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	1.368421052631579
G-CMA-ES	2.0526315789473686
VXQR1	3.1842105263157894

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 31.342105263157823.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 21.987692307692196.

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	4.837762640769081	1.3130881465534958E-6	0.016666666666666666
2	VXQR1	4.335137950819048	1.4566874163845129E-5	0.025
1	G-CMA-ES	1.633530242337612 8	0.10235752557227855	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	4.837762640769081	1.3130881465534958E-6	0.03333333333333333
2	VXQR1	4.335137950819048	1.4566874163845129E-5	0.05
1	G-CMA-ES	1.633530242337612 8	0.10235752557227855	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	1.3130881465534958E-6	3.9392644396604875E-6	3.9392644396604875E-6	3.9392644396604875E-6	3.9392644396604875E-6
2	VXQR1	1.4566874163845129E-5	4.370062249153539E-5	2.9133748327690257E-5	2.9133748327690257E-5	2.9133748327690257E-5
3	G-CMA-ES	0.10235752557227855	0.30707257671683563	0.10235752557227855	0.10235752557227855	0.10235752557227855

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
6	DE vs. CHC	4.837762640769081	1.3130881465534958E-6	0.008333333333333333	0.008333333333333333
5	CHC vs. VXQR1	4.335137950819048	1.4566874163845129E-5	0.01	0.016666666666666666
4	DE vs. G-CMA-ES	3.2042323984314676	0.0013542311595120392	0.0125	0.016666666666666666
3	G-CMA-ES vs. VXQR1	2.7016077084814354	0.006900512590003988	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	1.6335302423376128	0.10235752557227855	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	4.837762640769081	1.3130881465534958E-6	0.016666666666666666	0.016666666666666666
5	CHC vs. VXQR1	4.335137950819048	1.4566874163845129E-5	0.02	0.03333333333333333
4	DE vs. G-CMA-ES	3.2042323984314676	0.0013542311595120392	0.025	0.03333333333333333
3	G-CMA-ES vs. VXQR1	2.7016077084814354	0.006900512590003988	0.03333333333333333	0.03333333333333333
2	CHC vs. G-CMA-ES	1.6335302423376128	0.10235752557227855	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	1.3130881465534958E-6	7.878528879320975E-6	7.878528879320975E-6	7.878528879320975E-6	7.878528879320975E-6
2	CHC vs .VXQR1	1.4566874163845129E-5	8.740124498307078E-5	7.283437081922564E-5	4.370062249153539E-5	4.370062249153539E-5
3	DE vs .G-CMA-ES	0.0013542311595120392	0.008125386957072236	0.005416924638048157	0.004062693478536118	0.004062693478536118
4	G-CMA-ES vs .VXQR1	0.006900512590003988	0.041403075540023926	0.020701537770011963	0.020701537770011963	0.006900512590003988
5	CHC vs .G-CMA-ES	0.10235752557227855	0.6141451534336713	0.2047150511445571	0.2047150511445571	0.2047150511445571
6	DE vs .VXQR1	0.6152281670802465	3.691369002481479	0.6152281670802465	0.6152281670802465	0.6152281670802465