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	3.394736842105262
CHC	1.5263157894736836
G-CMA-ES	1.8684210526315788
VXQR1	3.2105263157894735

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 30.236842105263033.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 20.33628318584053.

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	4.460794123306556	8.165650609903694E-6	0.016666666666666666
2	VXQR1	4.020997519600278	5.7952215291898184E-5	0.025
1	G-CMA-ES	0.8167651211688072	0.41406266812926257	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	4.460794123306556	8.165650609903694E-6	0.03333333333333333
2	VXQR1	4.020997519600278	5.7952215291898184E-5	0.05
1	G-CMA-ES	0.8167651211688072	0.41406266812926257	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	8.165650609903694E-6	2.449695182971108E-5	2.449695182971108E-5	2.449695182971108E-5	2.449695182971108E-5
2	VXQR1	5.7952215291898184E-5	1.7385664587569454E-4	1.1590443058379637E-4	1.1590443058379637E-4	1.1590443058379637E-4
3	G-CMA-ES	0.41406266812926257	1.2421880043877878	0.41406266812926257	0.41406266812926257	0.41406266812926257

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.460794123306556	8.165650609903694E-6	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	4.020997519600278	5.7952215291898184E-5	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.6440290021377484	2.684031560092097E-4	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	3.2042323984314707	0.0013542311595120251	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	0.8167651211688072	0.41406266812926257	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	4.460794123306556	8.165650609903694E-6	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	4.020997519600278	5.7952215291898184E-5	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.6440290021377484	2.684031560092097E-4	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	3.2042323984314707	0.0013542311595120251	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	0.8167651211688072	0.41406266812926257	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	8.165650609903694E-6	4.899390365942216E-5	4.899390365942216E-5	4.899390365942216E-5	4.899390365942216E-5
2	CHC vs .VXQR1	5.7952215291898184E-5	3.477132917513891E-4	2.897610764594909E-4	1.7385664587569454E-4	1.7385664587569454E-4
3	DE vs .G-CMA-ES	2.684031560092097E-4	0.0016104189360552582	0.0010736126240368387	8.052094680276291E-4	8.052094680276291E-4
4	G-CMA-ES vs .VXQR1	0.0013542311595120251	0.00812538695707215	0.004062693478536075	0.004062693478536075	0.0013542311595120251
5	CHC vs .G-CMA-ES	0.41406266812926257	2.4843760087755755	0.8281253362585251	0.8281253362585251	0.8281253362585251
6	DE vs .VXQR1	0.660084427698066	3.960506566188396	0.8281253362585251	0.8281253362585251	0.8281253362585251