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	3.421052631578946
CHC	1.5263157894736836
G-CMA-ES	1.8157894736842102
VXQR1	3.2368421052631575

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 32.00526315789453.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 23.04864181933005.

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	4.52362220955031	6.0790192071150225E-6	0.016666666666666666
2	VXQR1	4.083825605844032	4.430028241597432E-5	0.025
1	G-CMA-ES	0.6911089486812981	0.48949707708823026	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	4.52362220955031	6.0790192071150225E-6	0.03333333333333333
2	VXQR1	4.083825605844032	4.430028241597432E-5	0.05
1	G-CMA-ES	0.6911089486812981	0.48949707708823026	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	6.0790192071150225E-6	1.8237057621345068E-5	1.8237057621345068E-5	1.8237057621345068E-5	1.8237057621345068E-5
2	VXQR1	4.430028241597432E-5	1.3290084724792295E-4	8.860056483194864E-5	8.860056483194864E-5	8.860056483194864E-5
3	G-CMA-ES	0.48949707708823026	1.4684912312646907	0.48949707708823026	0.48949707708823026	0.48949707708823026

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.52362220955031	6.0790192071150225E-6	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	4.083825605844032	4.430028241597432E-5	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.832513260869012	1.268407597480831E-4	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	3.3927166571627336	6.920318080538638E-4	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	0.6911089486812981	0.48949707708823026	0.025	0.025
1	DE vs. VXQR1	0.43979660370627793	0.660084427698066	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	4.52362220955031	6.0790192071150225E-6	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	4.083825605844032	4.430028241597432E-5	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.832513260869012	1.268407597480831E-4	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	3.3927166571627336	6.920318080538638E-4	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	0.6911089486812981	0.48949707708823026	0.05	0.05
1	DE vs. VXQR1	0.43979660370627793	0.660084427698066	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	6.0790192071150225E-6	3.6474115242690137E-5	3.6474115242690137E-5	3.6474115242690137E-5	3.6474115242690137E-5
2	CHC vs .VXQR1	4.430028241597432E-5	2.658016944958459E-4	2.2150141207987161E-4	1.3290084724792295E-4	1.3290084724792295E-4
3	DE vs .G-CMA-ES	1.268407597480831E-4	7.610445584884986E-4	5.073630389923324E-4	3.805222792442493E-4	3.805222792442493E-4
4	G-CMA-ES vs .VXQR1	6.920318080538638E-4	0.004152190848323183	0.0020760954241615913	0.0020760954241615913	6.920318080538638E-4
5	CHC vs .G-CMA-ES	0.48949707708823026	2.9369824625293814	0.9789941541764605	0.9789941541764605	0.9789941541764605
6	DE vs .VXQR1	0.660084427698066	3.960506566188396	0.9789941541764605	0.9789941541764605	0.9789941541764605