HNCO
Comparison of black box optimization algorithms
Cache lookup ratio

May 18, 2020

Contents

1 Ranking

algorithm	rank distribution									
	1	2	3	4	5	6	7	8	9	10
sa	11	7	0	1	0	0	0	0	0	0
umda	8	6	1	2	2	0	0	0	0	0
ea-1c10	0	4	0	1	5	9	0	0	0	0
ea-1p1	0	1	11	2	1	2	2	0	0	0
pbil	0	1	4	1	7	4	1	1	0	0
ea-1p10	0	0	3	10	3	3	0	0	0	0
rls	0	0	0	2	0	0	3	8	5	1
ea-10p1	0	0	0	0	1	1	9	3	5	0
ga	0	0	0	0	0	0	3	0	4	12
hc	0	0	0	0	0	0	1	7	5	6

Per function rankings (ex-eaquo are grouped in parentheses):

one-max umda, sa, ea-1p1, ea-1p10, ea-1c10, pbil, ga, ea-10p1, rls, hc

lin umda, sa, ea-1p1, ea-1p10, ea-1c10, pbil, ea-10p1, rls, hc, ga

leading-ones sa, umda, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, hc, rls, ga

ridge sa, umda, ea-1p1, ea-1p10, ea-1c10, pbil, hc, ea-10p1, ga, rls

jmp-5 sa, ea-1c10, pbil, umda, ea-1p10, ea-1p1, rls, hc, ea-10p1, ga

jmp-10 sa, ea-1c10, pbil, rls, umda, ea-1p10, ea-1p1, hc, ea-10p1, ga

djmp-5 sa, ea-1c10, pbil, umda, ea-1p10, ea-1p1, rls, hc, ea-10p1, ga

djmp-10 sa, ea-1c10, pbil, rls, umda, ea-1p10, ea-1p1, hc, ea-10p1, ga

fp-5 sa, umda, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, hc, rls, ga

fp-10 sa, umda, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, hc, rls, ga

nk umda, sa, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, rls, ga, hc

max-sat umda, sa, ea-1p1, pbil, ea-1p10, ea-1c10, ea-10p1, rls, ga, hc

labs sa, umda, ea-1p10, ea-1p1, ea-10p1, ea-1c10, pbil, rls, hc, ga

ep umda, ea-1p1, ea-1p10, sa, ea-1c10, ea-10p1, rls, pbil, hc, ga

cancel umda, sa, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, rls, hc, ga

trap umda, sa, ea-1p1, ea-1p10, ea-1c10, pbil, ga, ea-10p1, rls, hc

hiff sa, umda, ea-1p10, ea-1p1, pbil, ea-1c10, ea-10p1, rls, hc, ga

plateau sa, pbil, umda, ea-1c10, ea-1p1, ea-1p10, ga, rls, ea-10p1, hc

walsh2 umda, sa, ea-1p1, ea-1p10, pbil, ea-1c10, ea-10p1, rls, ga, hc

2 Function one-max

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.135	0.138	0.139	0.141	0.144	9
hc	0.046	0.046	0.047	0.048	0.048	10
sa	0.896	0.899	0.900	0.901	0.903	2
ea-1p1	0.863	0.864	0.865	0.865	0.866	3
ea-1p10	0.862	0.864	0.864	0.864	0.865	4
ea-10p1	0.143	0.144	0.145	0.146	0.148	8
ea-1c10	0.849	0.854	0.856	0.859	0.863	5
ga	0.367	0.372	0.374	0.375	0.381	7
pbil	0.854	0.855	0.855	0.856	0.856	6
umda	0.903	0.904	0.904	0.905	0.905	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.73	0.01	0.94	0.01
hc	0.18	0.00	0.74	0.01	0.92	0.01
sa	0.22	0.00	0.48	0.00	0.70	0.00
ea-1p1	0.31	0.00	0.52	0.01	0.83	0.01
ea-1p10	0.33	0.00	0.52	0.01	0.85	0.01
ea-10p1	0.42	0.01	0.77	0.01	1.19	0.01
ea-1c10	0.29	0.00	0.51	0.01	0.80	0.01
ga	1.20	0.00	0.70	0.01	1.89	0.01
pbil	1.26	0.00	0.52	0.01	1.77	0.01
umda	1.24	0.00	0.51	0.01	1.75	0.01

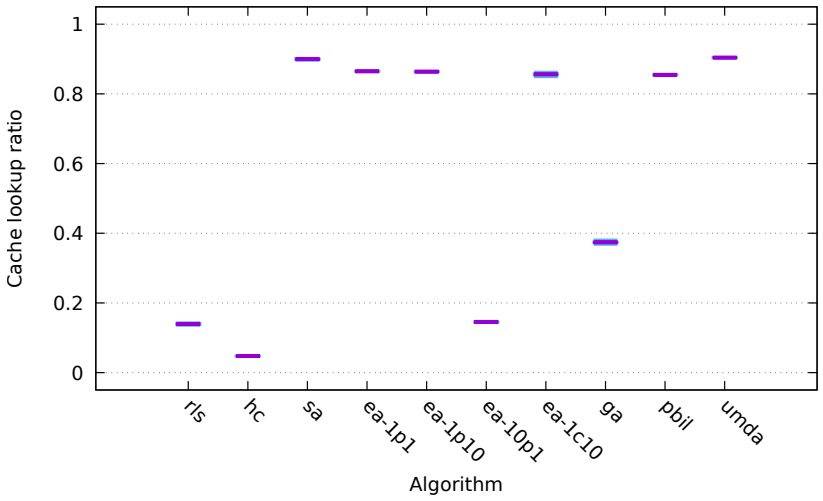

Figure 1: one-max

3 Function lin

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.133	0.137	0.138	0.141	0.145	8
hc	0.083	0.084	0.086	0.091	0.092	9
sa	0.864	0.870	0.872	0.874	0.884	2
ea-1p1	0.863	0.864	0.865	0.865	0.866	3
ea-1p10	0.862	0.863	0.863	0.864	0.865	4
ea-10p1	0.732	0.736	0.737	0.738	0.742	7
ea-1c10	0.849	0.855	0.857	0.858	0.867	5
ga	0.065	0.068	0.070	0.072	0.075	10
pbil	0.833	0.836	0.837	0.838	0.839	6
umda	0.902	0.902	0.903	0.903	0.904	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.79	0.01	1.00	0.01
hc	0.18	0.00	0.79	0.01	0.96	0.01
sa	0.22	0.01	0.50	0.01	0.71	0.02
ea-1p1	0.32	0.01	0.53	0.00	0.84	0.01
ea-1p10	0.34	0.00	0.53	0.00	0.86	0.01
ea-10p1	0.40	0.01	0.60	0.01	1.01	0.02
ea-1c10	0.29	0.00	0.52	0.01	0.81	0.01
ga	1.21	0.00	0.83	0.01	2.04	0.01
pbil	1.26	0.00	0.54	0.01	1.80	0.01
umda	1.24	0.01	0.51	0.01	1.76	0.01

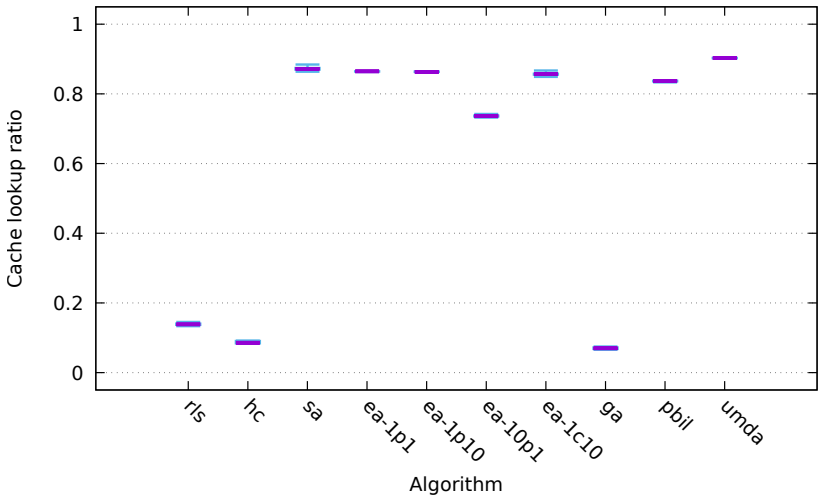

Figure 2: lin

4 Function leading-ones

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.041	0.043	0.044	0.045	0.047	9
hc	0.083	0.086	0.089	0.090	0.092	8
sa	0.558	0.982	0.984	0.985	0.989	1
ea-1p1	0.844	0.851	0.853	0.854	0.855	3
ea-1p10	0.846	0.849	0.851	0.852	0.855	4
ea-10p1	0.494	0.510	0.519	0.526	0.542	7
ea-1c10	0.568	0.610	0.614	0.621	0.649	6
ga	0.007	0.007	0.008	0.008	0.008	10
pbil	0.659	0.664	0.668	0.679	0.691	5
umda	0.869	0.876	0.878	0.879	0.884	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.20	0.00	0.79	0.01	0.99	0.01
hc	0.18	0.00	0.77	0.01	0.95	0.01
sa	0.21	0.00	0.46	0.04	0.67	0.04
ea-1p1	0.32	0.01	0.52	0.01	0.84	0.01
ea-1p10	0.33	0.00	0.52	0.00	0.86	0.00
ea-10p1	0.40	0.01	0.67	0.01	1.06	0.01
ea-1c10	0.29	0.00	0.60	0.01	0.89	0.01
ga	1.21	0.00	0.84	0.01	2.04	0.01
pbil	1.27	0.00	0.58	0.01	1.86	0.01
umda	1.25	0.01	0.52	0.01	1.77	0.01

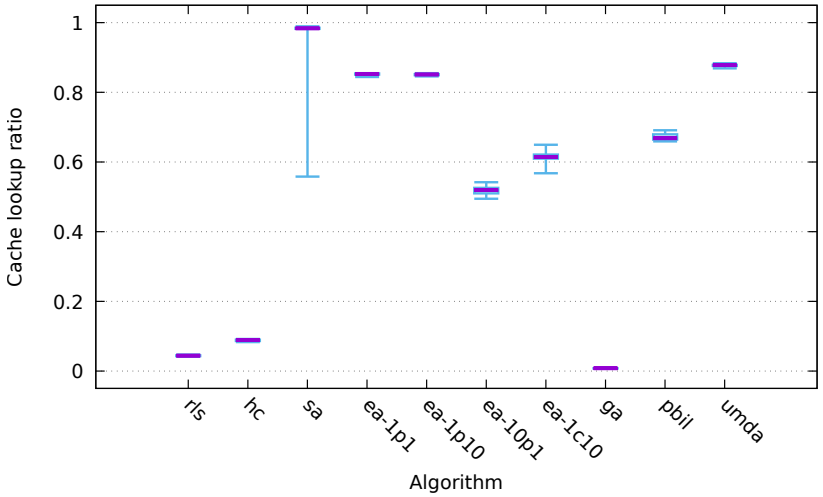

Figure 3: leading-ones

5 Function ridge

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.138	0.142	0.143	0.146	0.150	10
hc	0.632	0.637	0.643	0.645	0.648	7
sa	0.920	0.927	0.932	0.936	0.948	1
ea-1p1	0.824	0.830	0.832	0.833	0.835	3
ea-1p10	0.827	0.829	0.832	0.833	0.836	4
ea-10p1	0.560	0.573	0.581	0.585	0.590	8
ea-1c10	0.715	0.719	0.721	0.722	0.727	5
ga	0.366	0.370	0.372	0.375	0.382	9
pbil	0.691	0.693	0.694	0.695	0.696	6
umda	0.846	0.848	0.850	0.851	0.854	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.73	0.01	0.94	0.01
hc	0.18	0.00	0.59	0.01	0.77	0.01
sa	0.22	0.01	0.45	0.00	0.68	0.01
ea-1p1	0.32	0.01	0.53	0.00	0.85	0.01
ea-1p10	0.33	0.00	0.53	0.00	0.86	0.01
ea-10p1	0.40	0.01	0.63	0.01	1.03	0.01
ea-1c10	0.29	0.00	0.54	0.00	0.83	0.00
ga	1.20	0.00	0.70	0.01	1.90	0.01
pbil	1.26	0.00	0.55	0.00	1.81	0.00
umda	1.24	0.00	0.52	0.01	1.76	0.01

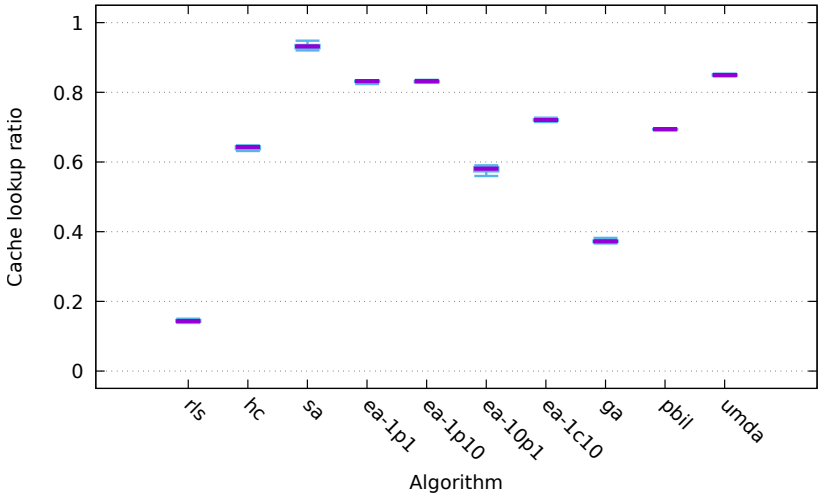

Figure 4: ridge

6 Function jmp-5

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.089	0.089	0.089	0.090	0.090	7
hc	0.019	0.019	0.019	0.019	0.019	8
sa	0.782	0.788	0.790	0.792	0.801	1
ea-1p1	0.101	0.102	0.103	0.104	0.105	6
ea-1p10	0.101	0.103	0.103	0.104	0.106	5
ea-10p1	0.012	0.013	0.013	0.013	0.013	9
ea-1c10	0.508	0.512	0.514	0.517	0.518	2
ga	0.004	0.004	0.004	0.004	0.005	10
pbil	0.170	0.297	0.352	0.410	0.475	3
umda	0.174	0.184	0.186	0.190	0.195	4

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.74	0.01	0.95	0.01
hc	0.18	0.00	0.74	0.01	0.92	0.01
sa	0.22	0.01	0.50	0.00	0.72	0.01
ea-1p1	0.32	0.01	0.75	0.01	1.08	0.02
ea-1p10	0.34	0.00	0.75	0.01	1.09	0.01
ea-10p1	0.42	0.01	0.79	0.01	1.21	0.02
ea-1c10	0.29	0.00	0.59	0.00	0.88	0.01
ga	1.20	0.00	0.80	0.01	1.99	0.01
pbil	1.30	0.01	0.68	0.03	1.99	0.03
umda	1.28	0.01	0.74	0.01	2.02	0.01

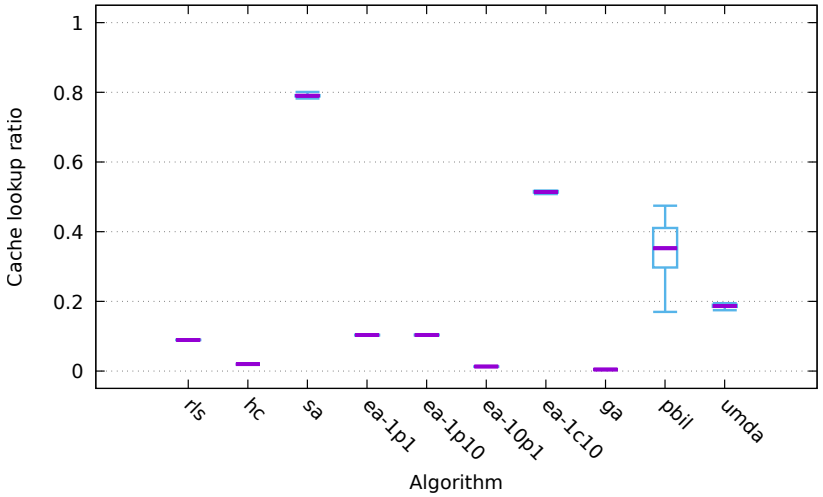

Figure 5: jmp-5

7 Function jmp-10

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.085	0.086	0.086	0.087	0.087	4
hc	0.019	0.019	0.019	0.019	0.019	8
sa	0.780	0.786	0.788	0.792	0.795	1
ea-1p1	0.056	0.057	0.058	0.059	0.060	7
ea-1p10	0.058	0.059	0.059	0.060	0.061	6
ea-10p1	0.010	0.010	0.010	0.010	0.010	9
ea-1c10	0.465	0.470	0.471	0.472	0.475	2
ga	0.003	0.003	0.003	0.004	0.004	10
pbil	0.119	0.205	0.264	0.319	0.373	3
umda	0.061	0.068	0.073	0.077	0.083	5

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.00	0.74	0.01	0.96	0.01
hc	0.18	0.00	0.74	0.01	0.92	0.01
sa	0.21	0.00	0.50	0.00	0.71	0.00
ea-1p1	0.33	0.01	0.76	0.01	1.09	0.02
ea-1p10	0.34	0.00	0.75	0.01	1.09	0.01
ea-10p1	0.42	0.01	0.79	0.01	1.22	0.02
ea-1c10	0.29	0.00	0.60	0.01	0.89	0.01
ga	1.20	0.00	0.81	0.01	2.01	0.01
pbil	1.33	0.01	0.73	0.03	2.06	0.03
umda	1.30	0.00	0.76	0.01	2.05	0.01

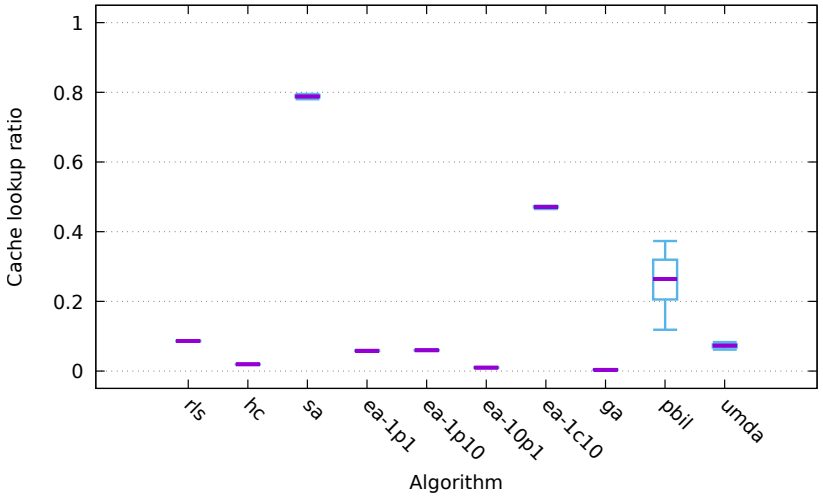

Figure 6: jmp-10

8 Function djmp-5

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.088	0.089	0.089	0.090	0.090	7
hc	0.019	0.019	0.019	0.019	0.019	8
sa	0.785	0.787	0.790	0.792	0.797	1
ea-1p1	0.101	0.102	0.103	0.103	0.105	6
ea-1p10	0.100	0.102	0.103	0.104	0.105	5
ea-10p1	0.012	0.013	0.013	0.013	0.014	9
ea-1c10	0.508	0.511	0.514	0.516	0.520	2
ga	0.004	0.004	0.004	0.004	0.005	10
pbil	0.202	0.251	0.295	0.385	0.492	3
umda	0.161	0.179	0.183	0.193	0.202	4

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.74	0.01	0.95	0.01
hc	0.18	0.00	0.74	0.01	0.92	0.01
sa	0.22	0.00	0.50	0.00	0.72	0.00
ea-1p1	0.32	0.01	0.75	0.01	1.07	0.01
ea-1p10	0.34	0.00	0.75	0.00	1.09	0.01
ea-10p1	0.42	0.01	0.79	0.01	1.21	0.02
ea-1c10	0.29	0.00	0.60	0.01	0.89	0.01
ga	1.20	0.00	0.80	0.01	1.99	0.01
pbil	1.30	0.01	0.70	0.03	2.00	0.04
umda	1.28	0.01	0.73	0.01	2.02	0.01

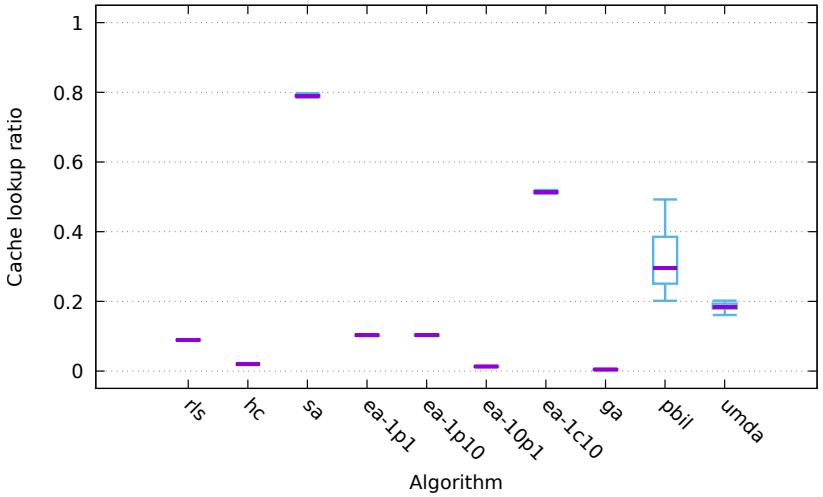

Figure 7: djmp-5

9 Function djmp-10

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.085	0.086	0.086	0.086	0.087	4
hc	0.019	0.019	0.019	0.019	0.019	8
sa	0.783	0.787	0.789	0.791	0.796	1
ea-1p1	0.057	0.058	0.058	0.059	0.059	7
ea-1p10	0.058	0.059	0.059	0.060	0.061	6
ea-10p1	0.009	0.010	0.010	0.010	0.010	9
ea-1c10	0.466	0.468	0.470	0.471	0.475	2
ga	0.003	0.003	0.004	0.004	0.004	10
pbil	0.162	0.268	0.306	0.334	0.415	3
umda	0.061	0.072	0.076	0.078	0.081	5

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.00	0.74	0.01	0.96	0.01
hc	0.18	0.00	0.74	0.01	0.93	0.01
sa	0.22	0.00	0.50	0.00	0.72	0.00
ea-1p1	0.33	0.01	0.76	0.01	1.09	0.01
ea-1p10	0.34	0.00	0.76	0.01	1.10	0.01
ea-10p1	0.42	0.01	0.79	0.01	1.21	0.02
ea-1c10	0.29	0.00	0.60	0.00	0.89	0.01
ga	1.20	0.00	0.80	0.01	2.00	0.01
pbil	1.33	0.01	0.72	0.04	2.05	0.04
umda	1.30	0.00	0.76	0.01	2.06	0.01

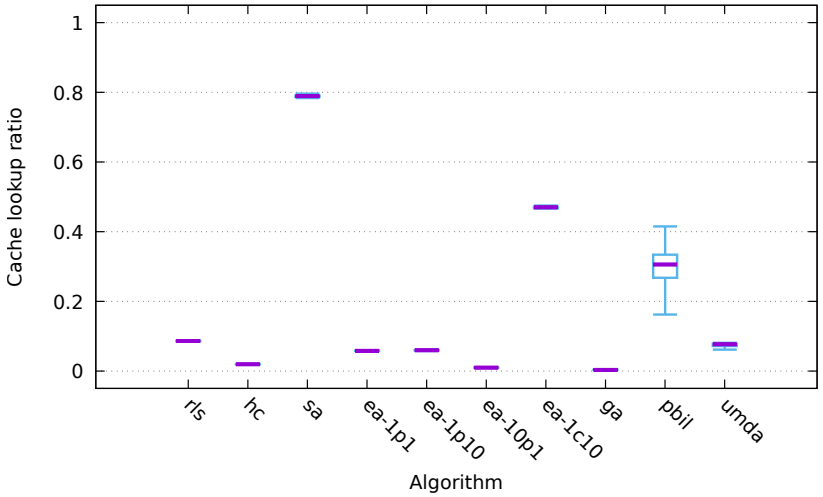

Figure 8: djmp-10

10 Function fp-5

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.040	0.041	0.042	0.043	0.047	9
hc	0.064	0.069	0.072	0.073	0.075	8
sa	0.588	0.982	0.984	0.986	0.990	1
ea-1p1	0.846	0.850	0.852	0.853	0.856	3
ea-1p10	0.846	0.850	0.852	0.853	0.855	4
ea-10p1	0.486	0.495	0.516	0.521	0.539	7
ea-1c10	0.594	0.613	0.623	0.635	0.654	6
ga	0.007	0.007	0.008	0.008	0.008	10
pbil	0.646	0.658	0.668	0.673	0.688	5
umda	0.868	0.874	0.878	0.881	0.885	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.20	0.01	0.77	0.01	0.97	0.01
hc	0.18	0.00	0.75	0.01	0.93	0.01
sa	0.21	0.00	0.45	0.02	0.66	0.02
ea-1p1	0.32	0.01	0.52	0.00	0.84	0.01
ea-1p10	0.33	0.00	0.52	0.00	0.86	0.01
ea-10p1	0.41	0.01	0.66	0.01	1.07	0.01
ea-1c10	0.29	0.00	0.59	0.01	0.88	0.01
ga	1.21	0.01	0.82	0.02	2.03	0.03
pbil	1.28	0.00	0.58	0.01	1.85	0.01
umda	1.24	0.00	0.52	0.01	1.76	0.01

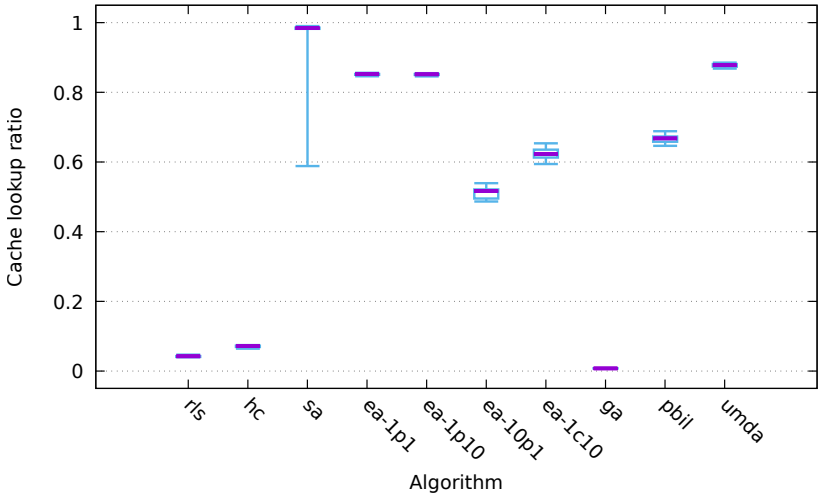

Figure 9: fp-5

11 Function fp-10

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.036	0.037	0.039	0.039	0.041	9
hc	0.066	0.069	0.071	0.072	0.076	8
sa	0.808	0.981	0.984	0.986	0.991	1
ea-1p1	0.846	0.850	0.852	0.853	0.859	3
ea-1p10	0.842	0.848	0.850	0.853	0.857	4
ea-10p1	0.468	0.503	0.513	0.520	0.534	7
ea-1c10	0.574	0.603	0.612	0.633	0.664	6
ga	0.007	0.007	0.007	0.008	0.008	10
pbil	0.658	0.671	0.679	0.689	0.702	5
umda	0.873	0.877	0.880	0.883	0.889	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.20	0.00	0.77	0.01	0.97	0.01
hc	0.18	0.00	0.75	0.00	0.93	0.01
sa	0.21	0.00	0.45	0.03	0.66	0.03
ea-1p1	0.32	0.01	0.53	0.01	0.84	0.01
ea-1p10	0.33	0.00	0.52	0.00	0.86	0.00
ea-10p1	0.40	0.01	0.66	0.01	1.07	0.02
ea-1c10	0.29	0.00	0.59	0.02	0.88	0.02
ga	1.21	0.00	0.84	0.02	2.05	0.02
pbil	1.28	0.00	0.57	0.01	1.85	0.01
umda	1.24	0.00	0.52	0.01	1.76	0.01

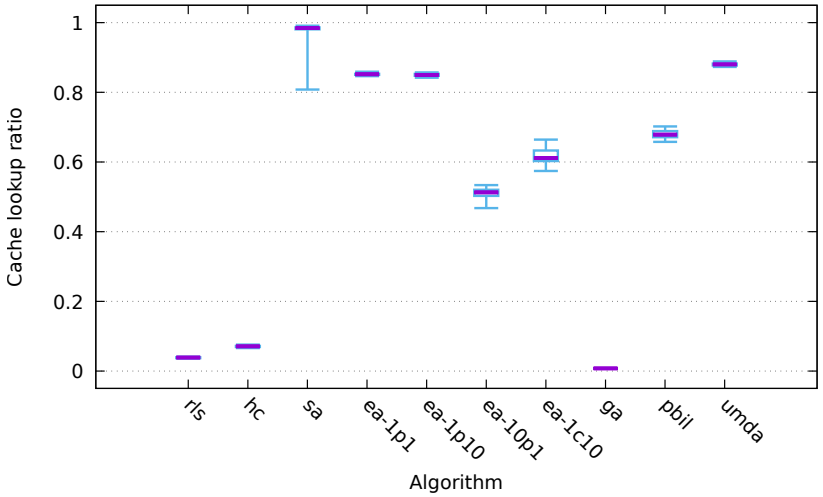

Figure 10: fp-10

12 Function nk

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.101	0.102	0.103	0.103	0.104	8
hc	0.019	0.019	0.019	0.019	0.019	10
sa	0.863	0.870	0.884	0.899	0.918	2
ea-1p1	0.819	0.833	0.846	0.854	0.865	3
ea-1p10	0.804	0.830	0.839	0.853	0.864	4
ea-10p1	0.649	0.675	0.695	0.720	0.737	7
ea-1c10	0.695	0.708	0.723	0.739	0.784	6
ga	0.018	0.023	0.028	0.033	0.068	9
pbil	0.769	0.774	0.776	0.782	0.790	5
umda	0.863	0.883	0.897	0.899	0.901	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.00	1.20	0.01	1.42	0.01
hc	0.19	0.00	1.22	0.01	1.40	0.02
sa	0.22	0.00	0.54	0.02	0.76	0.02
ea-1p1	0.32	0.01	0.63	0.01	0.95	0.01
ea-1p10	0.34	0.00	0.63	0.02	0.97	0.02
ea-10p1	0.41	0.01	0.80	0.03	1.20	0.03
ea-1c10	0.30	0.00	0.69	0.02	0.98	0.02
ga	1.22	0.00	1.40	0.02	2.62	0.02
pbil	1.27	0.00	0.74	0.01	2.01	0.02
umda	1.25	0.01	0.60	0.01	1.84	0.01

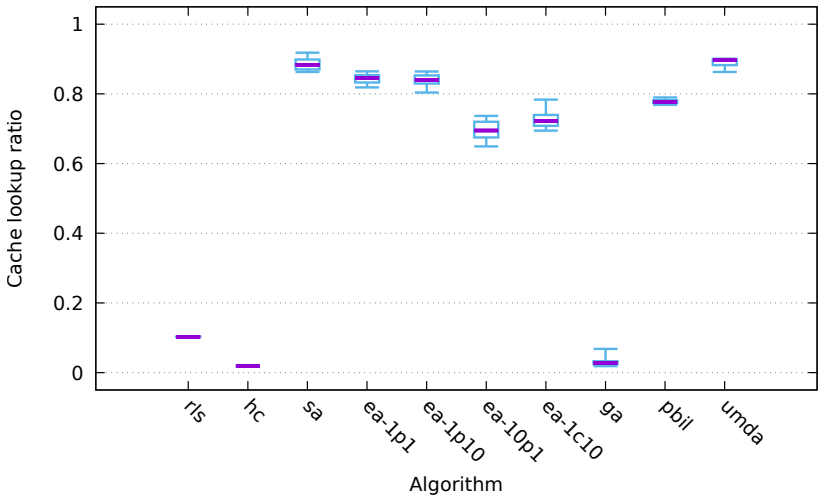

Figure 11: nk

13 Function max-sat

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.096	0.097	0.098	0.098	0.100	8
hc	0.019	0.019	0.019	0.019	0.019	10
sa	0.660	0.771	0.780	0.793	0.802	2
ea-1p1	0.533	0.683	0.759	0.813	0.846	3
ea-1p10	0.529	0.614	0.740	0.818	0.857	5
ea-10p1	0.053	0.105	0.160	0.200	0.220	7
ea-1c10	0.598	0.662	0.698	0.757	0.776	6
ga	0.020	0.024	0.035	0.056	0.082	9
pbil	0.710	0.725	0.744	0.758	0.798	4
umda	0.713	0.744	0.799	0.817	0.893	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.01	4.13	0.07	4.35	0.07
hc	0.19	0.00	4.01	0.04	4.20	0.05
sa	0.22	0.00	1.29	0.15	1.51	0.15
ea-1p1	0.33	0.01	1.68	0.36	2.00	0.36
ea-1p10	0.35	0.00	1.74	0.38	2.09	0.38
ea-10p1	0.44	0.01	4.39	0.19	4.82	0.19
ea-1c10	0.30	0.00	1.70	0.14	2.01	0.14
ga	1.22	0.00	5.04	0.11	6.26	0.11
pbil	1.28	0.01	1.86	0.09	3.14	0.10
umda	1.26	0.00	1.45	0.22	2.72	0.22

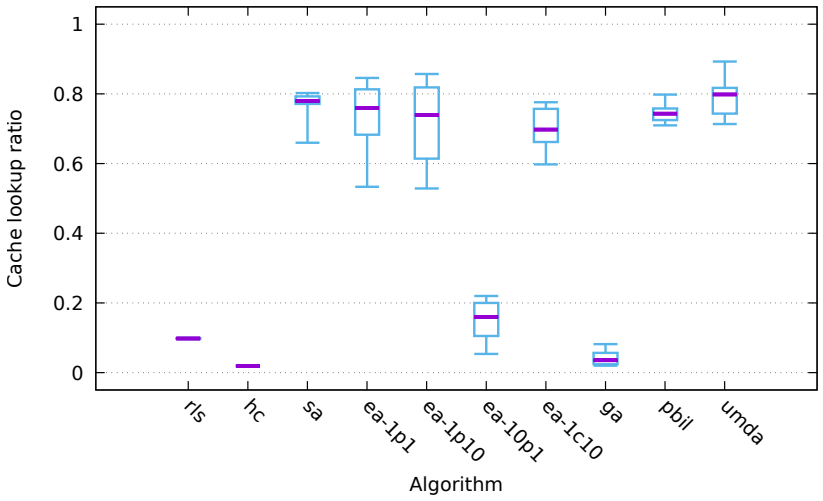

Figure 12: max-sat

14 Function labs

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.117	0.118	0.118	0.119	0.119	8
hc	0.018	0.018	0.018	0.018	0.018	9
sa	0.950	0.956	0.959	0.963	0.977	1
ea-1p1	0.815	0.844	0.852	0.859	0.865	4
ea-1p10	0.820	0.846	0.853	0.857	0.864	3
ea-10p1	0.658	0.690	0.696	0.705	0.723	5
ea-1c10	0.642	0.654	0.665	0.673	0.702	6
ga	0.012	0.016	0.016	0.021	0.029	10
pbil	0.497	0.526	0.546	0.554	0.580	7
umda	0.866	0.882	0.898	0.900	0.901	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	3.32	0.01	3.53	0.01
hc	0.18	0.00	3.64	0.01	3.81	0.01
sa	0.21	0.00	0.55	0.04	0.77	0.04
ea-1p1	0.31	0.01	0.95	0.03	1.27	0.04
ea-1p10	0.33	0.00	0.96	0.05	1.29	0.05
ea-10p1	0.39	0.01	1.50	0.07	1.89	0.07
ea-1c10	0.29	0.00	1.49	0.04	1.78	0.04
ga	1.19	0.00	3.68	0.03	4.87	0.03
pbil	1.31	0.00	1.96	0.07	3.27	0.07
umda	1.24	0.00	0.81	0.02	2.05	0.02

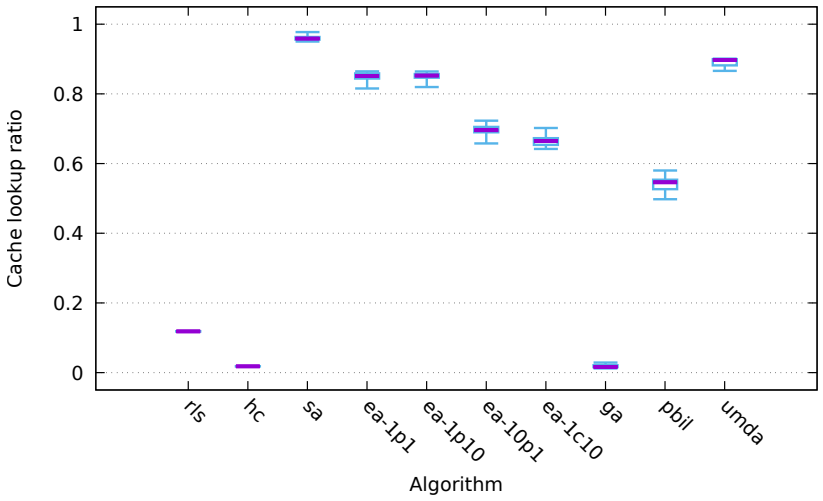

Figure 13: labs

15 Function ep

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.152	0.152	0.153	0.153	0.154	7
hc	0.013	0.013	0.013	0.013	0.013	9
sa	0.574	0.631	0.651	0.674	0.714	4
ea-1p1	0.814	0.833	0.841	0.846	0.865	2
ea-1p10	0.810	0.822	0.841	0.851	0.864	3
ea-10p1	0.580	0.594	0.602	0.610	0.627	6
ea-1c10	0.607	0.612	0.616	0.618	0.624	5
ga	0.005	0.005	0.005	0.005	0.005	10
pbil	0.004	0.052	0.105	0.137	0.179	8
umda	0.843	0.864	0.868	0.877	0.896	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.24	0.01	0.77	0.01	1.01	0.01
hc	0.19	0.00	0.80	0.01	0.98	0.01
sa	0.22	0.01	0.57	0.02	0.78	0.02
ea-1p1	0.32	0.01	0.54	0.01	0.85	0.01
ea-1p10	0.34	0.00	0.53	0.01	0.87	0.01
ea-10p1	0.40	0.01	0.65	0.00	1.05	0.01
ea-1c10	0.29	0.00	0.59	0.00	0.88	0.00
ga	1.21	0.00	0.93	0.01	2.14	0.01
pbil	1.39	0.01	0.93	0.02	2.32	0.03
umda	1.24	0.00	0.53	0.02	1.77	0.02

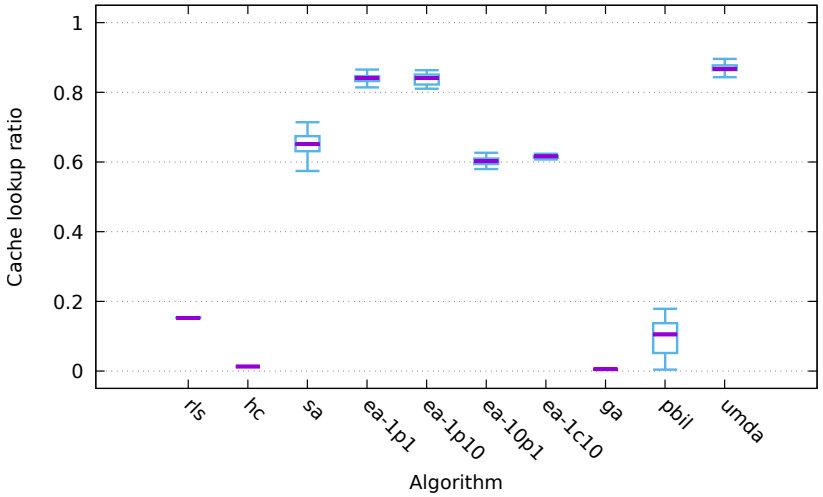

Figure 14: ep

16 Function cancel

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.091	0.093	0.094	0.095	0.095	8
hc	0.018	0.018	0.018	0.018	0.018	9
sa	0.648	0.689	0.702	0.720	0.743	2
ea-1p1	0.577	0.655	0.682	0.750	0.812	3
ea-1p10	0.584	0.616	0.670	0.730	0.815	4
ea-10p1	0.276	0.415	0.481	0.542	0.638	7
ea-1c10	0.593	0.601	0.606	0.618	0.630	6
ga	0.006	0.006	0.006	0.007	0.008	10
pbil	0.549	0.620	0.633	0.645	0.663	5
umda	0.828	0.839	0.861	0.875	0.897	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.78	0.01	0.99	0.01
hc	0.18	0.00	0.79	0.01	0.97	0.01
sa	0.22	0.01	0.54	0.01	0.76	0.02
ea-1p1	0.32	0.01	0.57	0.02	0.88	0.03
ea-1p10	0.34	0.00	0.56	0.02	0.90	0.01
ea-10p1	0.41	0.01	0.68	0.01	1.09	0.02
ea-1c10	0.29	0.00	0.58	0.00	0.88	0.00
ga	1.20	0.00	0.84	0.01	2.04	0.01
pbil	1.28	0.01	0.63	0.02	1.91	0.02
umda	1.23	0.00	0.52	0.01	1.76	0.01

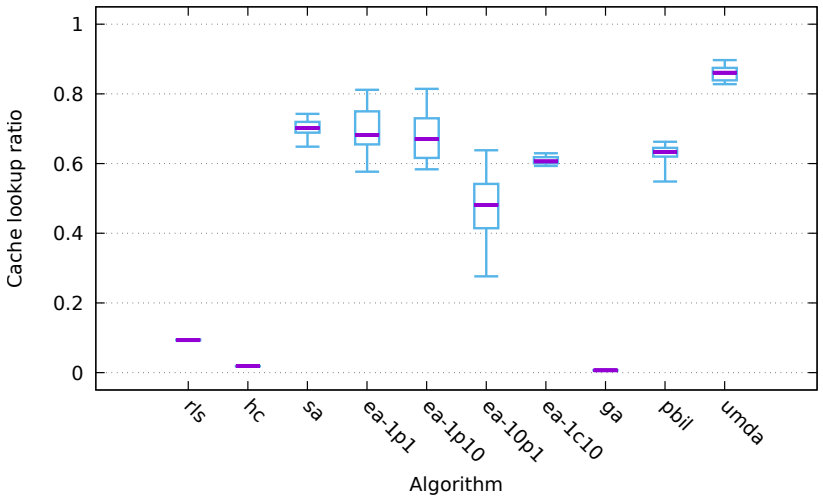

Figure 15: cancel

17 Function trap

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.135	0.138	0.139	0.140	0.142	9
hc	0.042	0.044	0.044	0.045	0.046	10
sa	0.894	0.898	0.899	0.900	0.902	2
ea-1p1	0.863	0.864	0.865	0.865	0.865	3
ea-1p10	0.863	0.863	0.864	0.864	0.865	4
ea-10p1	0.144	0.145	0.146	0.146	0.148	8
ea-1c10	0.851	0.855	0.857	0.860	0.868	5
ga	0.346	0.369	0.373	0.375	0.379	7
pbil	0.854	0.855	0.855	0.856	0.856	6
umda	0.903	0.904	0.904	0.904	0.905	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.76	0.01	0.97	0.01
hc	0.18	0.00	0.78	0.01	0.96	0.01
sa	0.21	0.00	0.48	0.00	0.70	0.00
ea-1p1	0.31	0.00	0.52	0.00	0.84	0.00
ea-1p10	0.33	0.00	0.52	0.00	0.86	0.00
ea-10p1	0.41	0.01	0.80	0.01	1.21	0.01
ea-1c10	0.29	0.00	0.52	0.01	0.80	0.01
ga	1.19	0.00	0.72	0.01	1.91	0.01
pbil	1.26	0.00	0.52	0.00	1.78	0.01
umda	1.24	0.00	0.51	0.01	1.75	0.01

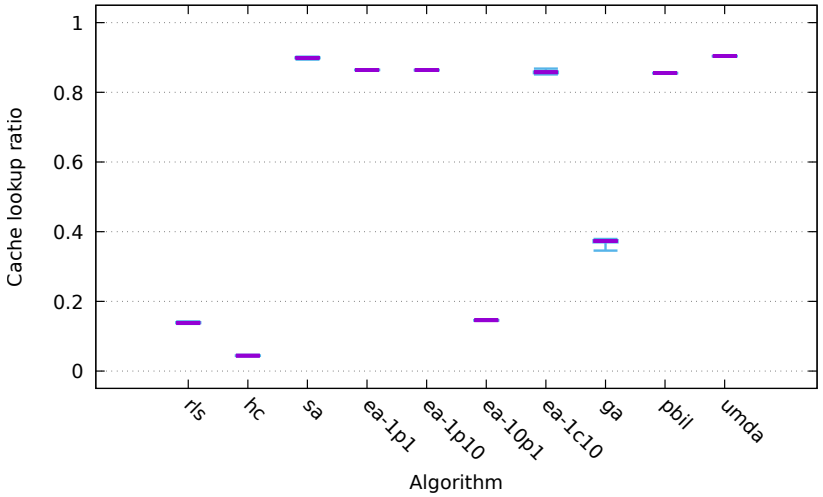

Figure 16: trap

18 Function hiff

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.084	0.085	0.085	0.085	0.086	8
hc	0.015	0.015	0.015	0.015	0.015	9
sa	0.941	0.957	0.963	0.969	0.984	1
ea-1p1	0.783	0.807	0.814	0.824	0.841	4
ea-1p10	0.800	0.809	0.821	0.825	0.838	3
ea-10p1	0.238	0.269	0.284	0.301	0.344	7
ea-1c10	0.623	0.633	0.641	0.645	0.651	6
ga	0.005	0.005	0.006	0.010	0.078	10
pbil	0.753	0.764	0.769	0.772	0.785	5
umda	0.824	0.847	0.862	0.873	0.890	2

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.00	0.99	0.01	1.21	0.01
hc	0.18	0.00	1.03	0.01	1.21	0.01
sa	0.22	0.00	0.53	0.01	0.75	0.01
ea-1p1	0.32	0.01	0.66	0.01	0.97	0.01
ea-1p10	0.33	0.00	0.65	0.01	0.99	0.01
ea-10p1	0.41	0.01	1.03	0.03	1.44	0.03
ea-1c10	0.29	0.00	0.73	0.02	1.03	0.02
ga	1.37	0.00	1.23	0.02	2.60	0.02
pbil	1.57	0.01	0.71	0.01	2.29	0.02
umda	1.54	0.01	0.63	0.02	2.17	0.02

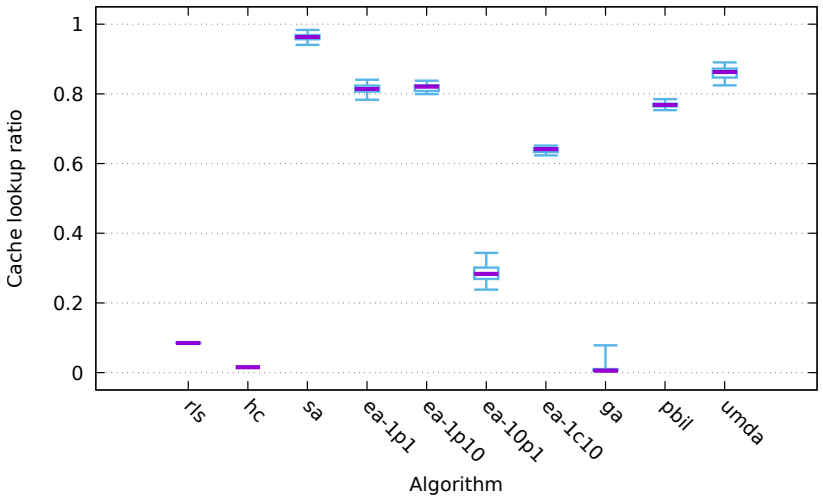

Figure 17: hiff

19 Function plateau

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.142	0.145	0.146	0.148	0.153	8
hc	0.046	0.046	0.047	0.047	0.048	10
sa	0.910	0.917	0.923	0.929	0.937	1
ea-1p1	0.599	0.613	0.631	0.656	0.697	5
ea-1p10	0.614	0.619	0.631	0.651	0.778	6
ea-10p1	0.136	0.138	0.139	0.140	0.141	9
ea-1c10	0.810	0.812	0.814	0.817	0.821	4
ga	0.370	0.372	0.374	0.376	0.377	7
pbil	0.839	0.846	0.850	0.852	0.855	2
umda	0.805	0.830	0.844	0.855	0.870	3

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.21	0.00	0.74	0.01	0.95	0.01
hc	0.18	0.00	0.75	0.01	0.93	0.01
sa	0.21	0.00	0.47	0.01	0.68	0.01
ea-1p1	0.32	0.01	0.60	0.02	0.91	0.02
ea-1p10	0.34	0.00	0.59	0.01	0.93	0.01
ea-10p1	0.42	0.01	0.78	0.00	1.20	0.01
ea-1c10	0.29	0.00	0.53	0.00	0.82	0.00
ga	1.20	0.00	0.70	0.01	1.90	0.01
pbil	1.26	0.00	0.53	0.01	1.78	0.01
umda	1.24	0.00	0.52	0.01	1.76	0.01

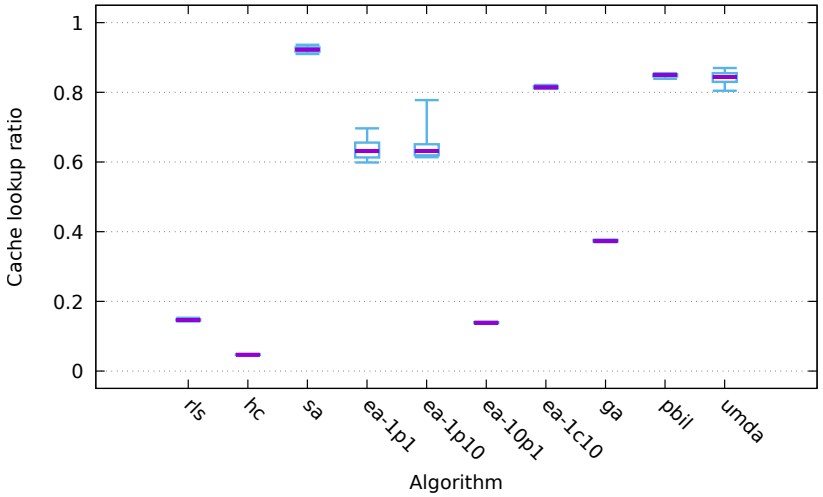

Figure 18: plateau

20 Function walsh2

algorithm	cache lookup ratio					
	min	Q_1	med.	Q_3	max	rk
rls	0.096	0.096	0.097	0.097	0.098	8
hc	0.019	0.019	0.019	0.019	0.020	10
sa	0.830	0.866	0.874	0.880	0.897	2
ea-1p1	0.810	0.852	0.858	0.862	0.866	3
ea-1p10	0.819	0.844	0.857	0.861	0.864	4
ea-10p1	0.635	0.708	0.718	0.724	0.735	7
ea-1c10	0.717	0.751	0.780	0.795	0.828	6
ga	0.027	0.036	0.038	0.049	0.095	9
pbil	0.748	0.775	0.783	0.794	0.802	5
umda	0.877	0.897	0.898	0.900	0.902	1

algorithm	algo. time (s)		eval. time (s)		total time (s)	
	mean	dev.	mean	dev.	mean	dev.
rls	0.22	0.00	3.35	0.02	3.57	0.02
hc	0.19	0.00	3.51	0.05	3.70	0.05
sa	0.22	0.00	0.87	0.05	1.10	0.05
ea-1p1	0.32	0.00	1.01	0.04	1.33	0.04
ea-1p10	0.35	0.01	1.04	0.04	1.39	0.04
ea-10p1	0.41	0.01	1.61	0.11	2.02	0.11
ea-1c10	0.31	0.00	1.30	0.11	1.60	0.11
ga	1.23	0.01	4.05	0.08	5.28	0.08
pbil	1.28	0.01	1.38	0.06	2.66	0.07
umda	1.23	0.07	0.84	0.04	2.07	0.11

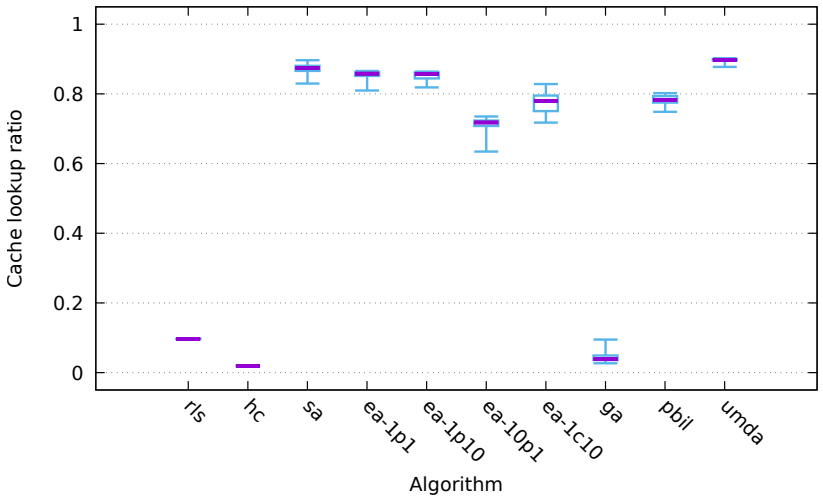

Figure 19: walsh2

A Plan

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    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "leading-ones",
    "opt": "-F 10",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "ridge",
    "opt": "-F 11",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "jmp-5",
    "opt": "-F 30 -t 5",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "jmp-10",
    "opt": "-F 30 -t 10",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "djmp-5",
    "opt": "-F 31 -t 5",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "djmp-10",
    "opt": "-F 31 -t 10",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "fp-5",
    "opt": "-F 40 -t 5",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "fp-10",
```

```
    "opt": "-F 40 -t 10",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "nk",
    "opt": "-F 60 -p instances/nk.100.4",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "max-sat",
    "opt": "-F 70 -p instances/ms.100.3.1000",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "labs",
    "opt": "-F 81",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "ep",
    "opt": "-F 90 -p instances/ep.100",
    "reverse": true,
    "logscale": true,
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "cancel",
    "opt": "-F 100 -s 99",
    "reverse": true,
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "trap",
    "opt": "-F 110 --fn-num-traps 10",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "hiff",
    "opt": "-F 120 -s 128",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "plateau",
    "opt": "-F 130",
    "rounding": {
        "value": { "before": 1, "after": 3 },
        "time": { "before": 1, "after": 2 } }
```

```
        },
        {
            "id": "walsh2",
            "opt": "-F 162 -p instances/walsh2.100",
            "rounding": {
                "value": { "before": 1, "after": 3 },
                "time": { "before": 1, "after": 2 } }
        }
    ],
    "algorithms": [
        {
            "id": "rls",
            "opt": "-A 100 --restart"
        },
        {
            "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"
        },
        {
            "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
```

```
# description_path = description.txt
# ea_lambda = 100
# ea_mu = 10
# expression = x
# 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_bit_herding = 0
# hea_num_seq_updates = 100
# hea_reset_period = 0
# hea_sampling_method = 0
# hea_weight = 1
# learning_rate = 0.001
# map = 0
# map_input_size = 100
# map_path = map.txt
# map_ts_length = 10
# map_ts_sampling_mode = 0
# mutation_probability = 1
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0
# num_threads = 1
# path = function.txt
# pn_mutation_probability = 1
# pn_neighborhood = 0
# pn_radius = 2
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# real_expression = (1-x)^2+100*(y-x^2)^2
# real_lower_bound = -2
# real_num_bits = 8
# real_upper_bound = 2
# results_path = results.json
# 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
# solution_path = solution.txt
# target = 100
# print_defaults
# last_parameter
# exec_name = hnco
# version = 0.14
# Generated from hnco.json
```