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	3.342105263157893
CHC	1.736842105263157
G-CMA-ES	1.7631578947368418
VXQR1	3.1578947368421053

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 25.847368421052465.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 14.934617334008948.

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	3.832513260869012	1.268407597480831E-4	0.016666666666666666
2	VXQR1	3.392716657162736	6.920318080538578E-4	0.025
1	G-CMA-ES	0.06282808624375558	0.9499034004565569	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	3.832513260869012	1.268407597480831E-4	0.03333333333333333
2	VXQR1	3.392716657162736	6.920318080538578E-4	0.05
1	G-CMA-ES	0.06282808624375558	0.9499034004565569	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	1.268407597480831E-4	3.805222792442493E-4	3.805222792442493E-4	3.805222792442493E-4	3.805222792442493E-4
2	VXQR1	6.920318080538578E-4	0.0020760954241615735	0.0013840636161077157	0.0013840636161077157	0.0013840636161077157
3	G-CMA-ES	0.9499034004565569	2.8497102013696707	0.9499034004565569	0.9499034004565569	0.9499034004565569

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	3.832513260869012	1.268407597480831E-4	0.008333333333333333	0.008333333333333333
5	DE vs. G-CMA-ES	3.769685174625256	1.6345359878088155E-4	0.01	0.016666666666666666
4	CHC vs. VXQR1	3.392716657162736	6.920318080538578E-4	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	3.32988857091898	8.68807453072011E-4	0.016666666666666666	0.016666666666666666
2	DE vs. VXQR1	0.4397966037062758	0.6600844276980674	0.025	0.025
1	CHC vs. G-CMA-ES	0.06282808624375558	0.9499034004565569	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	3.832513260869012	1.268407597480831E-4	0.016666666666666666	0.016666666666666666
5	DE vs. G-CMA-ES	3.769685174625256	1.6345359878088155E-4	0.02	0.03333333333333333
4	CHC vs. VXQR1	3.392716657162736	6.920318080538578E-4	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	3.32988857091898	8.68807453072011E-4	0.03333333333333333	0.03333333333333333
2	DE vs. VXQR1	0.4397966037062758	0.6600844276980674	0.05	0.05
1	CHC vs. G-CMA-ES	0.06282808624375558	0.9499034004565569	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	1.268407597480831E-4	7.610445584884986E-4	7.610445584884986E-4	7.610445584884986E-4	7.610445584884986E-4
2	DE vs .G-CMA-ES	1.6345359878088155E-4	9.807215926852892E-4	8.172679939044078E-4	7.610445584884986E-4	7.610445584884986E-4
3	CHC vs .VXQR1	6.920318080538578E-4	0.004152190848323147	0.002768127232215431 3	0.002076095424161573 5	0.002076095424161573 5
4	G-CMA-ES vs .VXQR1	8.68807453072011E-4	0.005212844718432066	0.002768127232215431 3	0.002606422359216033	0.002076095424161573 5
5	DE vs .VXQR1	0.6600844276980674	3.9605065661884042	1.3201688553961348	1.3201688553961348	1.3201688553961348
6	CHC vs .G-CMA-ES	0.9499034004565569	5.699420402739341	1.3201688553961348	1.3201688553961348	1.3201688553961348