Results

June 18, 2010

1 Tables of Friedman, Bonferroni-Dunn, Holm, Hochberg and Hommel Tests

Table 1: Average Rankings of the algorithms

Algorithm	Ranking
DE	3.368421052631578
CHC	1.5263157894736838
G-CMA-ES	2.1052631578947367
VXQR1	2.9999999999999996

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 24.03157894736834.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 13.12068965517234.

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.

Holm's procedure rejects those hypotheses that have a p-value ≤ 0.05.

Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.025.

Hommel's procedure rejects those hypotheses that have a p-value ≤ 0.05.

Table 2: Holm / Hochberg Table for $\alpha = 0.05$

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
3	DE	4.397966037062801	1.092700725019233E-5	0.016666666666666666
2	VXQR1	3.518372829650242	4.342018690566093E-4	0.025
1	G-CMA-ES	1.3822178973625958	0.16690480637428703	0.05

Table 3: Holm / Hochberg Table for $\alpha = 0.10$

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
3	DE	4.397966037062801	1.092700725019233E-5	0.03333333333333333
2	VXQR1	3.518372829650242	4.342018690566093E-4	0.05
1	G-CMA-ES	1.3822178973625958	0.16690480637428703	0.1

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value ≤ 0.03333333333333333.
Holm's procedure rejects those hypotheses that have a p-value ≤ 0.1.
Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.05.
Hommel's procedure rejects those hypotheses that have a p-value ≤ 0.05.

Table 4: Adjusted p-values

i	algorithm	unadjusted p	p_{Bonf}	p_{Holm}	p_{Hoch}	p_{Homm}
1	DE	1.092700725019233E-5	3.278102175057699E-5	3.278102175057699E-5	3.278102175057699E-5	3.278102175057699E-5
2	VXQR1	4.342018690566093E-4	0.001302605607169828	8.684037381132186E-4	8.684037381132186E-4	8.684037381132186E-4
3	G-CMA-ES	0.16690480637428703	0.5007144191228611	0.16690480637428703	0.16690480637428703	0.16690480637428703

Table 5: Holm / Shaffer Table for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.397966037062801	1.092700725019233E-5	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	3.518372829650242	4.342018690566093E-4	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.0157481397002055	0.00256346092386938	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	2.1361549322876465	0.03266678750121425	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	1.3822178973625958	0.16690480637428703	0.025	0.025
1	DE vs. VXQR1	0.8795932074125591	0.3790797199078282	0.05	0.05

Nemenyi's procedure rejects those hypotheses that have a p-value $\leq 0.008333333333333333$.

Holm's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Shaffer's procedure rejects those hypotheses that have a p-value $\leq 0.008333333333333333$.
Bergmann's procedure rejects these hypotheses:

- DE vs. CHC
- DE vs. G-CMA-ES
- CHC vs. VXQR1
- G-CMA-ES vs. VXQR1

Table 6: Holm / Shaffer Table for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.397966037062801	1.092700725019233E-5	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	3.518372829650242	4.342018690566093E-4	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.0157481397002055	0.00256346092386938	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	2.1361549322876465	0.03266678750121425	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	1.3822178973625958	0.16690480637428703	0.05	0.05
1	DE vs. VXQR1	0.8795932074125591	0.3790797199078282	0.1	0.1

Nemenyi's procedure rejects those hypotheses that have a p-value $\leq 0.008333333333333333$.
Holm's procedure rejects those hypotheses that have a p-value ≤ 0.05.
Shaffer's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Bergmann's procedure rejects these hypotheses:

- DE vs. CHC
- DE vs. G-CMA-ES
- CHC vs. VXQR1
- G-CMA-ES vs. VXQR1

Table 7: Adjusted p-values

i	hypothesis	unadjusted p	p_{Neme}	p_{Holm}	p_{Shaf}	p_{Berg}
1	DE vs .CHC	1.092700725019233E-5	6.556204350115398E-5	6.556204350115398E-5	6.556204350115398E-5	6.556204350115398E-5
2	CHC vs .VXQR1	4.342018690566093E-4	0.002605211214339656	0.0021710093452830463	0.00130260560716982	0.00130260560716982
3	DE vs .G-CMA-ES	0.00256346092386938	0.015380765543216279	0.01025384369547752	0.007690382771608139	0.007690382771608139
4	G-CMA-ES vs .VXQR1	0.03266678750121425	0.19600072500728552	0.09800036250364276	0.09800036250364276	0.03266678750121425
5	CHC vs .G-CMA-ES	0.16690480637428703	1.0014288382457222	0.33380961274857407	0.33380961274857407	0.33380961274857407
6	DE vs .VXQR1	0.3790797199078282	2.274478319446969	0.3790797199078282	0.3790797199078282	0.3790797199078282