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	1.368421052631579
G-CMA-ES	2.026315789473684
VXQR1	3.2368421052631575

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 31.94210526315776.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 22.945179584120762.

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	4.774934554525326	1.7976570566877927E-6	0.016666666666666666
2	VXQR1	4.460794123306556	8.165650609903694E-6	0.025
1	G-CMA-ES	1.5707021560938577	0.11625184815284836	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	4.774934554525326	1.7976570566877927E-6	0.03333333333333333
2	VXQR1	4.460794123306556	8.165650609903694E-6	0.05
1	G-CMA-ES	1.5707021560938577	0.11625184815284836	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	1.7976570566877927E-6	5.3929711700633785E-6	5.3929711700633785E-6	5.3929711700633785E-6	5.3929711700633785E-6
2	VXQR1	8.165650609903694E-6	2.449695182971108E-5	1.6331301219807388E-5	1.6331301219807388E-5	1.6331301219807388E-5
3	G-CMA-ES	0.11625184815284836	0.34875554445854506	0.11625184815284836	0.11625184815284836	0.11625184815284836

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.774934554525326	1.7976570566877927E-6	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	4.460794123306556	8.165650609903694E-6	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.2042323984314685	0.0013542311595120353	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	2.8900919672126983	0.0038512913785902596	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	1.5707021560938577	0.11625184815284836	0.025	0.025
1	DE vs. VXQR1	0.31414043121876994	0.7534143830088174	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 ≤ 0.025.
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	4.774934554525326	1.7976570566877927E-6	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	4.460794123306556	8.165650609903694E-6	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.2042323984314685	0.0013542311595120353	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	2.8900919672126983	0.0038512913785902596	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	1.5707021560938577	0.11625184815284836	0.05	0.05
1	DE vs. VXQR1	0.31414043121876994	0.7534143830088174	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	1.7976570566877927E-6	1.0785942340126757E-5	1.0785942340126757E-5	1.0785942340126757E-5	1.0785942340126757E-5
2	CHC vs .VXQR1	8.165650609903694E-6	4.899390365942216E-5	4.082825304951847E-5	2.449695182971108E-5	2.449695182971108E-5
3	DE vs .G-CMA-ES	0.0013542311595120353	0.008125386957072211	0.005416924638048141	0.004062693478536106	0.004062693478536106
4	G-CMA-ES vs .VXQR1	0.0038512913785902596	0.023107748271541557	0.011553874135770779	0.011553874135770779	0.004062693478536106
5	CHC vs .G-CMA-ES	0.11625184815284836	0.6975110889170901	0.23250369630569673	0.23250369630569673	0.23250369630569673
6	DE vs .VXQR1	0.7534143830088174	4.520486298052904	0.7534143830088174	0.7534143830088174	0.7534143830088174