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	3.2894736842105248
CHC	1.6842105263157894
G-CMA-ES	1.9473684210526307
VXQR1	3.078947368421052

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 21.99473684210506.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 11.309878213802264.

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	3.8325132608690105	1.2684075974808373E-4	0.016666666666666666
2	VXQR1	3.3298885709189787	8.688074530720151E-4	0.025
1	G-CMA-ES	0.6282808624375416	0.5298199661707867	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	3.8325132608690105	1.2684075974808373E-4	0.03333333333333333
2	VXQR1	3.3298885709189787	8.688074530720151E-4	0.05
1	G-CMA-ES	0.6282808624375416	0.5298199661707867	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	1.2684075974808373E-4	3.805222792442512E-4	3.805222792442512E-4	3.805222792442512E-4	3.805222792442512E-4
2	VXQR1	8.688074530720151E-4	0.002606422359216045 5	0.0017376149061440302	0.0017376149061440302	0.0017376149061440302
3	G-CMA-ES	0.5298199661707867	1.5894598985123602	0.5298199661707867	0.5298199661707867	0.5298199661707867

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	3.8325132608690105	1.2684075974808373E-4	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	3.3298885709189787	8.688074530720151E-4	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.204232398431469	0.0013542311595120327	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	2.701607708481437	0.00690051259000395	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	0.6282808624375416	0.5298199661707867	0.025	0.025
1	DE vs. VXQR1	0.502624689950032	0.6152281670802465	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	3.8325132608690105	1.2684075974808373E-4	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	3.3298885709189787	8.688074530720151E-4	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.204232398431469	0.0013542311595120327	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	2.701607708481437	0.00690051259000395	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	0.6282808624375416	0.5298199661707867	0.05	0.05
1	DE vs. VXQR1	0.502624689950032	0.6152281670802465	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	1.2684075974808373E-4	7.610445584885024E-4	7.610445584885024E-4	7.610445584885024E-4	7.610445584885024E-4
2	CHC vs .VXQR1	8.688074530720151E-4	0.005212844718432091	0.004344037265360075	0.002604223592160455	0.002604223592160455
3	DE vs .G-CMA-ES	0.0013542311595120327	0.008125386957072196	0.005416924638048131	0.004062693478536098	0.004062693478536098
4	G-CMA-ES vs .VXQR1	0.00690051259000395	0.041403075540023704	0.020701537770011852	0.020701537770011852	0.00690051259000395
5	CHC vs .G-CMA-ES	0.5298199661707867	3.1789197970247205	1.0596399323415735	1.0596399323415735	1.0596399323415735
6	DE vs .VXQR1	0.6152281670802465	3.691369002481479	1.0596399323415735	1.0596399323415735	1.0596399323415735