

Results

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1 Tables of Friedman, Bonferroni-Dunn, Holm, Hochberg and Hommel Tests

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Table 1: Average Rankings of the algorithms

Algorithm	Ranking
DE	3.1578947368421044
CHC	2.0526315789473686
G-CMA-ES	1.81578947368421
VXQR1	2.973684210526315

Friedman statistic considering reduction performance (distributed according to chi-square with 3 degrees of freedom: 15.110526315789338.
Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 3 and 54 degrees of freedom: 6.49302676215597.

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	3.2042323984314702	0.001354231159512026	0.016666666666666666
2	VXQR1	2.76443579472519	0.005702132761524356	0.025
1	CHC	0.5654527761937908	0.5717658361284762	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	3.2042323984314702	0.001354231159512026	0.033333333333333333
2	VXQR1	2.76443579472519	0.005702132761524356	0.05
1	CHC	0.5654527761937908	0.5717658361284762	0.1

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.033333333333333333$.

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_{Hochb}	p_{Hommel}
1	DE	0.001354231159512026	0.004062693478536078	0.004062693478536078	0.004062693478536078	0.004062693478536078
2	VXQR1	0.005702132761524356	0.01710639828457907	0.011404265523048712	0.011404265523048712	0.011404265523048712
3	CHC	0.5717658361284762	1.7152975083854285	0.5717658361284762	0.5717658361284762	0.5717658361284762

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

i	algorithms	$z = (R_0 - R_i) / SE$	p	Holm	Shaffer
6	DE vs. G-CMA-ES	3.2042323984314702	0.001354231159512026	0.008333333333333333	0.008333333333333333
5	G-CMA-ES vs. VXQR1	2.76443579472519	0.005702132761524356	0.01	0.016666666666666666
4	DE vs. CHC	2.638779622237679	0.00832050523884444	0.0125	0.016666666666666666
3	CHC vs. VXQR1	2.198983018531399	0.027879129799048708	0.016666666666666666	0.016666666666666666
2	CHC vs. G-CMA-ES	0.5654527761937908	0.5717658361284762	0.025	0.025
1	DE vs. VXQR1	0.43979660370628004	0.6600844276980644	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 $\leq 0.016666666666666666$.
 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. G-CMA-ES	3.2042323984314702	0.001354231159512026	0.016666666666666666	0.016666666666666666
5	G-CMA-ES vs. VXQR1	2.76443579472519	0.005702132761524356	0.02	0.033333333333333333
4	DE vs. CHC	2.638779622237679	0.00832050523884444	0.025	0.033333333333333333
3	CHC vs. VXQR1	2.198983018531399	0.027879129799048708	0.033333333333333333	0.033333333333333333
2	CHC vs. G-CMA-ES	0.5654527761937908	0.5717658361284762	0.05	0.05
1	DE vs. VXQR1	0.43979660370628004	0.6600844276980644	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_{Nemc}	p_{Holm}	p_{Shaf}	p_{Berg}
1	DE vs G-CMA-ES	0.001354231159512026	0.008125386957072156	0.008125386957072156	0.008125386957072156	0.008125386957072156
2	G-CMA-ES vs .VXQR1	0.005702132761524356	0.03421279656914614	0.02851066380762178	0.01710639828457307	0.01710639828457307
3	DE vs .CHC	0.008320505023884444	0.049923030143306665	0.033282020095537775	0.024961515071653333	0.024961515071653333
4	CHC vs .VXQR1	0.027879129799048708	0.16727477879429226	0.08363738939714613	0.08363738939714613	0.027879129799048708
5	CHC vs G-CMA-ES	0.5717658361284762	3.430595016770857	1.1435316722569524	1.1435316722569524	1.1435316722569524
6	DE vs .VXQR1	0.6600844276980644	3.9605065661883865	1.1435316722569524	1.1435316722569524	1.1435316722569524