HNCO
Fixed-budget analysis

January 6, 2023

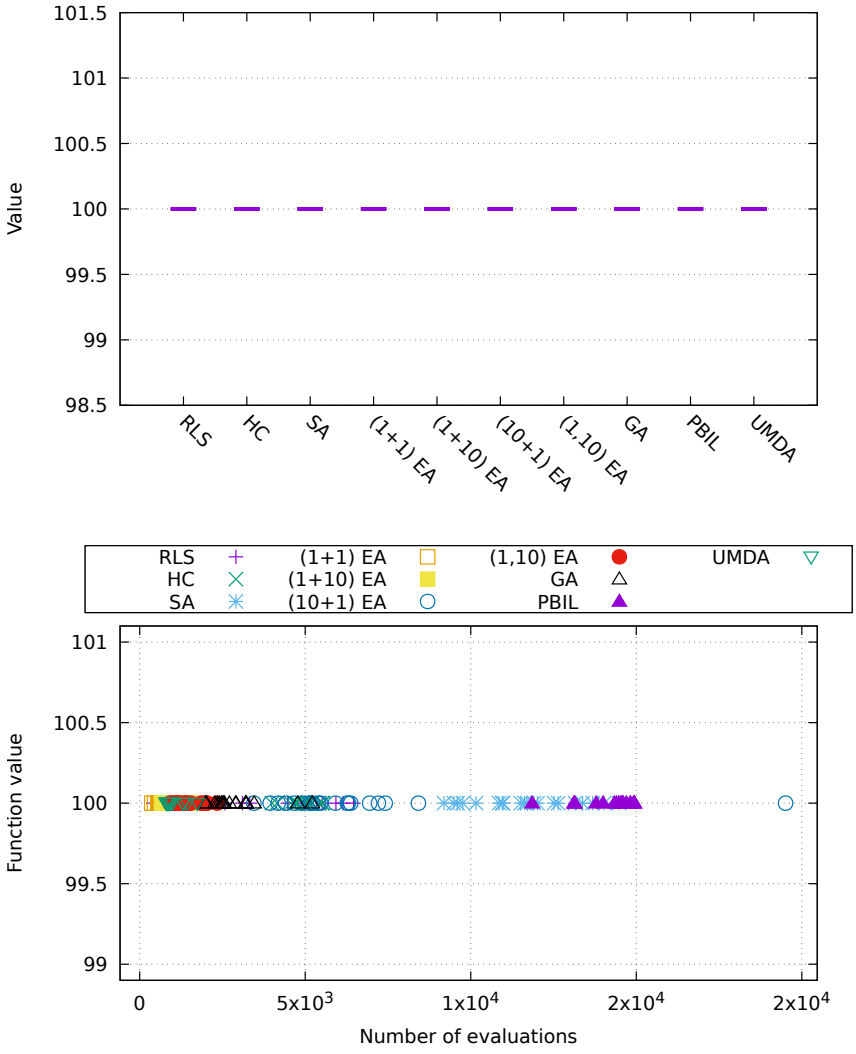
Contents

1 Global results

Algorithm	Rank				
	min	Q_1	med.	Q_3	max
PBIL	1	1.00	1.0	7.00	10
SA	1	1.00	2.0	3.50	10
RLS	1	2.00	2.0	5.00	10
GA	1	1.50	3.0	4.00	10
HC	1	1.00	4.0	5.50	10
$(1+1)$ EA	1	1.00	4.0	7.50	9
UMDA	1	1.00	4.0	7.50	10
$(10+1)$ EA	1	1.50	4.0	4.50	6
$(1,10)$ EA	1	2.00	4.0	4.50	8
$(1+10)$ EA	1	2.00	4.0	8.00	9

2 Function one-max

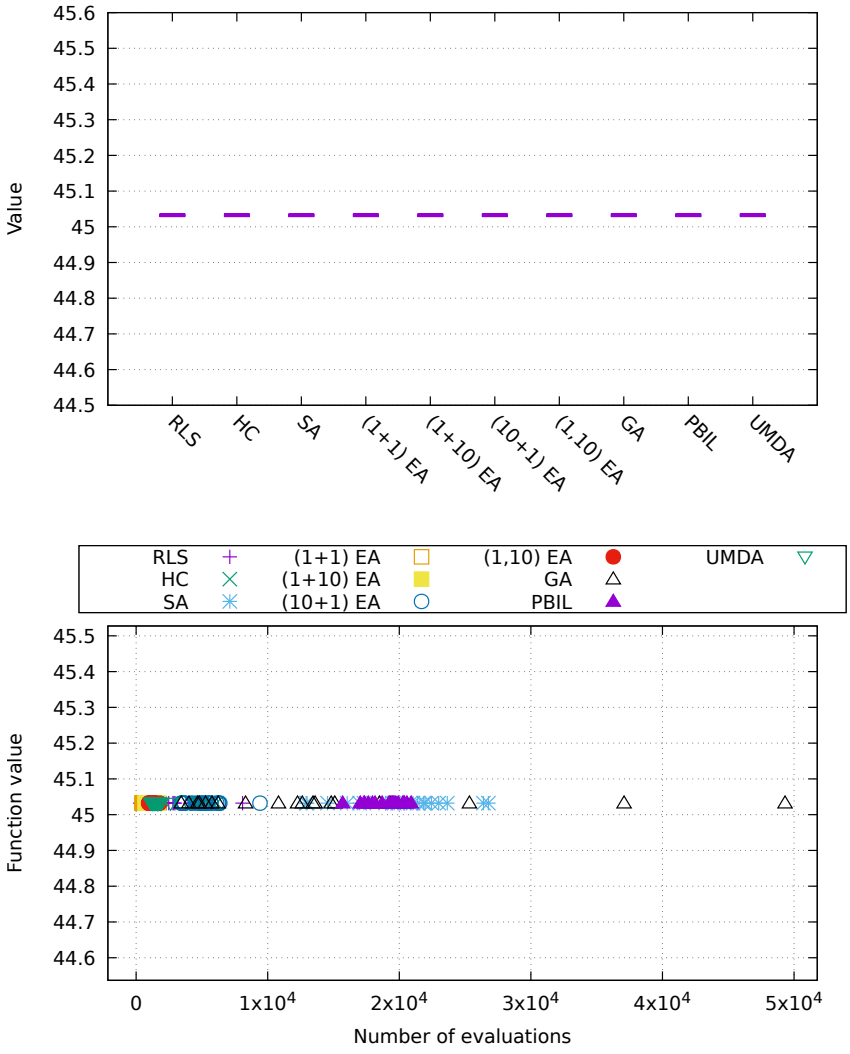
Algorithm	Value				
	min	Q_1	med.	Q_3	max
RLS	**100**	**100**	**100**	**100**	**100**
HC	**100**	**100**	**100**	**100**	**100**
SA	**100**	**100**	**100**	**100**	**100**
$(1+1)$ EA	**100**	**100**	**100**	**100**	**100**
$(1+10)$ EA	**100**	**100**	**100**	**100**	**100**
$(10+1)$ EA	**100**	**100**	**100**	**100**	**100**
$(1,10)$ EA	**100**	**100**	**100**	**100**	**100**
GA	**100**	**100**	**100**	**100**	**100**
PBIL	**100**	**100**	**100**	**100**	**100**
UMDA	**100**	**100**	**100**	**100**	**100**



Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
$(1+1)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
$(1+10)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
$(1,10)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
RLS	0.00	0.00	0.00	0.00	0.00	0.00
HC	0.00	0.00	0.00	0.00	0.00	0.00
UMDA	0.00	0.00	0.00	0.00	0.00	0.00
$(10+1)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
SA	0.00	0.00	0.00	0.00	0.01	0.00
GA	0.01	0.00	0.00	0.00	0.01	0.00
PBIL	0.04	0.00	0.01	0.00	0.04	0.00

3 Function lin

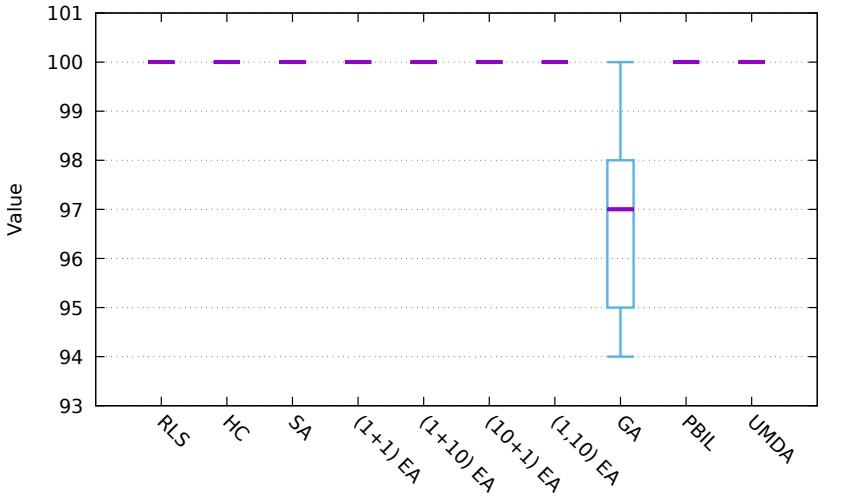
Algorithm	Value				
	min	Q_1	med.	Q_3	max
RLS	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
HC	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
SA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
$(1+1)$ EA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
$(1+10)$ EA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
$(10+1)$ EA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
$(1,10)$ EA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
GA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
PBIL	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**
UMDA	**45.03**	**45.03**	**45.03**	**45.03**	**45.03**

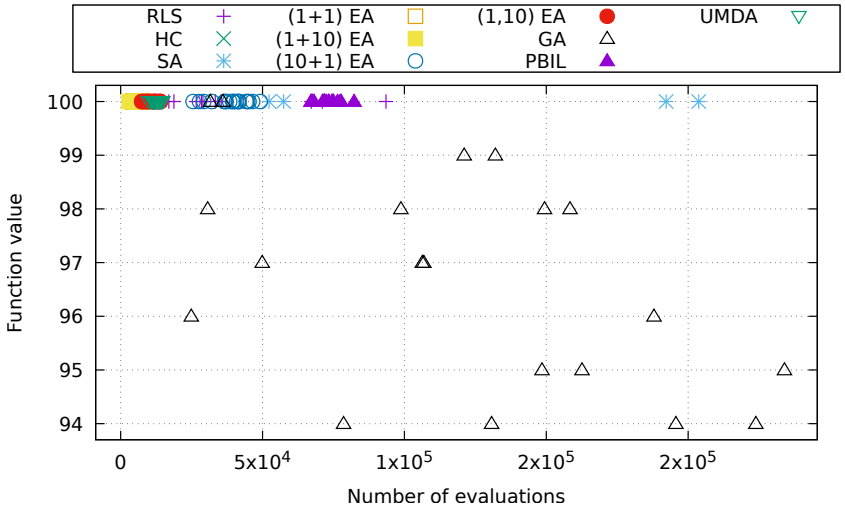


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
$(1+1)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
$(1+10)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
$(1,10)$ EA	0.00	0.00	0.00	0.00	0.00	0.00
RLS	0.00	0.00	0.00	0.00	0.00	0.00
HC	0.00	0.00	0.00	0.00	0.00	0.00
$(10+1)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
UMDA	0.00	0.00	0.00	0.00	0.00	0.00
SA	0.01	0.00	0.01	0.00	0.02	0.00
GA	0.03	0.02	0.01	0.01	0.04	0.03
PBIL	0.05	0.00	0.01	0.00	0.06	0.00

4 Function leading-ones

Algorithm	Value				
	min	Q_1	med.	Q_3	max
RLS	**100**	**100**	**100**	**100**	**100**
HC	**100**	**100**	**100**	**100**	**100**
SA	**100**	**100**	**100**	**100**	**100**
$(1+1)$ EA	**100**	**100**	**100**	**100**	**100**
$(1+10)$ EA	**100**	**100**	**100**	**100**	**100**
$(10+1)$ EA	**100**	**100**	**100**	**100**	**100**
$(1,10)$ EA	**100**	**100**	**100**	**100**	**100**
PBIL	**100**	**100**	**100**	**100**	**100**
UMDA	**100**	**100**	**100**	**100**	**100**
GA	94	95	97	98	**100**

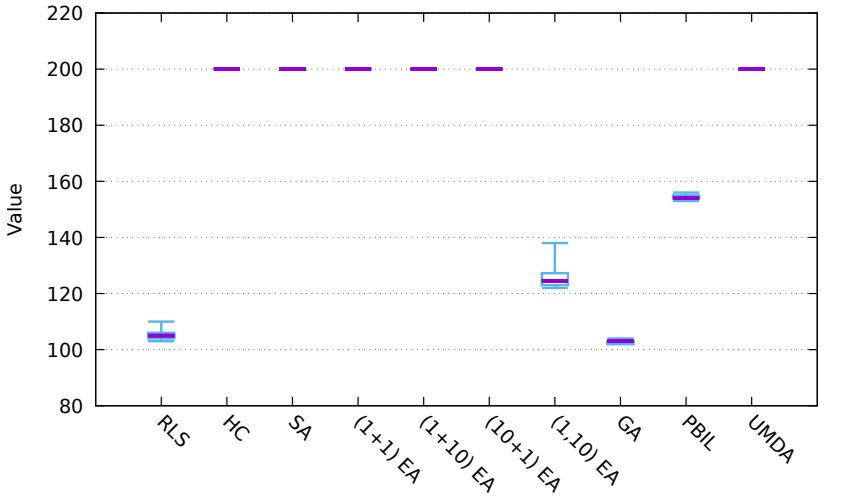


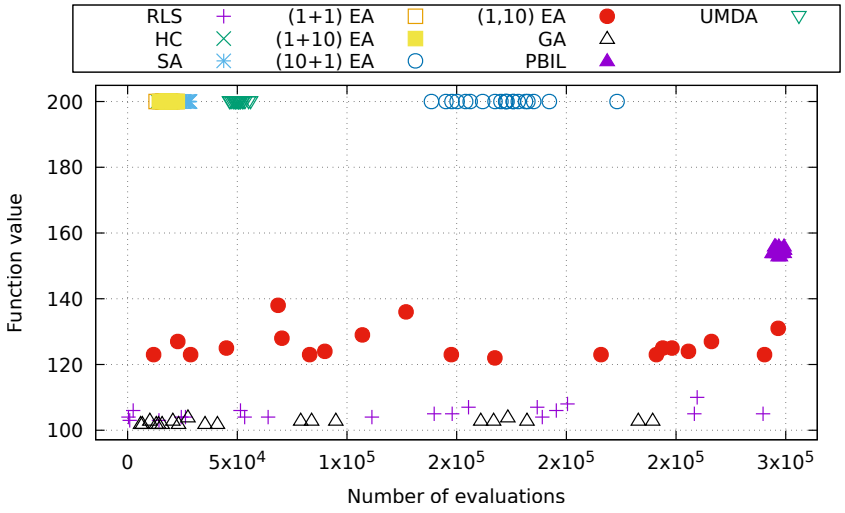


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.00	0.00	0.00	0.00	0.00	0.00
$(1 + 10)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
$(1 + 1)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
$(1, 10)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
RLS	0.01	0.01	0.01	0.01	0.02	0.02
SA	0.01	0.02	0.01	0.02	0.02	0.04
$(10 + 1)$ EA	0.02	0.00	0.02	0.00	0.04	0.01
UMDA	0.03	0.00	0.00	0.00	0.03	0.00
PBIL	0.18	0.01	0.03	0.00	0.21	0.01
GA	0.55	0.17	0.11	0.03	0.66	0.20

5 Function ridge

Algorithm	Value				
	min	Q_1	med.	Q_3	max
HC	**200**	**200**	**200**	**200**	**200**
SA	**200**	**200**	**200**	**200**	**200**
$(1+1)$ EA	**200**	**200**	**200**	**200**	**200**
$(1+10)$ EA	**200**	**200**	**200**	**200**	**200**
$(10+1)$ EA	**200**	**200**	**200**	**200**	**200**
UMDA	**200**	**200**	**200**	**200**	**200**
PBIL	153	154	154	155	156
$(1,10)$ EA	122	123	125	127	138
RLS	103	104	105	106	110
GA	102	102	103	103	104

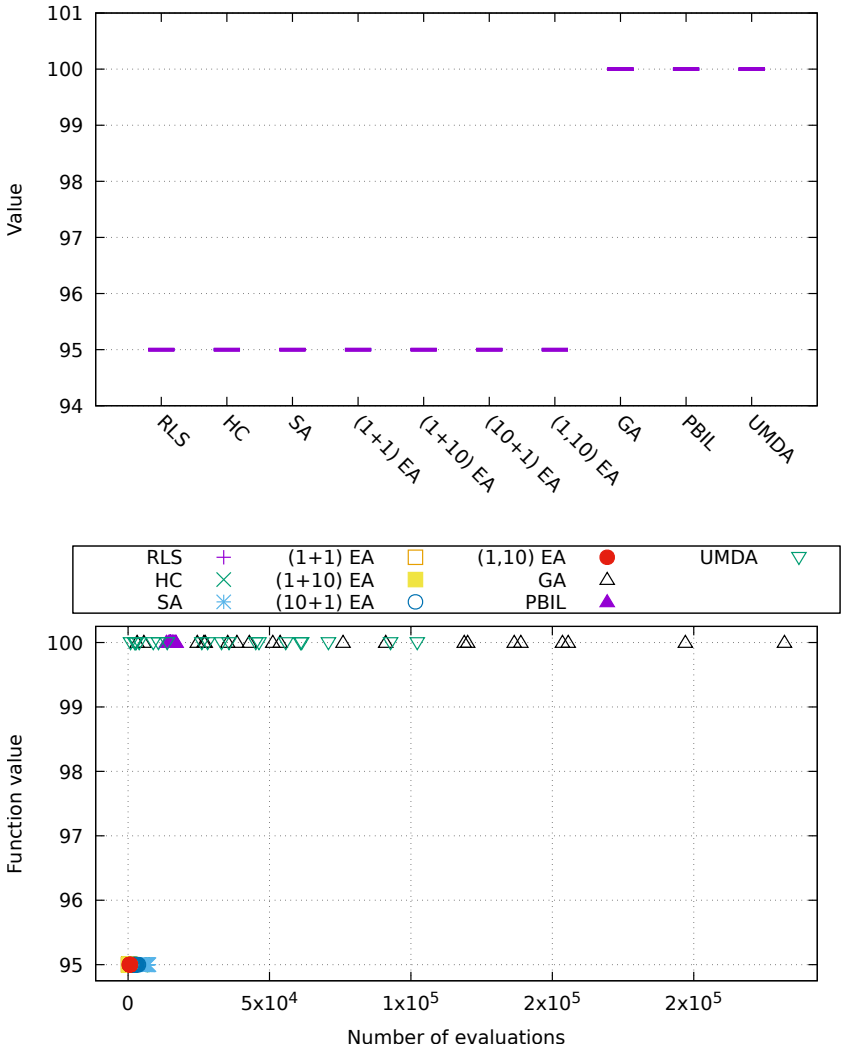




Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.00	0.00	0.01	0.00	0.01	0.00
SA	0.01	0.00	0.01	0.00	0.02	0.00
$(1+1)$ EA	0.01	0.00	0.01	0.00	0.02	0.00
$(1+10)$ EA	0.01	0.00	0.01	0.00	0.02	0.00
RLS	0.09	0.00	0.11	0.00	0.21	0.00
$(10+1)$ EA	0.10	0.01	0.07	0.01	0.17	0.02
UMDA	0.11	0.01	0.02	0.00	0.13	0.01
$(1, 10)$ EA	0.13	0.00	0.12	0.00	0.25	0.01
GA	0.61	0.01	0.12	0.00	0.73	0.01
PBIL	0.66	0.01	0.13	0.00	0.79	0.01

6 Function jmp-5

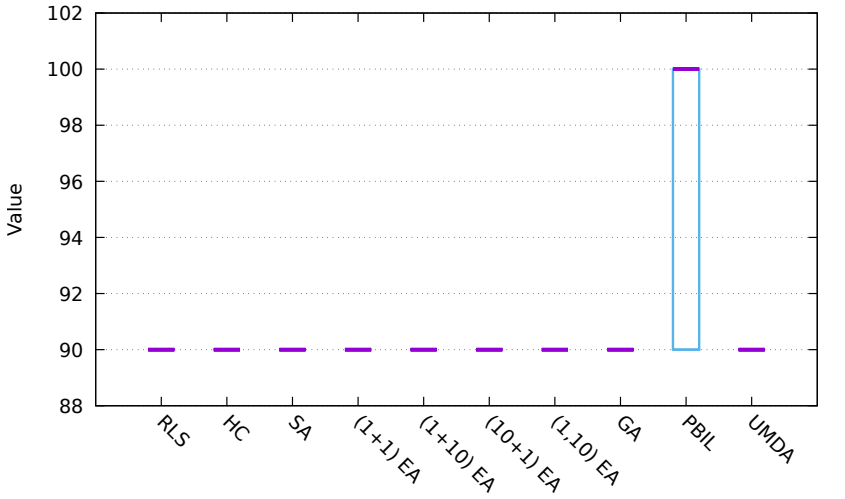
Algorithm	Value				
	min	Q_1	med.	Q_3	max
GA	**100**	**100**	**100**	**100**	**100**
PBIL	**100**	**100**	**100**	**100**	**100**
UMDA	**100**	**100**	**100**	**100**	**100**
RLS	95	95	95	95	95
HC	95	95	95	95	95
SA	95	95	95	95	95
$(1+1)$ EA	95	95	95	95	95
$(1+10)$ EA	95	95	95	95	95
$(10+1)$ EA	95	95	95	95	95
$(1,10)$ EA	95	95	95	95	95

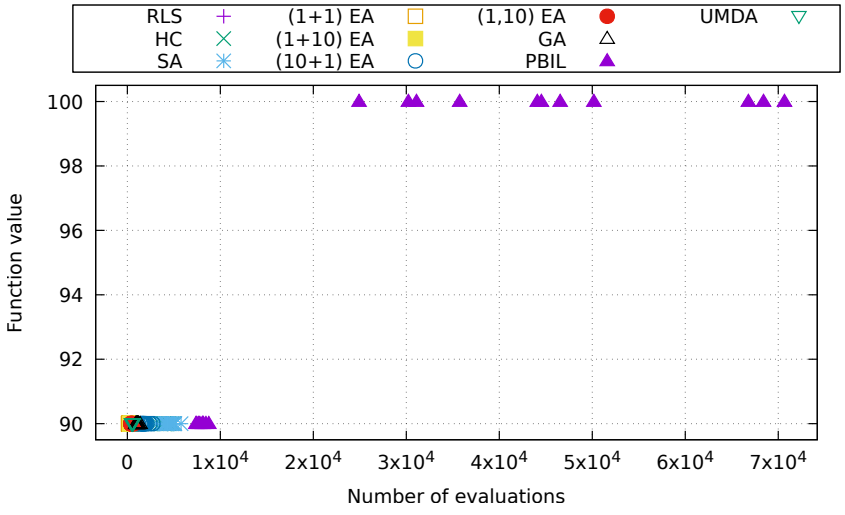


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
PBIL	0.04	0.00	0.01	0.00	0.05	0.00
UMDA	0.08	0.07	0.01	0.01	0.09	0.08
HC	0.08	0.00	0.11	0.00	0.19	0.00
RLS	0.09	0.00	0.11	0.00	0.20	0.00
SA	0.10	0.00	0.11	0.00	0.21	0.00
$(1, 10)$ EA	0.13	0.00	0.11	0.00	0.24	0.00
$(1 + 1)$ EA	0.14	0.00	0.11	0.00	0.25	0.01
$(1 + 10)$ EA	0.15	0.00	0.11	0.00	0.26	0.01
$(10 + 1)$ EA	0.17	0.00	0.11	0.00	0.29	0.01
GA	0.18	0.14	0.03	0.03	0.21	0.16

7 Function jmp-10

Algorithm	Value				
	min	Q_1	med.	Q_3	max
PBIL	**90**	**90**	**100**	**100**	**100**
RLS	**90**	**90**	90	90	90
HC	**90**	**90**	90	90	90
SA	**90**	**90**	90	90	90
$(1+1)$ EA	**90**	**90**	90	90	90
$(1+10)$ EA	**90**	**90**	90	90	90
$(10+1)$ EA	**90**	**90**	90	90	90
$(1,10)$ EA	**90**	**90**	90	90	90
GA	**90**	**90**	90	90	90
UMDA	**90**	**90**	90	90	90

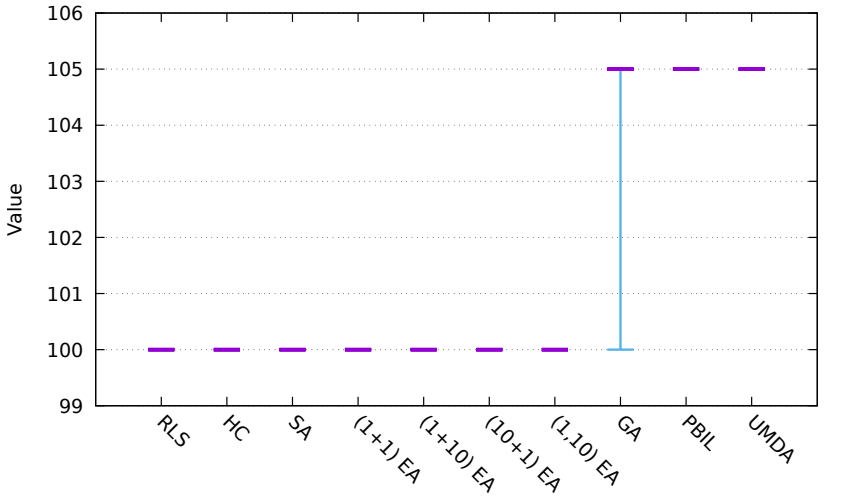


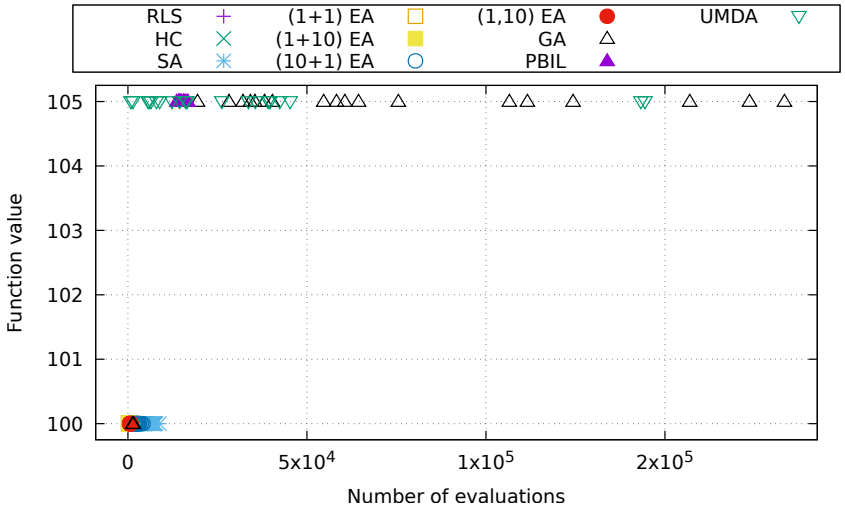


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.11	0.00	0.19	0.00
RLS	0.09	0.00	0.11	0.00	0.20	0.00
SA	0.10	0.00	0.11	0.00	0.21	0.00
$(1, 10)$ EA	0.13	0.00	0.11	0.00	0.24	0.01
$(1 + 1)$ EA	0.14	0.00	0.11	0.00	0.25	0.01
$(1 + 10)$ EA	0.15	0.00	0.11	0.00	0.26	0.00
$(10 + 1)$ EA	0.17	0.00	0.11	0.00	0.29	0.01
PBIL	0.38	0.30	0.06	0.05	0.44	0.34
GA	0.61	0.01	0.11	0.00	0.72	0.01
UMDA	0.68	0.01	0.11	0.00	0.79	0.01

8 Function djmp-5

Algorithm	Value				
	min	Q_1	med.	Q_3	max
PBIL	**105**	**105**	**105**	**105**	**105**
UMDA	**105**	**105**	**105**	**105**	**105**
GA	100	**105**	**105**	**105**	**105**
RLS	100	100	100	100	100
HC	100	100	100	100	100
SA	100	100	100	100	100
$(1+1)$ EA	100	100	100	100	100
$(1+10)$ EA	100	100	100	100	100
$(10+1)$ EA	100	100	100	100	100
$(1,10)$ EA	100	100	100	100	100

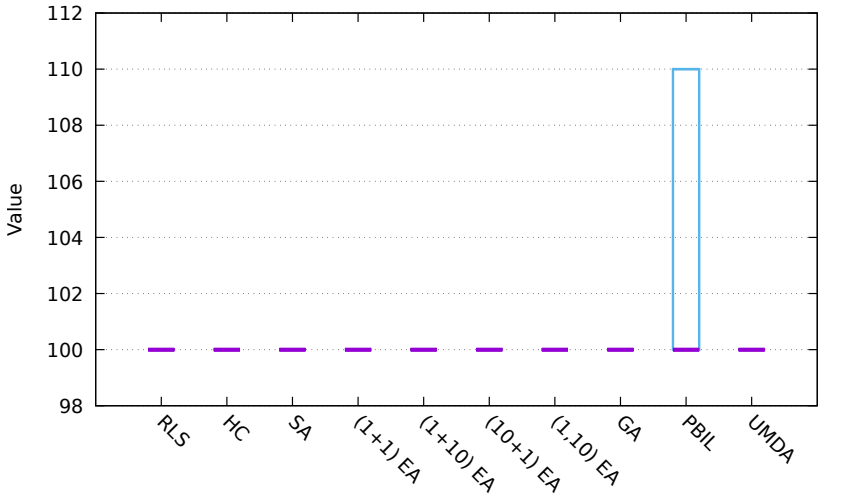


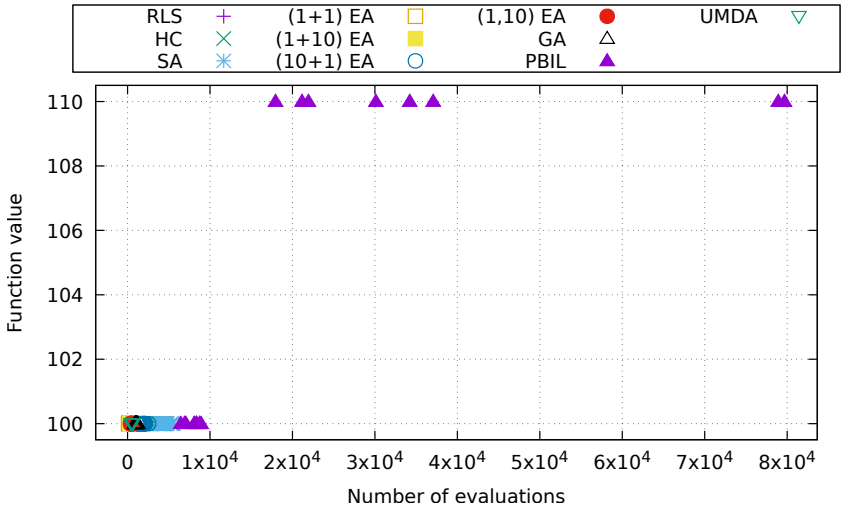


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
PBIL	0.04	0.00	0.01	0.00	0.05	0.00
UMDA	0.07	0.09	0.01	0.02	0.08	0.11
HC	0.08	0.00	0.11	0.00	0.19	0.00
RLS	0.09	0.00	0.11	0.00	0.21	0.01
SA	0.10	0.00	0.11	0.00	0.21	0.01
$(1, 10)$ EA	0.13	0.00	0.11	0.00	0.24	0.00
$(1 + 1)$ EA	0.14	0.00	0.11	0.00	0.25	0.01
$(1 + 10)$ EA	0.15	0.00	0.11	0.00	0.26	0.01
$(10 + 1)$ EA	0.17	0.00	0.11	0.00	0.29	0.01
GA	0.20	0.17	0.04	0.03	0.24	0.20

9 Function djmp-10

Algorithm	Value				
	min	Q_1	med.	Q_3	max
PBIL	**100**	**100**	**100**	**110**	**110**
RLS	**100**	**100**	**100**	100	100
HC	**100**	**100**	**100**	100	100
SA	**100**	**100**	**100**	100	100
$(1+1)$ EA	**100**	**100**	**100**	100	100
$(1+10)$ EA	**100**	**100**	**100**	100	100
$(10+1)$ EA	**100**	**100**	**100**	100	100
$(1,10)$ EA	**100**	**100**	**100**	100	100
GA	**100**	**100**	**100**	100	100
UMDA	**100**	**100**	**100**	100	100

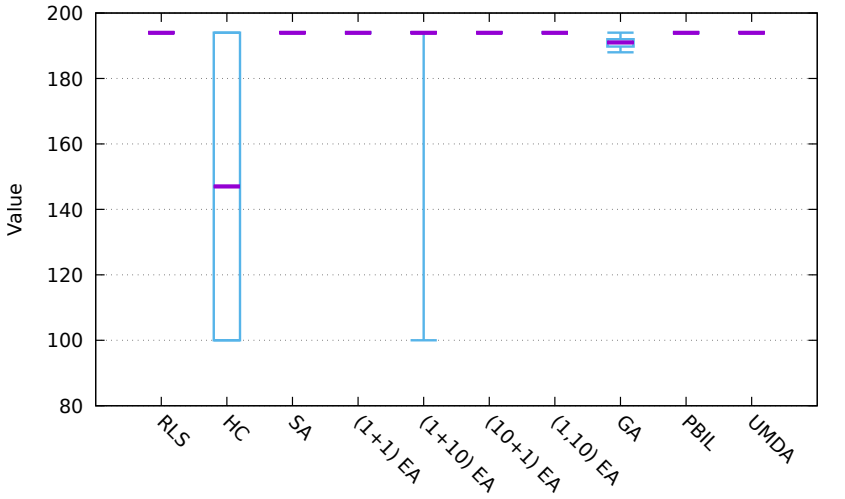


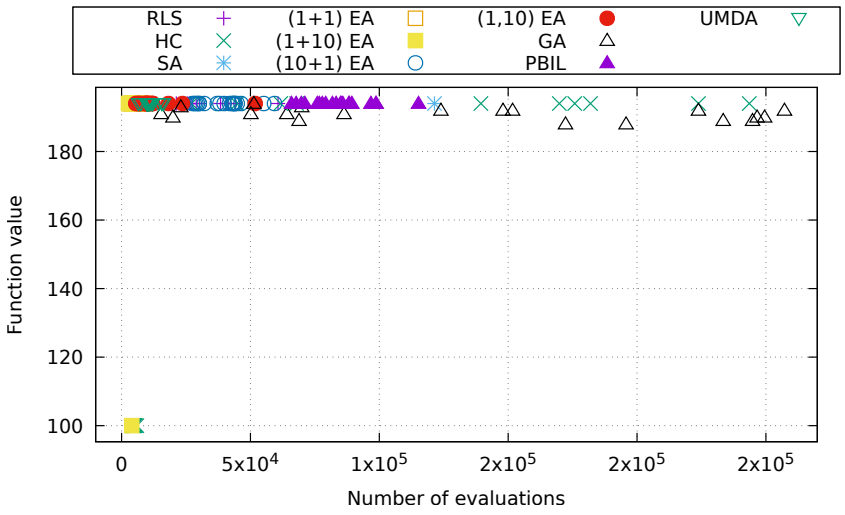


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.11	0.00	0.20	0.00
RLS	0.09	0.00	0.11	0.00	0.21	0.01
SA	0.10	0.00	0.11	0.00	0.21	0.01
$(1, 10)$ EA	0.13	0.00	0.11	0.00	0.24	0.01
$(1 + 1)$ EA	0.14	0.00	0.11	0.00	0.25	0.01
$(1 + 10)$ EA	0.15	0.00	0.11	0.00	0.26	0.01
$(10 + 1)$ EA	0.17	0.00	0.11	0.00	0.29	0.01
PBIL	0.46	0.30	0.08	0.05	0.54	0.35
GA	0.61	0.01	0.11	0.00	0.72	0.01
UMDA	0.68	0.01	0.11	0.00	0.79	0.01

10 Function fp-5

Algorithm	Value				
	min	Q_1	med.	Q_3	max
RLS	**194**	**194**	**194**	**194**	**194**
SA	**194**	**194**	**194**	**194**	**194**
$(1+1)$ EA	**194**	**194**	**194**	**194**	**194**
$(10+1)$ EA	**194**	**194**	**194**	**194**	**194**
$(1,10)$ EA	**194**	**194**	**194**	**194**	**194**
PBIL	**194**	**194**	**194**	**194**	**194**
UMDA	**194**	**194**	**194**	**194**	**194**
$(1+10)$ EA	100	**194**	**194**	**194**	**194**
GA	188	190	191	192	**194**
HC	100	100	147	**194**	**194**

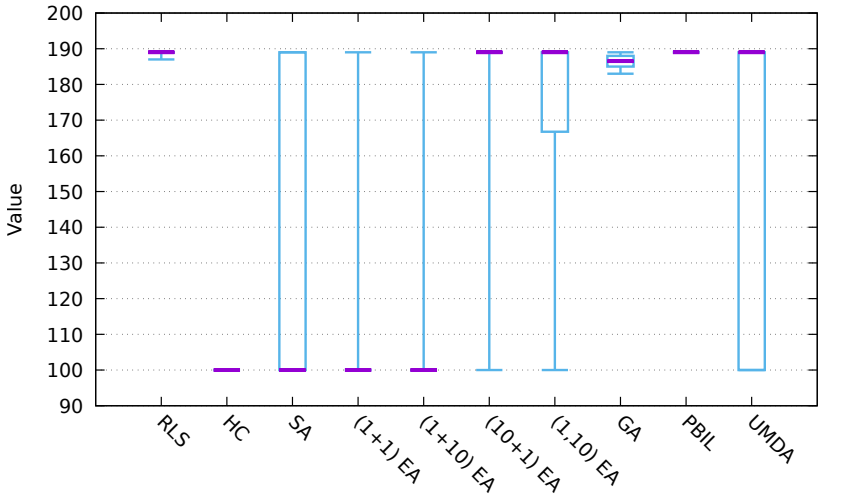


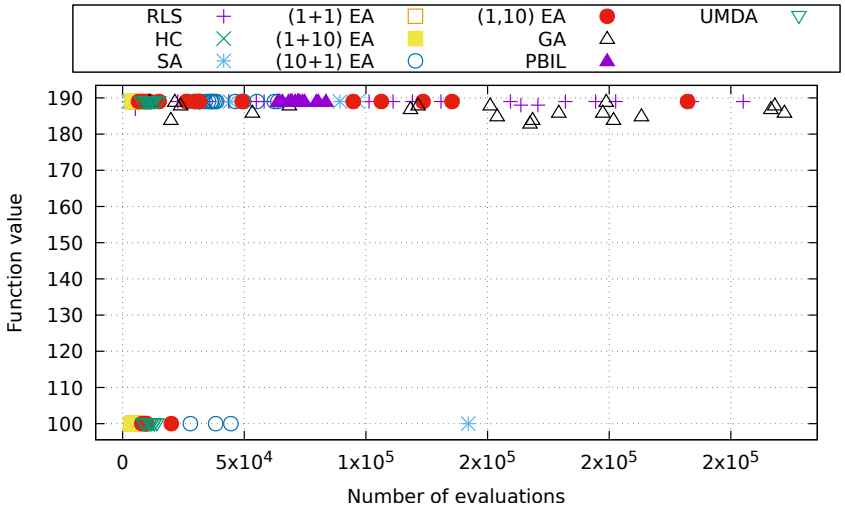


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
$(1+1)$ EA	0.00	0.00	0.00	0.00	0.01	0.00
SA	0.00	0.01	0.00	0.01	0.01	0.02
$(1,10)$ EA	0.01	0.00	0.01	0.00	0.01	0.01
RLS	0.01	0.00	0.01	0.01	0.02	0.01
$(1+10)$ EA	0.01	0.03	0.01	0.03	0.02	0.06
$(10+1)$ EA	0.02	0.00	0.02	0.00	0.04	0.01
UMDA	0.03	0.01	0.00	0.00	0.03	0.01
HC	0.06	0.03	0.09	0.04	0.15	0.07
PBIL	0.20	0.03	0.04	0.01	0.24	0.03
GA	0.59	0.11	0.12	0.02	0.71	0.14

11 Function fp-10

Algorithm	Value				
	min	Q_1	med.	Q_3	max
PBIL	**189**	**189**	**189**	**189**	**189**
RLS	187	**189**	**189**	**189**	**189**
$(10+1)$ EA	100	**189**	**189**	**189**	**189**
$(1,10)$ EA	100	167	**189**	**189**	**189**
UMDA	100	100	**189**	**189**	**189**
GA	183	185	187	188	**189**
SA	100	100	100	**189**	**189**
$(1+1)$ EA	100	100	100	100	**189**
$(1+10)$ EA	100	100	100	100	**189**
HC	100	100	100	100	100

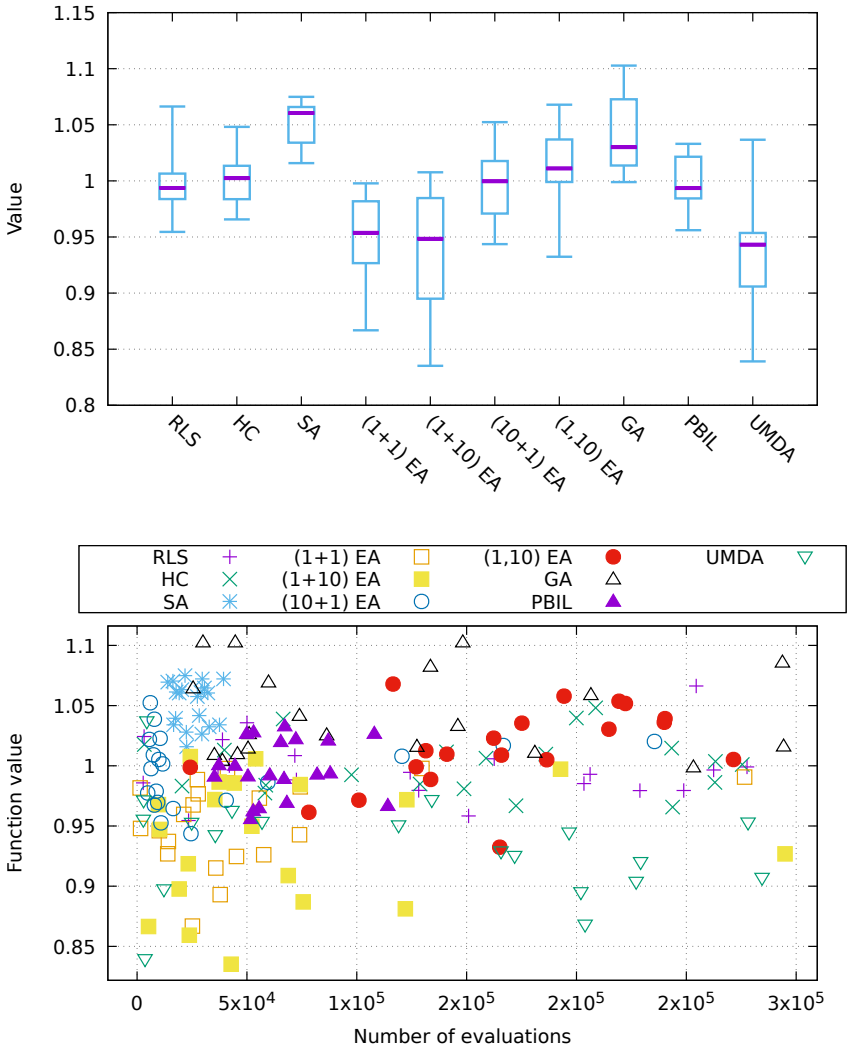




Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
RLS	0.04	0.03	0.06	0.04	0.10	0.07
$(10+1)$ EA	0.05	0.06	0.03	0.04	0.08	0.10
$(1,10)$ EA	0.05	0.05	0.05	0.05	0.10	0.10
SA	0.07	0.04	0.09	0.05	0.16	0.09
HC	0.08	0.00	0.12	0.00	0.20	0.01
$(1+10)$ EA	0.12	0.06	0.10	0.05	0.21	0.11
$(1+1)$ EA	0.12	0.05	0.10	0.04	0.22	0.10
PBIL	0.18	0.01	0.03	0.00	0.21	0.01
UMDA	0.28	0.31	0.05	0.06	0.33	0.38
GA	0.54	0.18	0.11	0.04	0.66	0.22

12 Function nk

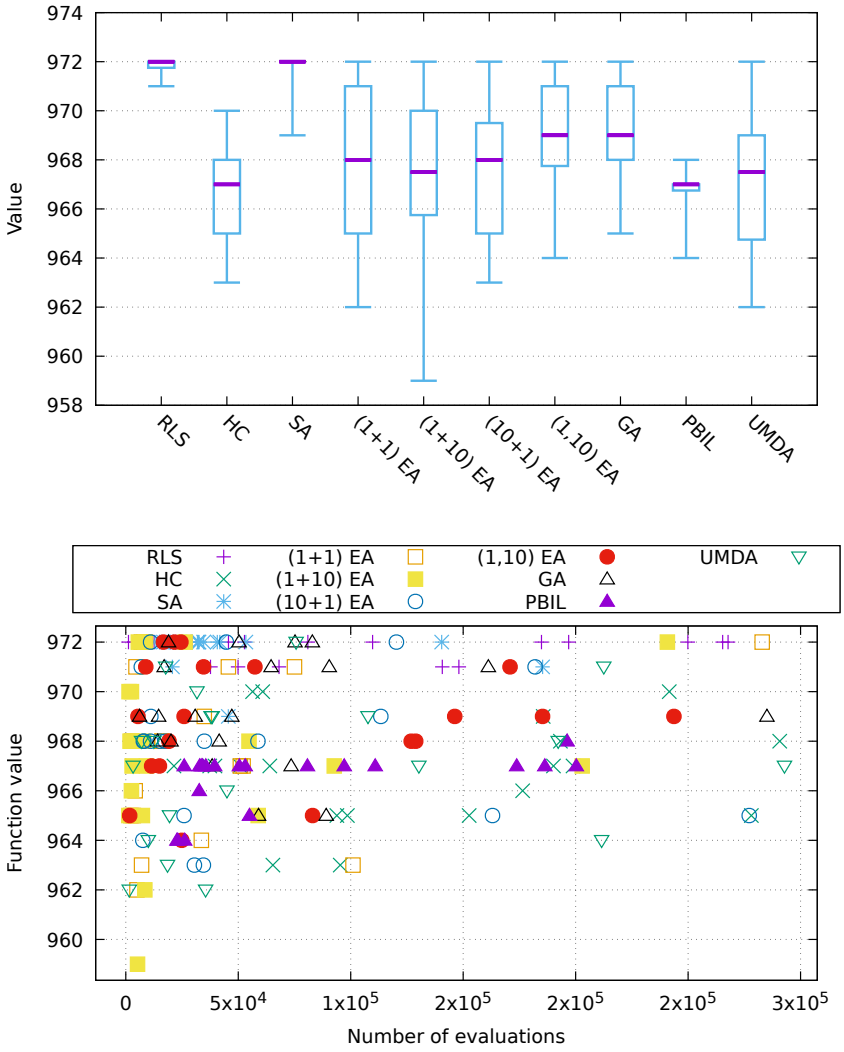
Algorithm	Value				
	min	Q_1	med.	Q_3	max
SA	**1.02**	**1.03**	**1.06**	1.07	1.07
GA	1.00	1.01	1.03	**1.07**	**1.10**
$(1, 10)$ EA	0.93	1.00	1.01	1.04	1.07
HC	0.97	0.98	1.00	1.01	1.05
$(10 + 1)$ EA	0.94	0.97	1.00	1.02	1.05
RLS	0.95	0.98	0.99	1.01	1.07
PBIL	0.96	0.98	0.99	1.02	1.03
$(1 + 1)$ EA	0.87	0.93	0.95	0.98	1.00
$(1 + 10)$ EA	0.84	0.90	0.95	0.98	1.01
UMDA	0.84	0.91	0.94	0.95	1.04



Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.48	0.01	0.57	0.01
RLS	0.10	0.00	0.50	0.01	0.60	0.01
SA	0.10	0.00	0.46	0.01	0.56	0.01
$(1, 10)$ EA	0.13	0.00	0.46	0.01	0.60	0.01
$(1 + 1)$ EA	0.15	0.00	0.48	0.01	0.63	0.01
$(1 + 10)$ EA	0.15	0.00	0.49	0.01	0.64	0.01
$(10 + 1)$ EA	0.18	0.00	0.51	0.02	0.69	0.02
GA	0.61	0.01	0.58	0.01	1.19	0.01
UMDA	0.65	0.01	0.47	0.01	1.12	0.01
PBIL	0.67	0.01	0.52	0.01	1.19	0.01

13 Function max-sat

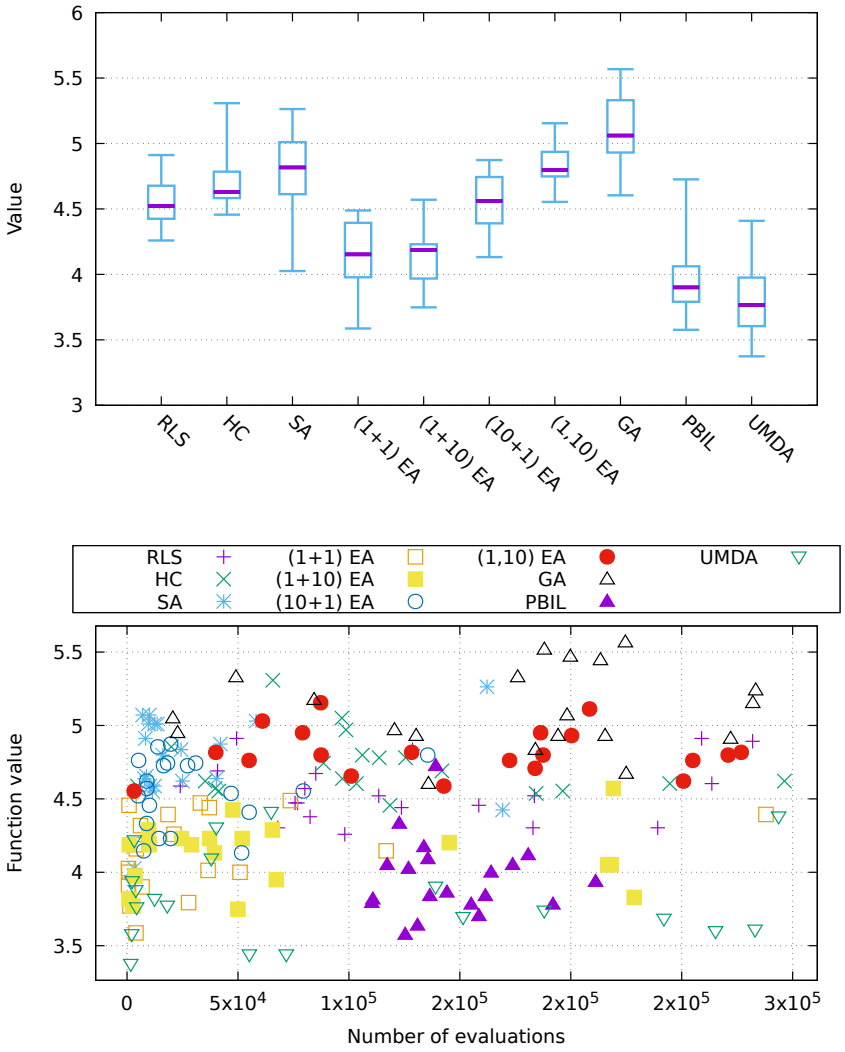
Algorithm	Value				
	min	Q_1	med.	Q_3	max
SA	969	**972**	**972**	**972**	**972**
RLS	**971**	972	**972**	**972**	**972**
GA	965	968	969	971	**972**
$(1, 10)$ EA	964	968	969	971	**972**
$(1 + 1)$ EA	962	965	968	971	**972**
$(10 + 1)$ EA	963	965	968	970	**972**
$(1 + 10)$ EA	959	966	968	970	**972**
UMDA	962	965	968	969	**972**
HC	963	965	967	968	970
PBIL	964	967	967	967	968



Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.09	0.00	1.88	0.04	1.97	0.04
RLS	0.10	0.00	1.90	0.05	2.00	0.05
SA	0.10	0.00	1.75	0.04	1.86	0.04
$(1, 10)$ EA	0.13	0.00	1.72	0.04	1.86	0.04
$(1 + 1)$ EA	0.15	0.00	1.91	0.04	2.06	0.04
$(1 + 10)$ EA	0.15	0.01	1.89	0.07	2.04	0.07
$(10 + 1)$ EA	0.19	0.00	2.18	0.06	2.36	0.06
GA	0.62	0.01	2.34	0.06	2.95	0.06
UMDA	0.66	0.01	1.75	0.04	2.41	0.04
PBIL	0.68	0.04	1.93	0.10	2.61	0.14

14 Function labs

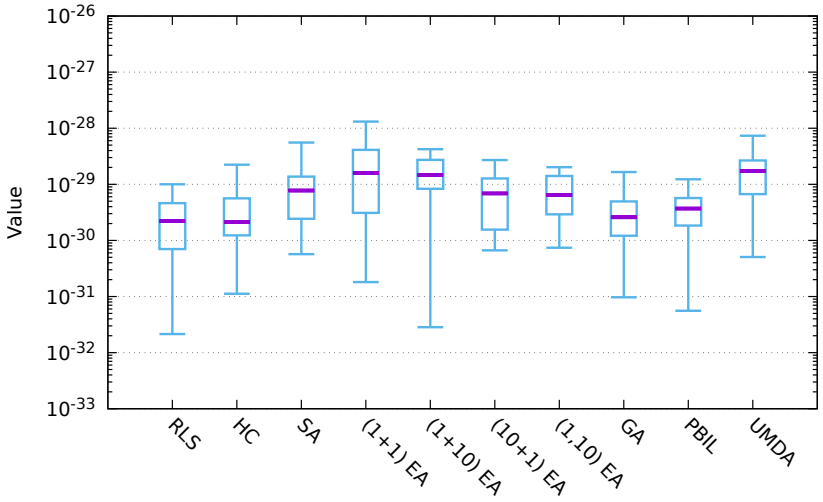
Algorithm	Value				
	min	Q_1	med.	Q_3	max
GA	**4.60**	**4.93**	**5.06**	**5.33**	**5.57**
SA	4.03	4.61	4.82	5.01	5.26
$(1, 10)$ EA	4.55	4.75	4.80	4.94	5.15
HC	4.46	4.58	4.63	4.78	5.31
$(10 + 1)$ EA	4.13	4.39	4.56	4.74	4.87
RLS	4.26	4.42	4.52	4.68	4.91
$(1 + 10)$ EA	3.75	3.97	4.19	4.23	4.57
$(1 + 1)$ EA	3.59	3.98	4.15	4.39	4.49
PBIL	3.58	3.79	3.90	4.06	4.73
UMDA	3.37	3.60	3.77	3.98	4.41

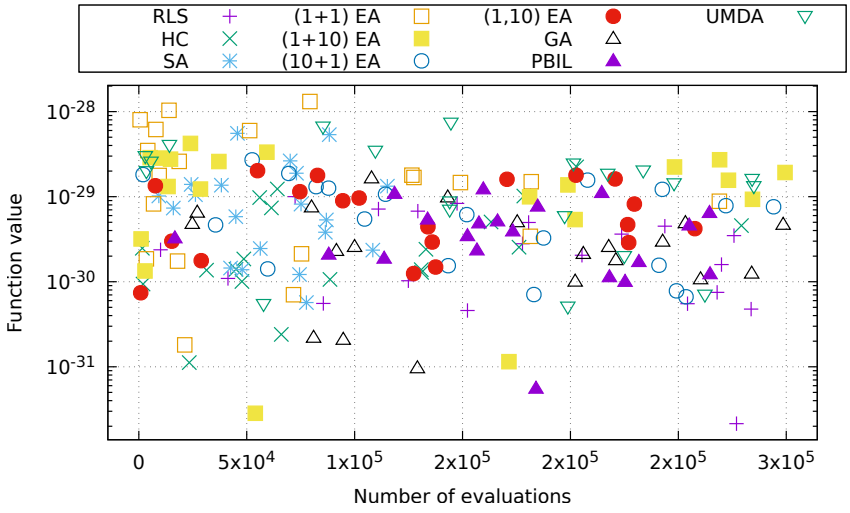


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	1.39	0.05	1.47	0.05
RLS	0.10	0.00	1.38	0.04	1.47	0.04
SA	0.10	0.00	1.39	0.06	1.49	0.06
$(1, 10)$ EA	0.13	0.00	1.39	0.06	1.52	0.06
$(1 + 1)$ EA	0.14	0.00	1.39	0.06	1.53	0.07
$(1 + 10)$ EA	0.15	0.00	1.38	0.03	1.52	0.03
$(10 + 1)$ EA	0.18	0.00	1.41	0.07	1.59	0.07
GA	0.61	0.01	1.38	0.05	2.00	0.05
UMDA	0.65	0.01	1.39	0.07	2.04	0.07
PBIL	0.71	0.01	1.37	0.05	2.08	0.05

15 Function ep

Algorithm	Value				
	min	Q_1	med.	Q_3	max
HC	1.1×10^{-31}	1.2×10^{-30}	$\mathbf{2.1 \times 10^{-30}}$	5.6×10^{-30}	2.2×10^{-29}
RLS	$\mathbf{2.1 \times 10^{-32}}$	$\mathbf{7.0 \times 10^{-31}}$	2.2×10^{-30}	$\mathbf{4.6 \times 10^{-30}}$	$\mathbf{1.0 \times 10^{-29}}$
GA	9.7×10^{-32}	1.2×10^{-30}	2.6×10^{-30}	5.0×10^{-30}	1.7×10^{-29}
PBIL	5.6×10^{-32}	1.8×10^{-30}	3.7×10^{-30}	5.7×10^{-30}	1.2×10^{-29}
$(1, 10)$ EA	7.4×10^{-31}	2.9×10^{-30}	6.4×10^{-30}	1.4×10^{-29}	2.0×10^{-29}
$(10 + 1)$ EA	6.7×10^{-31}	1.6×10^{-30}	6.9×10^{-30}	1.3×10^{-29}	2.7×10^{-29}
SA	5.7×10^{-31}	2.4×10^{-30}	7.8×10^{-30}	1.4×10^{-29}	5.6×10^{-29}
$(1 + 10)$ EA	2.8×10^{-32}	8.3×10^{-30}	1.5×10^{-29}	2.7×10^{-29}	4.2×10^{-29}
$(1 + 1)$ EA	1.8×10^{-31}	3.1×10^{-30}	1.6×10^{-29}	4.1×10^{-29}	1.3×10^{-28}
UMDA	5.1×10^{-31}	6.7×10^{-30}	1.7×10^{-29}	2.7×10^{-29}	7.4×10^{-29}

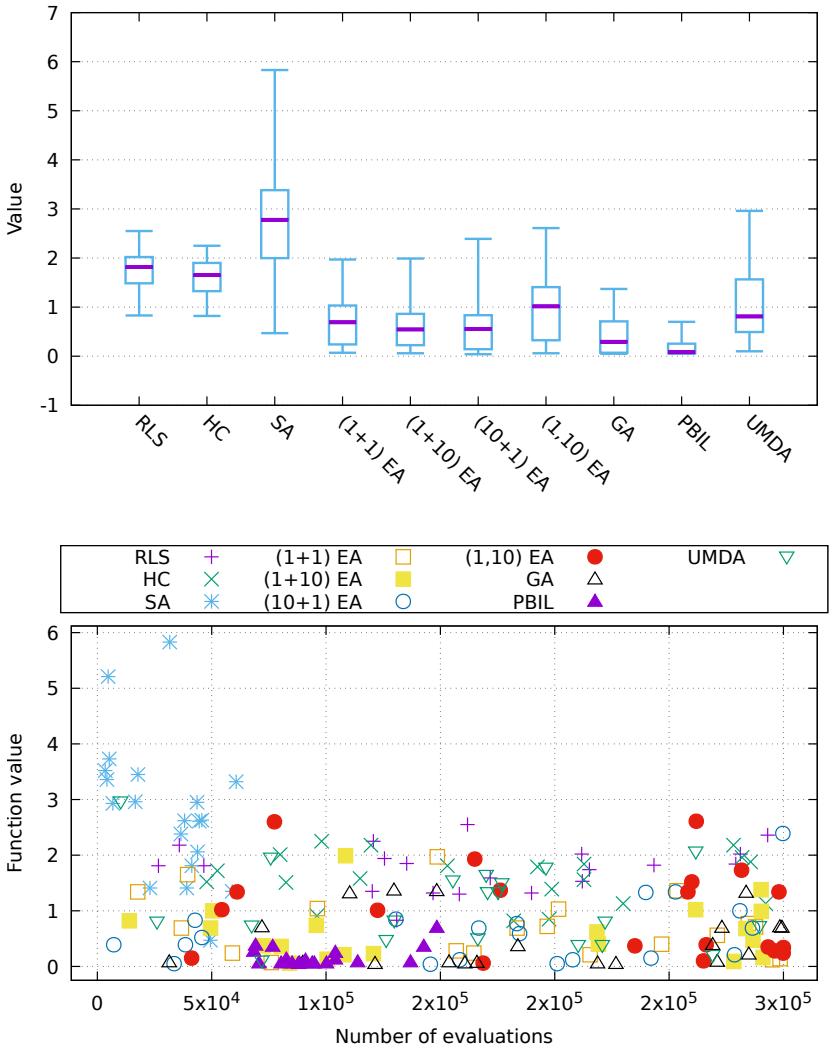




Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.15	0.00	0.23	0.00
RLS	0.10	0.00	0.16	0.00	0.25	0.00
SA	0.10	0.00	0.15	0.00	0.25	0.00
$(1, 10)$ EA	0.13	0.00	0.15	0.00	0.28	0.00
$(1 + 1)$ EA	0.14	0.00	0.15	0.00	0.29	0.00
$(1 + 10)$ EA	0.14	0.00	0.15	0.00	0.29	0.00
$(10 + 1)$ EA	0.17	0.00	0.16	0.00	0.34	0.00
GA	0.61	0.01	0.20	0.00	0.81	0.01
UMDA	0.65	0.01	0.15	0.00	0.80	0.01
PBIL	0.76	0.01	0.21	0.00	0.97	0.01

16 Function cancel

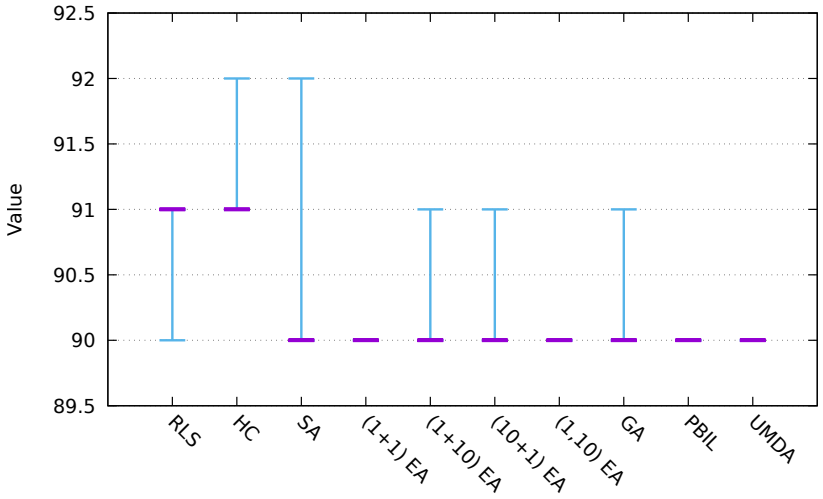
Algorithm	Value				
	min	Q_1	med.	Q_3	max
PBIL	0.05	**0.06**	**0.08**	**0.26**	**0.70**
GA	0.05	0.07	0.30	0.71	1.37
$(1+10)$ EA	0.06	0.23	0.55	0.86	1.99
$(10+1)$ EA	**0.04**	0.14	0.56	0.84	2.39
$(1+1)$ EA	0.07	0.24	0.69	1.03	1.97
UMDA	0.10	0.49	0.81	1.57	2.96
$(1,10)$ EA	0.06	0.33	1.02	1.41	2.61
HC	0.82	1.33	1.65	1.90	2.25
RLS	0.83	1.49	1.82	2.02	2.55
SA	0.47	2.00	2.78	3.38	5.83

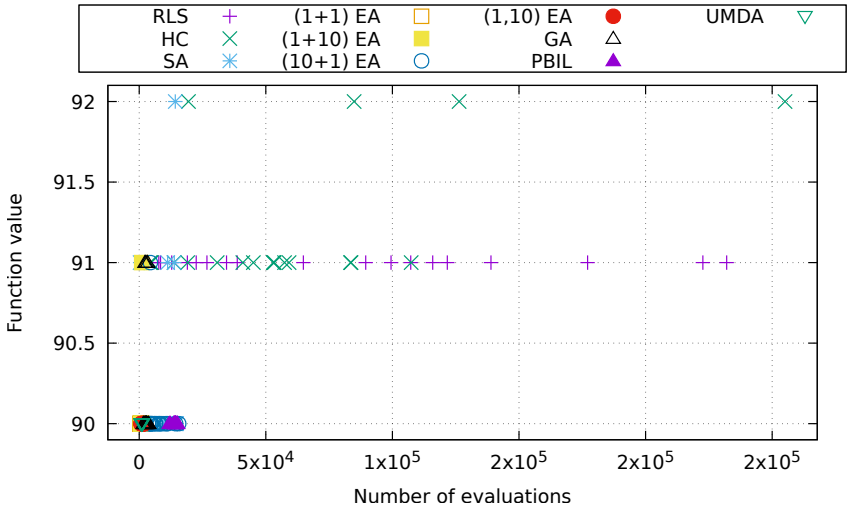


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.14	0.00	0.22	0.01
RLS	0.09	0.00	0.14	0.00	0.23	0.01
SA	0.10	0.00	0.14	0.00	0.23	0.01
$(1, 10)$ EA	0.13	0.00	0.14	0.00	0.26	0.01
$(1 + 1)$ EA	0.14	0.00	0.14	0.00	0.28	0.00
$(1 + 10)$ EA	0.14	0.00	0.14	0.00	0.28	0.00
$(10 + 1)$ EA	0.17	0.00	0.14	0.00	0.31	0.01
GA	0.61	0.01	0.14	0.00	0.75	0.01
UMDA	0.65	0.01	0.14	0.00	0.78	0.02
PBIL	0.68	0.01	0.15	0.00	0.83	0.01

17 Function trap

Algorithm	Value				
	min	Q_1	med.	Q_3	max
HC	**91**	**91**	**91**	**91**	**92**
RLS	90	**91**	**91**	**91**	91
SA	90	90	90	90	**92**
$(1+10)$ EA	90	90	90	90	91
$(10+1)$ EA	90	90	90	90	91
GA	90	90	90	90	91
$(1+1)$ EA	90	90	90	90	90
$(1,10)$ EA	90	90	90	90	90
PBIL	90	90	90	90	90
UMDA	90	90	90	90	90

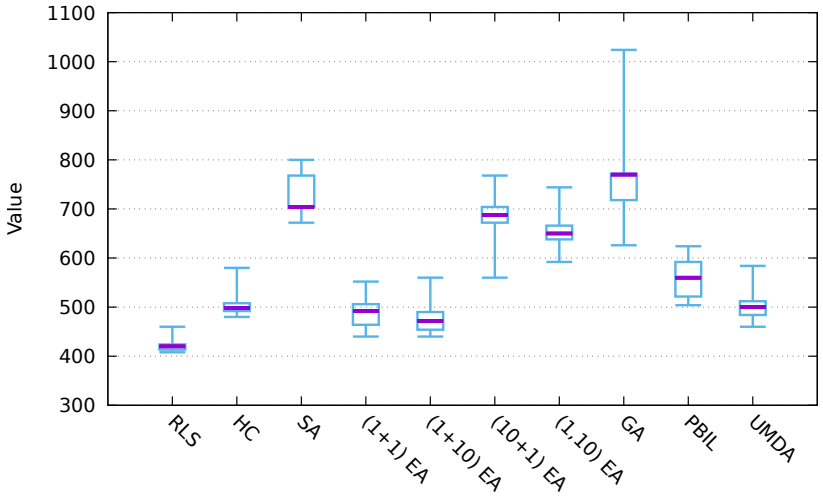


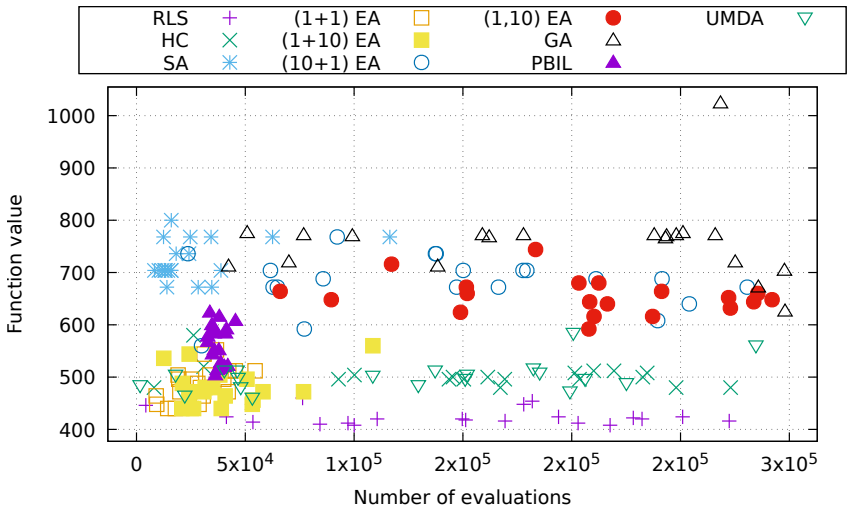


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.13	0.00	0.21	0.01
RLS	0.09	0.00	0.13	0.00	0.22	0.01
SA	0.10	0.00	0.13	0.00	0.23	0.01
$(1, 10)$ EA	0.13	0.00	0.13	0.00	0.26	0.01
$(1 + 1)$ EA	0.14	0.00	0.13	0.00	0.27	0.01
$(1 + 10)$ EA	0.15	0.00	0.13	0.00	0.28	0.00
$(10 + 1)$ EA	0.17	0.00	0.13	0.00	0.30	0.01
GA	0.61	0.01	0.13	0.00	0.74	0.01
UMDA	0.65	0.01	0.13	0.00	0.77	0.01
PBIL	0.66	0.01	0.13	0.00	0.79	0.01

18 Function hiff

Algorithm	Value				
	min	Q_1	med.	Q_3	max
GA	626	**718**	**770**	**772**	**1,024**
SA	**672**	704	704	768	800
$(10+1)$ EA	560	672	688	704	768
$(1,10)$ EA	592	638	650	666	744
PBIL	504	522	560	592	624
UMDA	460	484	500	512	584
HC	480	492	498	508	580
$(1+1)$ EA	440	464	492	506	552
$(1+10)$ EA	440	454	472	490	560
RLS	408	414	420	424	460

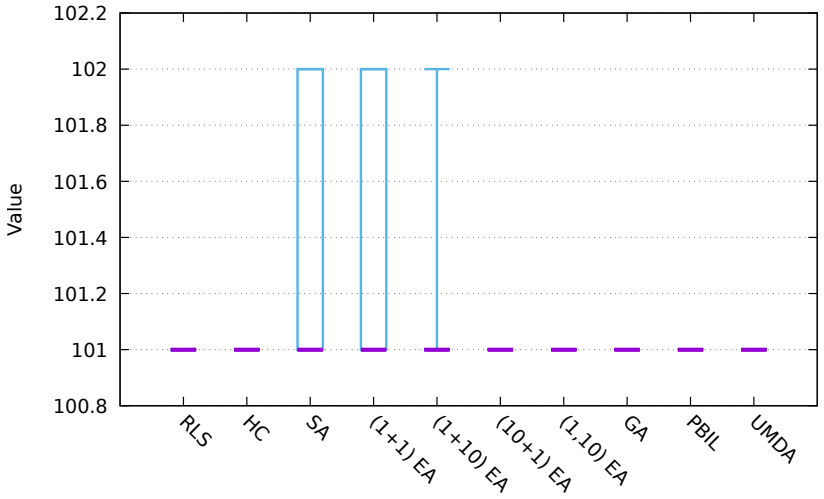


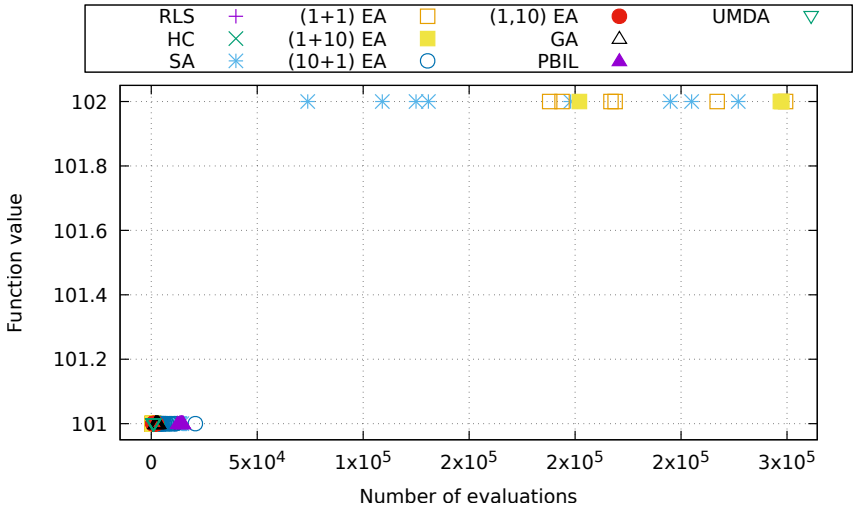


Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.08	0.00	0.33	0.01	0.41	0.01
RLS	0.09	0.00	0.32	0.01	0.42	0.01
SA	0.10	0.00	0.37	0.01	0.47	0.01
$(1, 10)$ EA	0.13	0.00	0.36	0.01	0.49	0.01
$(1 + 1)$ EA	0.14	0.00	0.34	0.01	0.49	0.01
$(1 + 10)$ EA	0.15	0.00	0.34	0.01	0.49	0.01
$(10 + 1)$ EA	0.18	0.00	0.38	0.01	0.55	0.01
GA	0.71	0.02	0.40	0.01	1.11	0.03
UMDA	0.80	0.01	0.35	0.01	1.15	0.02
PBIL	0.84	0.01	0.37	0.01	1.20	0.02

19 Function plateau

Algorithm	Value				
	min	Q_1	med.	Q_3	max
SA	**101**	**101**	**101**	**102**	**102**
$(1+1)$ EA	**101**	**101**	**101**	**102**	**102**
$(1+10)$ EA	**101**	**101**	**101**	101	**102**
RLS	**101**	**101**	**101**	101	101
HC	**101**	**101**	**101**	101	101
$(10+1)$ EA	**101**	**101**	**101**	101	101
$(1,10)$ EA	**101**	**101**	**101**	101	101
GA	**101**	**101**	**101**	101	101
PBIL	**101**	**101**	**101**	101	101
UMDA	**101**	**101**	**101**	101	101

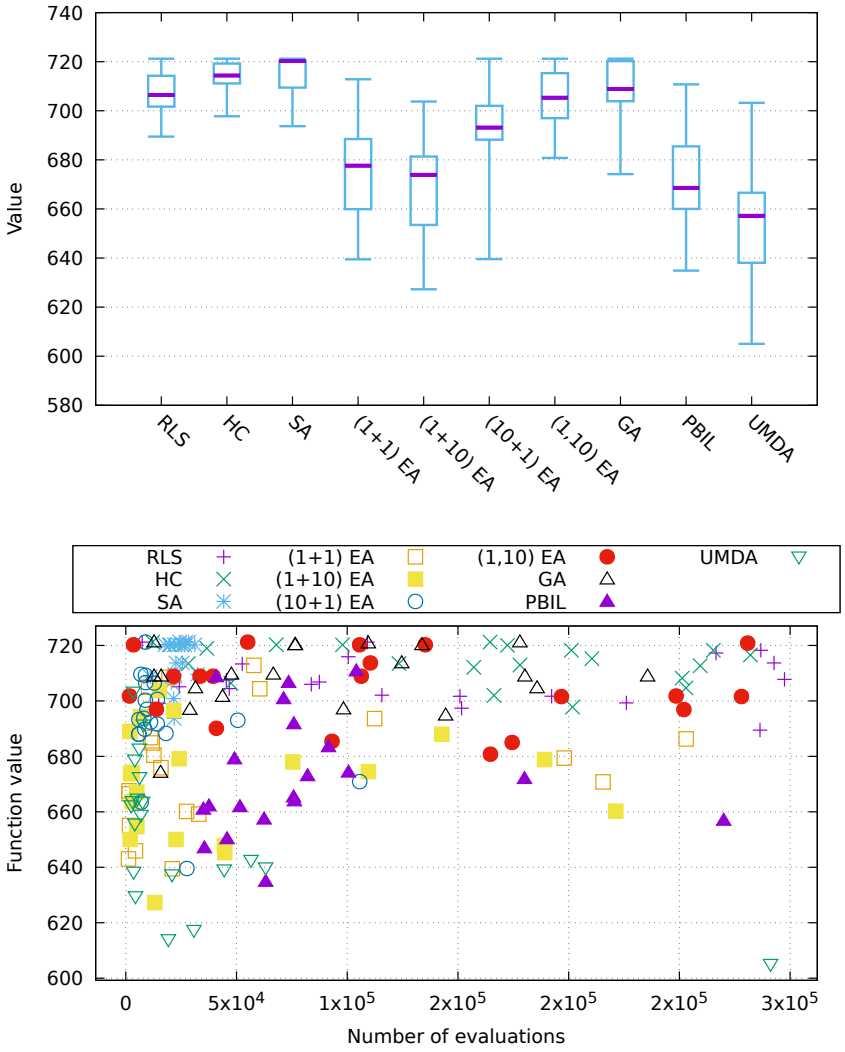




Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
SA	0.08	0.03	0.10	0.03	0.18	0.06
HC	0.08	0.00	0.11	0.00	0.20	0.00
RLS	0.09	0.00	0.11	0.00	0.21	0.00
$(1, 10)$ EA	0.13	0.00	0.12	0.00	0.25	0.01
$(1 + 1)$ EA	0.13	0.02	0.11	0.02	0.24	0.03
$(1 + 10)$ EA	0.14	0.01	0.12	0.01	0.26	0.02
$(10 + 1)$ EA	0.17	0.00	0.12	0.00	0.29	0.01
GA	0.61	0.01	0.12	0.00	0.73	0.01
UMDA	0.65	0.01	0.12	0.00	0.77	0.01
PBIL	0.66	0.01	0.12	0.00	0.78	0.01

20 Function walsh2

Algorithm	Value				
	min	Q_1	med.	Q_3	max
SA	693.71	709.44	**720.24**	**720.24**	**721.22**
HC	**697.77**	**711.14**	714.36	719.22	**721.22**
GA	674.19	703.90	708.91	**720.24**	**721.22**
RLS	689.46	701.69	706.40	714.25	**721.22**
$(1, 10)$ EA	680.78	696.97	705.34	715.33	**721.22**
$(10 + 1)$ EA	639.56	688.22	693.15	702.01	**721.22**
$(1 + 1)$ EA	639.46	659.90	677.65	688.48	712.83
$(1 + 10)$ EA	627.27	653.48	673.94	681.34	703.76
PBIL	634.87	660.01	668.64	685.49	710.76
UMDA	605.04	638.05	657.25	666.60	703.23



Algorithm	Time (s)					
	algorithm		evaluation		total	
	mean	dev.	mean	dev.	mean	dev.
HC	0.09	0.00	2.08	0.04	2.17	0.04
RLS	0.10	0.00	2.11	0.04	2.21	0.04
SA	0.10	0.00	2.07	0.05	2.17	0.05
$(1, 10)$ EA	0.13	0.00	2.05	0.04	2.18	0.04
$(1 + 1)$ EA	0.15	0.00	2.15	0.06	2.30	0.06
$(1 + 10)$ EA	0.15	0.00	2.15	0.04	2.31	0.04
$(10 + 1)$ EA	0.18	0.01	2.26	0.11	2.44	0.11
GA	0.62	0.01	2.43	0.05	3.05	0.05
UMDA	0.66	0.01	2.05	0.03	2.71	0.03
PBIL	0.68	0.01	2.15	0.05	2.83	0.05

A Plan


```
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            "id": "jmp-10",
            "opt": "-F 30 --stop-on-maximum -t 10",
```

```
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "djmp-5",
    "opt": "-F 31 --stop-on-maximum -t 5",
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "djmp-10",
    "opt": "-F 31 --stop-on-maximum -t 10",
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "fp-5",
    "opt": "-F 40 --stop-on-maximum -t 5",
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "fp-10",
    "opt": "-F 40 --stop-on-maximum -t 10",
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "nk",
    "opt": "-F 60 -p instances/nk.100.4",
    "rounding": {
        "value": { "before": 1, "after": 2 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "max-sat",
    "opt": "-F 70 -p instances/ms.100.3.1000",
    "rounding": {
        "value": { "before": 3, "after": 0 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "labs",
    "opt": "-F 81",
    "rounding": {
        "value": { "before": 1, "after": 2 },
        "time": { "before": 1, "after": 2 } }
},
{
    "id": "ep",
    "opt": "-F 90 -p instances/ep.100",
    "reverse": true,
    "logscale": true,
    "rounding": {
        "value": { "before": 1, "after": 1 },
        "time": { "before": 1, "after": 2 } }
},
{
```

```
        "id": "cancel",
        "opt": "-F 100 -s 99",
        "reverse": true,
        "rounding": {
            "value": { "before": 1, "after": 2 },
            "time": { "before": 1, "after": 2 } }
    },
    {
        "id": "trap",
        "opt": "-F 110 --stop-on-maximum --fn-num-traps 10",
        "rounding": {
            "value": { "before": 3, "after": 0 },
            "time": { "before": 1, "after": 2 } }
    },
    {
        "id": "hiff",
        "opt": "-F 120 --stop-on-maximum -s 128",
        "rounding": {
            "value": { "before": 4, "after": 0 },
            "time": { "before": 1, "after": 2 } }
    },
    {
        "id": "plateau",
        "opt": "-F 130 --stop-on-maximum",
        "rounding": {
            "value": { "before": 3, "after": 0 },
            "time": { "before": 1, "after": 2 } }
    },
    {
        "id": "walsh2",
        "opt": "-F 162 -p instances/walsh2.100",
        "rounding": {
            "value": { "before": 3, "after": 2 },
            "time": { "before": 1, "after": 2 } }
    }
],
"algorithms": [
    {
        "id": "rls",
        "opt": "-A 100 --restart",
        "labels": {
            "latex": "RLS",
            "gnuplot": "RLS"
        }
    },
    {
        "id": "hc",
        "opt": "-A 150 --restart",
        "labels": {
            "latex": "HC",
            "gnuplot": "HC"
        }
    },
    {
        "id": "sa",
        "opt": "-A 200 --sa-beta-ratio 1.05 --sa-num-trials 10",
        "labels": {
            "latex": "SA",
            "gnuplot": "SA"
        }
    },
    {
        "id": "ea-1p1",
```

```
            "opt": "-A 300",
            "labels": {
                "latex": "$(1+1)$ EA",
                "gnuplot": "(1+1) EA"
            }
        },
        {
            "id": "ea-1p10",
            "opt": "-A 310 --ea-mu 1 --ea-lambda 10",
            "labels": {
                "latex": "$(1+10)$ EA",
                "gnuplot": "(1+10) EA"
            }
        },
        {
            "id": "ea-10p1",
            "opt": "-A 310 --ea-mu 10 --ea-lambda 1",
            "labels": {
                "latex": "$(10+1)$ EA",
                "gnuplot": "(10+1) EA"
            }
        },
        {
            "id": "ea-1c10",
            "opt": "-A 320 --ea-mu 1 --ea-lambda 10 --ea-allow-no-mutation",
            "labels": {
                "latex": "$(1,10)$ EA",
                "gnuplot": "(1,10) EA"
            }
        },
        {
            "id": "ga",
            "opt": "-A 400 --ea-mu 100",
            "labels": {
                "latex": "GA",
                "gnuplot": "GA"
            }
        },
        {
            "id": "pbil",
            "opt": "-A 500 -l 5e-3",
            "labels": {
                "latex": "PBIL",
                "gnuplot": "PBIL"
            }
        },
        {
            "id": "umda",
            "opt": "-A 600 -x 100 -y 10",
            "labels": {
                "latex": "UMDA",
                "gnuplot": "UMDA"
            }
        }
    ]
}
```

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
# fp_expression = (1-x)^2+100*(y-x^2)^2
# fp_lower_bound = -2
# fp_num_bits = 8
# fp_precision = 0.01
# fp_upper_bound = 2
# 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_rate = 1
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0
# num_threads = 1
# path = function.txt
# pn_mutation_rate = 1
# pn_neighborhood = 0
# pn_radius = 2
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# rep_categorical_representation = 0
# 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 = 0.18
# Generated from hnco.json
```