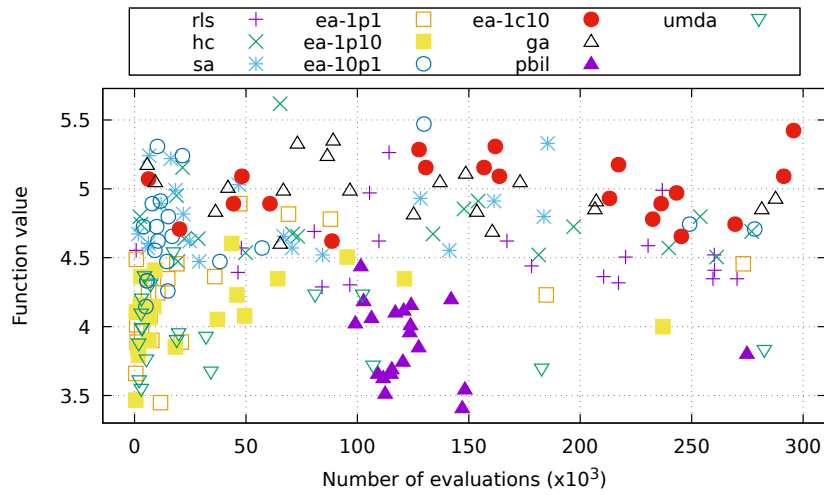


Figure 26: labs

15 Function ep

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	2.8×10^{-31}	1.2×10^{-30}	2.0×10^{-30}	3.5×10^{-30}	1.0×10^{-29}	2	0.206	0.007
hc	1.9×10^{-31}	9.1×10^{-31}	1.8×10^{-30}	5.6×10^{-30}	2.0×10^{-29}	1	0.162	0.004
sa	4.3×10^{-31}	2.0×10^{-30}	4.1×10^{-30}	8.9×10^{-30}	1.9×10^{-29}	4	0.194	0.005
ea-lp1	3.3×10^{-32}	3.4×10^{-30}	1.1×10^{-29}	2.4×10^{-29}	7.6×10^{-29}	8	0.315	0.026
ea-lp10	5.8×10^{-31}	6.4×10^{-30}	2.3×10^{-29}	3.2×10^{-29}	8.2×10^{-29}	9	0.313	0.007
ea-10p1	6.7×10^{-31}	2.1×10^{-30}	4.5×10^{-30}	1.3×10^{-29}	2.4×10^{-29}	5	0.398	0.012
ea-1c10	9.1×10^{-32}	1.8×10^{-30}	6.0×10^{-30}	8.8×10^{-30}	2.1×10^{-29}	7	0.268	0.006
ga	1.4×10^{-31}	2.1×10^{-30}	5.1×10^{-30}	1.0×10^{-29}	2.3×10^{-29}	6	1.279	0.018
pbil	1.3×10^{-31}	1.2×10^{-30}	3.5×10^{-30}	5.6×10^{-30}	1.9×10^{-29}	3	1.446	0.020
umda	1.8×10^{-30}	1.3×10^{-29}	3.3×10^{-29}	4.1×10^{-29}	7.1×10^{-29}	10	1.228	0.013

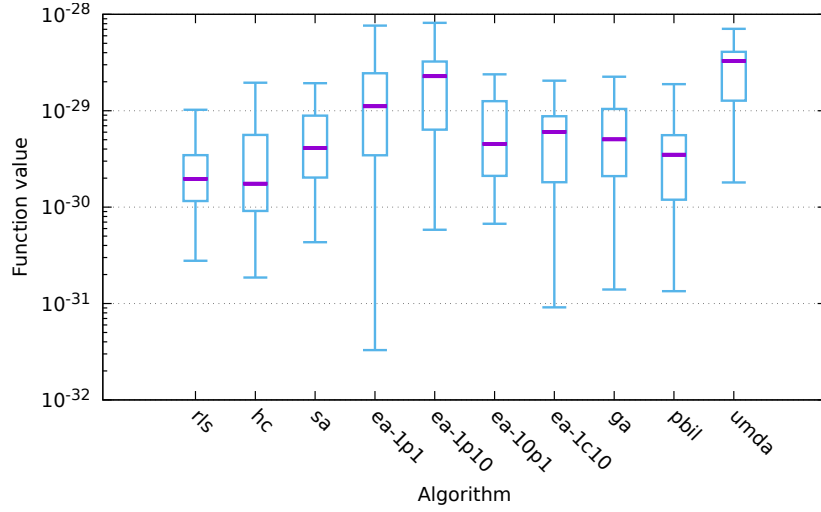


Figure 27: ep

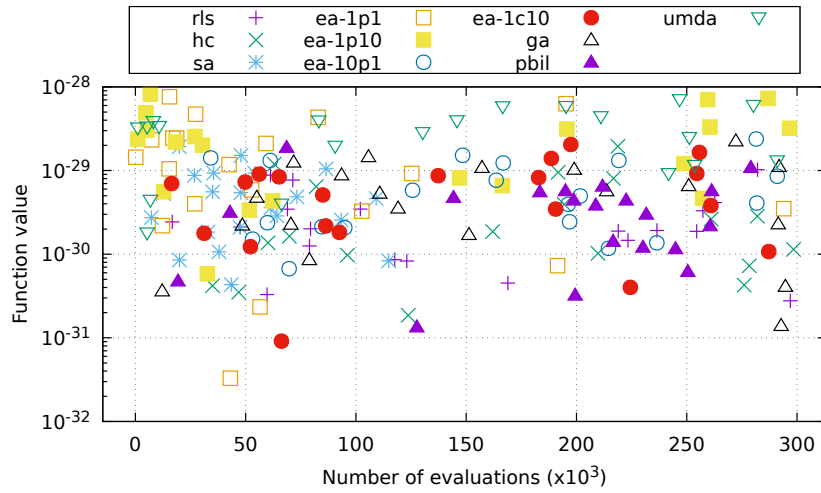


Figure 28: ep

16 Function cancel

algorithm	function value					time (s)		
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	0.62	1.37	1.53	1.69	2.29	8	0.182	0.005
hc	1.24	2.50	3.61	4.49	7.49	10	0.146	0.006
sa	0.44	1.25	2.48	3.21	3.98	9	0.184	0.005
ea-1p1	0.06	0.13	0.24	0.69	1.50	2	0.304	0.009
ea-1p10	0.05	0.31	0.69	0.76	1.79	4	0.311	0.008
ea-10p1	0.06	0.20	0.69	0.81	1.64	5	0.380	0.009
ea-1c10	0.06	0.41	0.75	1.36	2.66	6	0.262	0.007
ga	0.03	0.08	0.54	0.76	1.67	3	1.224	0.018
pbil	0.04	0.06	0.07	0.10	0.32	1	1.279	0.017
umda	0.16	1.14	1.46	1.91	2.43	7	1.215	0.016

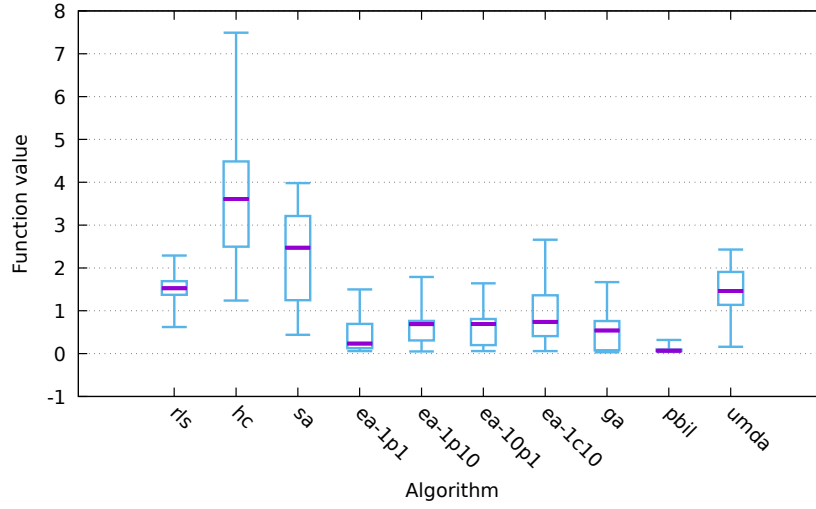


Figure 29: cancel

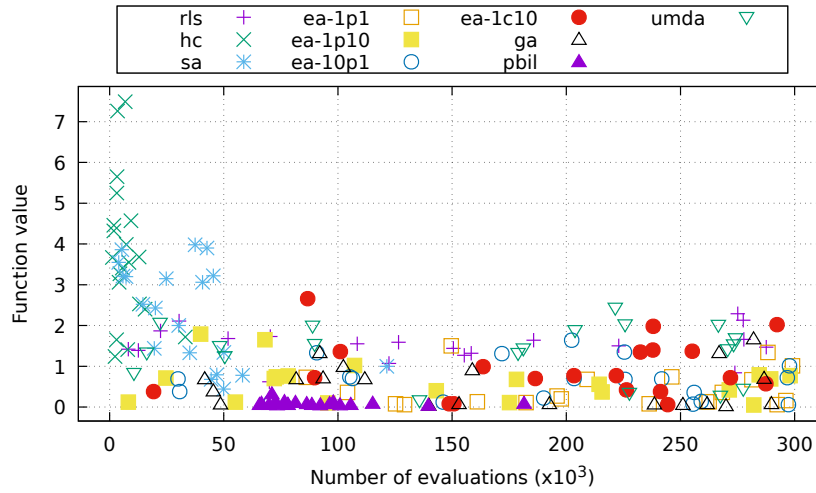


Figure 30: cancel

17 Function trap

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	90	91	91	91	91	2	0.185	0.006
hc	91	91	91	91	92	1	0.151	0.004
sa	90	90	90	90	90	5	0.191	0.003
ea-lp1	90	90	90	90	90	5	0.308	0.010
ea-lp10	90	90	90	90	91	3	0.308	0.008
ea-10p1	90	90	90	90	91	3	0.386	0.009
ea-1c10	90	90	90	90	90	5	0.263	0.005
ga	90	90	90	90	90	5	1.209	0.020
pbil	90	90	90	90	90	5	1.235	0.020
umda	90	90	90	90	90	5	1.218	0.014

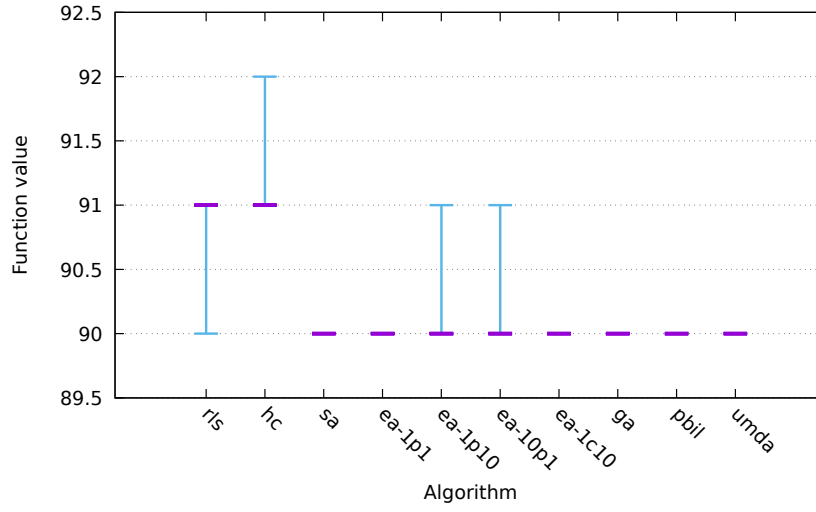


Figure 31: trap

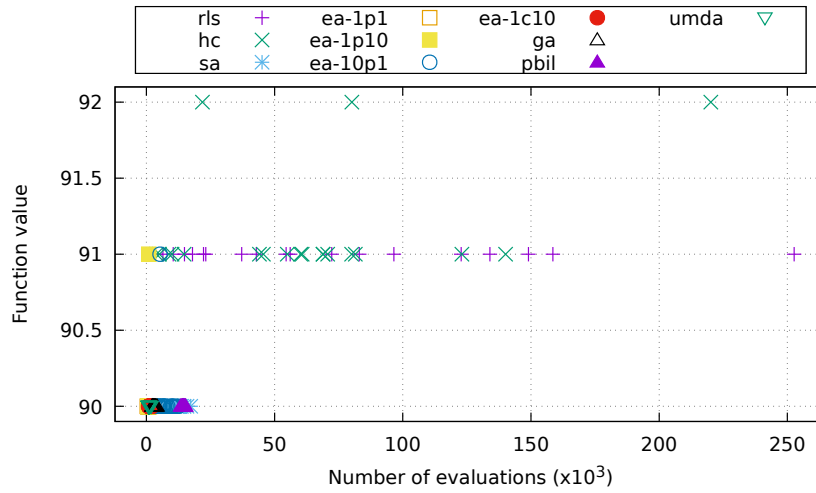


Figure 32: trap

18 Function hiff

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	402	416	422	429	448	10	0.533	0.015
hc	476	484	504	516	560	6	0.498	0.012
sa	640	704	704	768	832	3	0.628	0.017
ea-1p1	440	478	492	514	552	8	0.689	0.020
ea-1p10	416	462	476	496	584	9	0.683	0.023
ea-10p1	632	684	736	800	896	2	0.820	0.019
ea-1c10	612	643	664	682	760	4	0.667	0.015
ga	704	717	768	772	776	1	1.839	0.026
pbil	474	508	544	561	642	5	1.933	0.022
umda	456	472	502	522	560	7	1.870	0.018

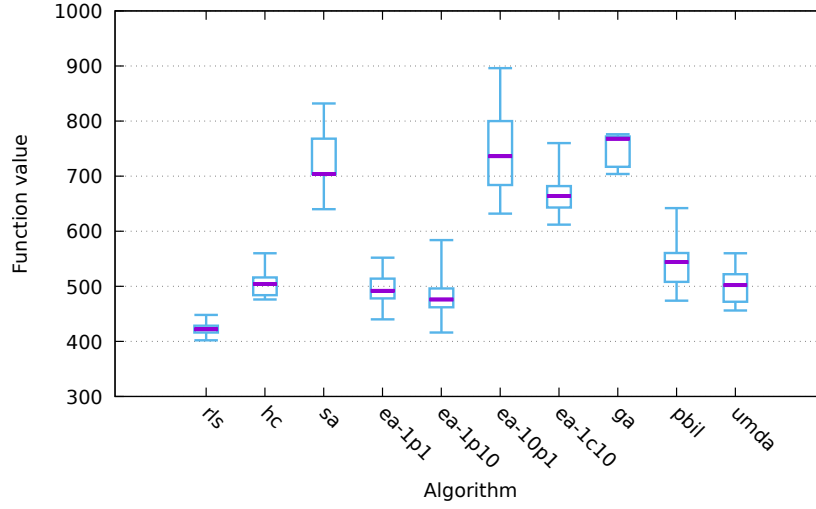


Figure 33: hiff

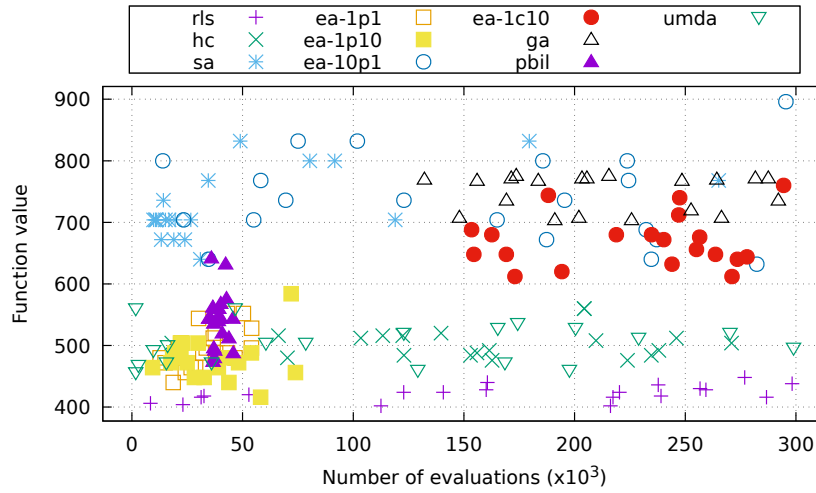


Figure 34: hiff

19 Function plateau

algorithm	function value						time (s)	
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	101	101	101	101	101	5	0.157	0.008
hc	101	101	101	101	102	2	0.131	0.018
sa	101	101	101	102	102	1	0.146	0.045
ea-lp1	101	101	101	101	102	4	0.260	0.054
ea-lp10	101	101	101	101	102	2	0.282	0.023
ea-10p1	101	101	101	101	101	5	0.349	0.010
ea-1c10	101	101	101	101	101	5	0.243	0.005
ga	101	101	101	101	101	5	1.188	0.012
pbil	101	101	101	101	101	5	1.215	0.013
umda	101	101	101	101	101	5	1.207	0.028

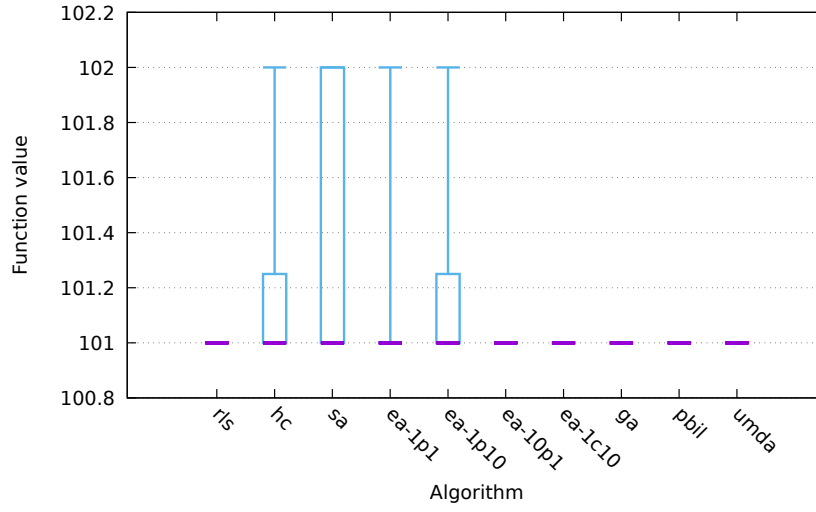


Figure 35: plateau

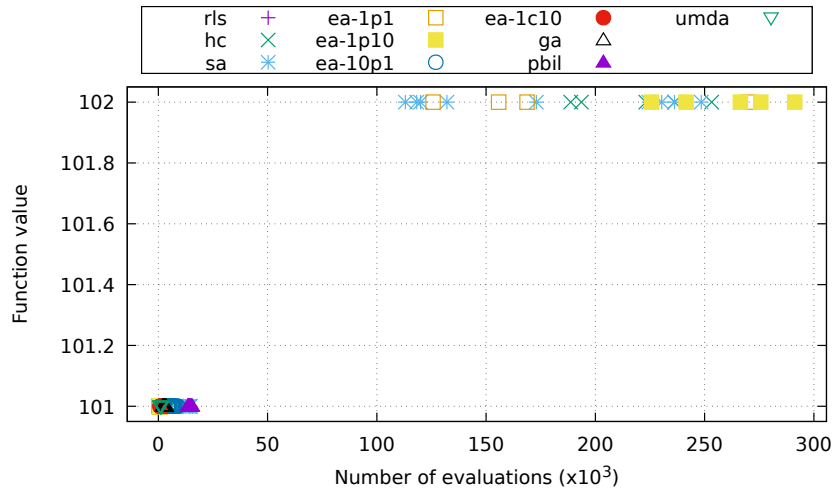


Figure 36: plateau

20 Function walsh2

algorithm	function value					time (s)		
	min	Q_1	med.	Q_3	max	rk	mean	dev.
rls	695.51	698.54	699.79	705.97	720.04	5	2.930	0.017
hc	704.56	710.10	714.75	718.70	721.22	1	2.789	0.023
sa	701.56	710.17	713.69	720.24	721.22	2	2.834	0.048
ea-1p1	589.72	628.62	665.00	691.37	716.57	9	3.277	0.065
ea-1p10	612.37	668.89	685.75	704.44	720.24	7	3.325	0.099
ea-10p1	640.19	678.82	690.40	702.12	721.22	6	3.575	0.112
ea-1c10	682.78	698.16	702.83	713.69	721.22	4	3.046	0.061
ga	683.58	702.96	708.12	720.39	721.22	3	4.596	0.060
pbil	626.93	644.79	656.09	666.47	712.76	10	4.171	0.204
umda	634.87	657.23	667.08	680.47	713.69	8	4.046	0.259

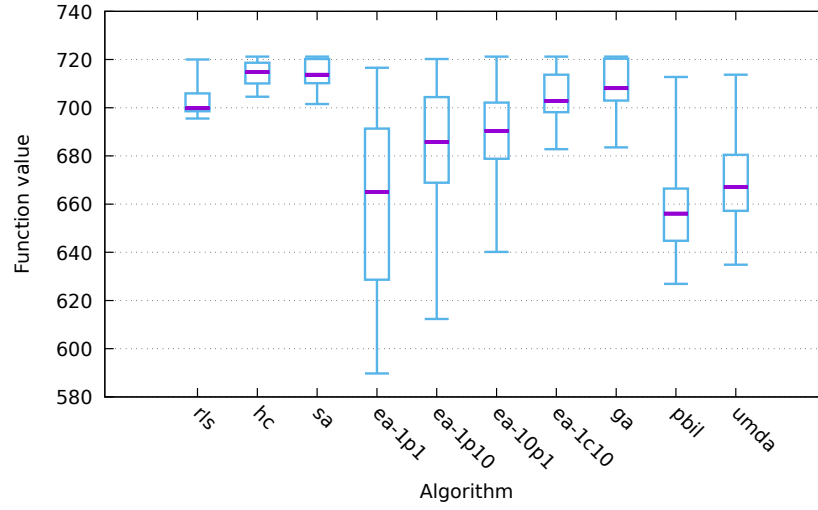


Figure 37: walsh2

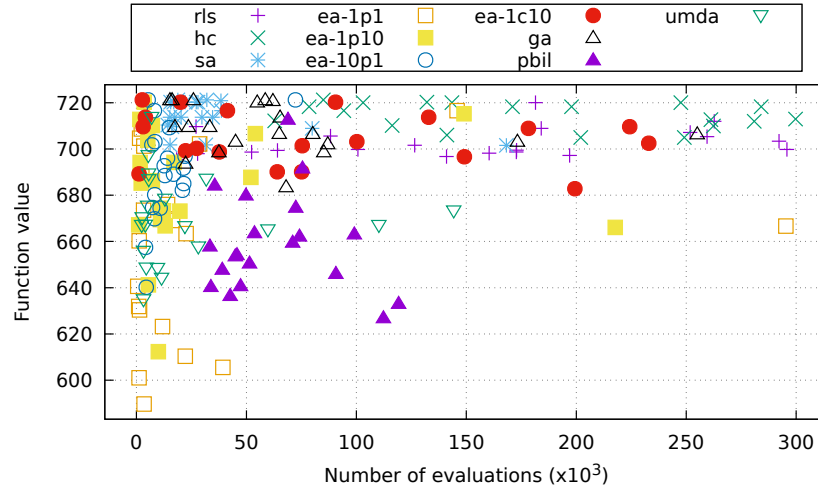


Figure 38: walsh2

A Plan

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{
  "exec": "hnco",
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```

"opt": "--print-performance --map 1 --map-random -s 100 -i 0 -b 300000",
"num_runs": 20,
"parallel": true,
"results": "results",
"graphics": "graphics",
"report": "report",
"functions": [
  {
    "id": "one-max",
    "opt": "-F 0 --stop-on-maximum",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "lin",
    "opt": "-F 1 -p instances/lin.100",
    "col": ">{\nnprouddigits{2}}N{2}{2}"
  },
  {
    "id": "leading-ones",
    "opt": "-F 10 --stop-on-maximum",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "ridge",
    "opt": "-F 11 --stop-on-maximum",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "jmp-5",
    "opt": "-F 30 --stop-on-maximum -t 5",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "jmp-10",
    "opt": "-F 30 --stop-on-maximum -t 10",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "djmp-5",
    "opt": "-F 31 --stop-on-maximum -t 5",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "djmp-10",
    "opt": "-F 31 --stop-on-maximum -t 10",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "fp-5",
    "opt": "-F 40 --stop-on-maximum -t 5",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "fp-10",
    "opt": "-F 40 --stop-on-maximum -t 10",
    "col": ">{\nnprouddigits{0}}N{3}{0}"
  },
  {
    "id": "nk",
    "opt": "-F 60 -p instances/nk.100.4",
    "col": ">{\nnprouddigits{2}}N{1}{2}"
  },
  {

```

```

    "id": "max-sat",
    "opt": "-F 70 -p instances/ms.100.3.1000",
    "col": ">{\nprounddigits{0}}N{3}{0}"
  },
  {
    "id": "labs",
    "opt": "-F 81",
    "col": ">{\nprounddigits{2}}N{1}{2}"
  },
  {
    "id": "ep",
    "opt": "-F 90 -p instances/ep.100",
    "reverse": true,
    "logscale": true,
    "col": ">{\nprounddigits{1}}N{1}{1}"
  },
  {
    "id": "cancel",
    "opt": "-F 100 -s 99",
    "reverse": true,
    "col": ">{\nprounddigits{2}}N{1}{2}"
  },
  {
    "id": "trap",
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    "col": ">{\nprounddigits{0}}N{3}{0}"
  },
  {
    "id": "hiff",
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    "col": ">{\nprounddigits{0}}N{3}{0}"
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  {
    "id": "plateau",
    "opt": "-F 130 --stop-on-maximum",
    "col": ">{\nprounddigits{0}}N{3}{0}"
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  {
    "id": "walsh2",
    "opt": "-F 162 -p instances/walsh2.100",
    "col": ">{\nprounddigits{2}}N{3}{2}"
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],
"algorithms": [
  {
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  },
  {
    "id": "hc",
    "opt": "-A 150 --restart"
  },
  {
    "id": "sa",
    "opt": "-A 200 --sa-beta-ratio 1.05 --sa-num-trials 10"
  },
  {
    "id": "ea-1p1",
    "opt": "-A 300"
  },
  {
    "id": "ea-1p10",
    "opt": "-A 310 --ea-mu 1 --ea-lambda 10"
  }
]

```

```

    },
    {
        "id": "ea-10p1",
        "opt": "-A 310 --ea-mu 10 --ea-lambda 1"
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    {
        "id": "ea-1c10",
        "opt": "-A 320 --ea-mu 1 --ea-lambda 10 --allow-stay"
    },
    {
        "id": "ga",
        "opt": "-A 400 --ea-mu 100"
    },
    {
        "id": "pbil",
        "opt": "-A 500 -r 5e-3"
    },
    {
        "id": "umda",
        "opt": "-A 600 -x 100 -y 10"
    }
]
}

```

B Default parameters

```

# algorithm = 100
# bm_mc_reset_strategy = 1
# bm_num_gs_cycles = 1
# bm_num_gs_steps = 100
# bm_sampling = 1
# budget = 10000
# bv_size = 100
# cache_budget = 0
# ea_lambda = 100
# ea_mu = 10
# fn_name = noname
# fn_num_traps = 10
# fn_prefix_length = 2
# fn_threshold = 10
# function = 0
# ga_crossover_bias = 0.5
# ga_crossover_probability = 0.5
# ga_tournament_size = 10
# hea_binary_dynamics = 0
# hea_delay = 10000
# hea_num_par_updates = 1
# hea_num_seq_updates = 100
# hea_rate_strategy = 0
# hea_reset_period = 0
# hea_sampling_method = 0
# hea_time_constant = 1000
# hea_weight = 1
# learning_rate = 0.001
# map = 0
# map_input_size = 100
# map_path = nopath
# mutation_probability = 1
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0

```



```
# num_threads = 1
# path = nopath
# pn_mutation_probability = 1
# pn_neighborhood = 0
# pn_radius = 2
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# rls_patience = 50
# sa_beta_ratio = 1.2
# sa_initial_acceptance_probability = 0.6
# sa_num_transitions = 50
# sa_num_trials = 100
# seed = 0
# selection_size = 1
# target = 100
# print_defaults
# last_parameter
# exec_name = hnco
# version = 0.7
# Generated from hnco.json
```