

# MINMEAN - Results

August 21, 2016

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

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Table 1: Average Rankings of the algorithms	
Algorithm	Ranking
IRS	6.6
EUCLIDEAN	3.8000000000000003
CHEBYSHEV	6.0
KULLBACKLEIBLER	3.0
HELLINGER	1.4
TOTALVARIATION	1.7999999999999998
CHISQUARE	5.4

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 27.171428571428553.  
P-value computed by Friedman Test: 1.3448112365843645E-4.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 6 and 24 degrees of freedom: 38.42424242424215.

P-value computed by Iman and Daveport Test: 3.743913634508992E-11.

Table 2: Holm / Hochberg Table for  $\alpha = 0.05$

$i$	algorithm	$z = (R_0 - R_i)/SE$	$p$	Holm/Hochberg/Hommel
6	IRS	3.8060102844992794	1.4122651246579272E-4	0.008333333333333333
5	CHEBYSHEV	3.3668552516724395	7.603058428726023E-4	0.01
4	CHISQUARE	2.9277002188455996	0.003414791178117856	0.0125
3	EUCLIDEAN	1.7566201313073602	0.0789825792637829	0.016666666666666666
2	KULLBACKLEIBLER	1.1710800875382399	0.24156658696897293	0.025
1	TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.05

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value  $\leq 0.008333333333333333$ .

Holm's procedure rejects those hypotheses that have a p-value  $\leq 0.016666666666666666$ .

Hochberg's procedure rejects those hypotheses that have a p-value  $\leq 0.0125$ .

Hommel's procedure rejects those hypotheses that have a p-value  $\leq 0.016666666666666666$ .

Table 3: Holm / Hochberg Table for  $\alpha = 0.10$

$i$	algorithm	$z = (R_0 - R_i)/SE$	$p$	Holm/Hochberg/Hommel
6	IRS	3.8060102844992794	1.4122651246579272E-4	0.016666666666666666
5	CHEBYSHEV	3.3668552516724395	7.603058428726023E-4	0.02
4	CHISQUARE	2.9277002188455996	0.003414791178117856	0.025
3	EUCLIDEAN	1.7566201313073602	0.0789825792637829	0.033333333333333333
2	KULLBACKLEIBLER	1.1710800875382399	0.24156658696897293	0.05
1	TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.1

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  $\leq 0.033333333333333333$ .

Hochberg's procedure rejects those hypotheses that have a p-value  $\leq 0.025$ .

Hommel's procedure rejects those hypotheses that have a p-value  $\leq 0.016666666666666666$ .

Nemenyi's procedure rejects those hypotheses that have a p-value  $\leq 0.002380952380952381$ .

Holm's procedure rejects those hypotheses that have a p-value  $\leq 0.0029411764705882353$ .

Table 4: Adjusted  $p$ -values

$i$	algorithm	unadjusted $p$	$p_{Bonf}$	$p_{Holm}$	$p_{Hoch}$	$p_{Hommel}$
1	IRS	1.4122651246579272E-4	8.473590747947563E-4	8.473590747947563E-4	8.473590747947563E-4	8.4735907479475
2	CHEBYSHEV	7.603058428726023E-4	0.004561835057235614	0.0038015292143630114	0.0038015292143630114	0.00380152921436
3	CHISQUARE	0.003414791178117856	0.020488747068707135	0.013659164712471424	0.013659164712471424	0.0136591647124
4	EUCLIDEAN	0.0789825792637829	0.4738954755826974	0.2369477377913487	0.2369477377913487	0.236947737791
5	KULLBACKLEIBLER	0.24156658696897293	1.4493995218138376	0.48313317393794586	0.48313317393794586	0.4831331739379
6	TOTALVARIATION	0.7696979437812898	4.618187662687738	0.7696979437812898	0.7696979437812898	0.769697943781

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

$i$	algorithms	$z = (R_0 - R_i)/SE$	$p$	Holm	Shaffer
21	IRS vs. HELLINGER	3.8060102844992794	1.4122651246579272E-4	0.002380952380952381	0.002380952380952
20	IRS vs. TOTALVARIATION	3.5132402626147194	4.4267698634329765E-4	0.0025	0.003333333333333
19	CHEBYSHEV vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.002631578947368421	0.003333333333333
18	CHEBYSHEV vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.0027777777777777778	0.003333333333333
17	HELLINGER vs. CHISQUARE	2.9277002188455996	0.003414791178117856	0.0029411764705882353	0.003333333333333
16	TOTALVARIATION vs. CHISQUARE	2.63493019696104	0.008415458738002115	0.003125	0.003333333333333
15	IRS vs. KULLBACKLEIBLER	2.6349301969610397	0.008415458738002124	0.0033333333333333335	0.003333333333333
14	CHEBYSHEV vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.0035714285714285718	0.003571428571428
13	IRS vs. EUCLIDEAN	2.0493901531919194	0.04042397933690863	0.0038461538461538464	0.003846153846153
12	EUCLIDEAN vs. HELLINGER	1.7566201313073602	0.0789825792637829	0.004166666666666667	0.004166666666666
11	KULLBACKLEIBLER vs. CHISQUARE	1.7566201313073602	0.0789825792637829	0.004545454545454546	0.004545454545454
10	EUCLIDEAN vs. CHEBYSHEV	1.6102351203650798	0.10734653699381101	0.005	0.005
9	EUCLIDEAN vs. TOTALVARIATION	1.4638501094228002	0.14323490752466958	0.005555555555555556	0.005555555555555
8	EUCLIDEAN vs. CHISQUARE	1.1710800875382399	0.24156658696897293	0.00625	0.00625
7	KULLBACKLEIBLER vs. HELLINGER	1.1710800875382399	0.24156658696897293	0.0071428571428571435	0.007142857142857
6	KULLBACKLEIBLER vs. TOTALVARIATION	0.8783100656536801	0.379775474840949	0.008333333333333333	0.008333333333333
5	IRS vs. CHISQUARE	0.8783100656536794	0.3797754748409493	0.01	0.01
4	EUCLIDEAN vs. KULLBACKLEIBLER	0.5855400437691202	0.5581846494226572	0.0125	0.0125
3	IRS vs. CHEBYSHEV	0.4391550328268397	0.660549205201673	0.01666666666666666	0.016666666666666
2	CHEBYSHEV vs. CHISQUARE	0.4391550328268397	0.660549205201673	0.025	0.025
1	HELLINGER vs. TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.05	0.05

Shaffer's procedure rejects those hypotheses that have a p-value  $\leq 0.002380952380952381$ .

Bergmann's procedure rejects these hypotheses:

- IRS vs. HELLINGER
- IRS vs. TOTALVARIATION
- CHEBYSHEV vs. HELLINGER
- CHEBYSHEV vs. TOTALVARIATION
- HELLINGER vs. CHISQUARE

Table 6: Holm / Shaffer Table for  $\alpha = 0.10$

$i$	algorithms	$z = (R_0 - R_i)/SE$	$p$	Holm	Shaffer
21	IRS vs. HELLINGER	3.8060102844992794	1.4122651246579272E-4	0.004761904761904762	0.004761904761904762
20	IRS vs. TOTALVARIATION	3.5132402626147194	4.4267698634329765E-4	0.005	0.006666666666666667
19	CHEBYSHEV vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.005263157894736842	0.006666666666666667
18	CHEBYSHEV vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.005555555555555556	0.006666666666666667
17	HELLINGER vs. CHISQUARE	2.9277002188455996	0.003414791178117856	0.0058823529411764705	0.006666666666666667
16	TOTALVARIATION vs. CHISQUARE	2.63493019696104	0.008415458738002115	0.00625	0.006666666666666667
15	IRS vs. KULLBACKLEIBLER	2.6349301969610397	0.008415458738002124	0.006666666666666667	0.006666666666666667
14	CHEBYSHEV vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.0071428571428571435	0.0071428571428571435
13	IRS vs. EUCLIDEAN	2.0493901531919194	0.04042397933690863	0.007692307692307693	0.007692307692307693
12	EUCLIDEAN vs. HELLINGER	1.7566201313073602	0.0789825792637829	0.008333333333333333	0.008333333333333333
11	KULLBACKLEIBLER vs. CHISQUARE	1.7566201313073602	0.0789825792637829	0.009090909090909092	0.009090909090909092
10	EUCLIDEAN vs. CHEBYSHEV	1.6102351203650798	0.10734653699381101	0.01	0.01
9	EUCLIDEAN vs. TOTALVARIATION	1.4638501094228002	0.14323490752466958	0.011111111111111112	0.011111111111111112
8	EUCLIDEAN vs. CHISQUARE	1.1710800875382399	0.24156658696897293	0.0125	0.0125
7	KULLBACKLEIBLER vs. HELLINGER	1.1710800875382399	0.24156658696897293	0.014285714285714287	0.014285714285714287
6	KULLBACKLEIBLER vs. TOTALVARIATION	0.8783100656536801	0.379775474840949	0.016666666666666666	0.016666666666666666
5	IRS vs. CHISQUARE	0.8783100656536794	0.3797754748409493	0.02	0.02
4	EUCLIDEAN vs. KULLBACKLEIBLER	0.5855400437691202	0.5581846494226572	0.025	0.025
3	IRS vs. CHEBYSHEV	0.4391550328268397	0.660549205201673	0.03333333333333333	0.03333333333333333
2	CHEBYSHEV vs. CHISQUARE	0.4391550328268397	0.660549205201673	0.05	0.05
1	HELLINGER vs. TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.1	0.1

Nemenyi's procedure rejects those hypotheses that have a p-value  $\leq 0.004761904761904762$ .

Holm's procedure rejects those hypotheses that have a p-value  $\leq 0.00625$ .

Shaffer's procedure rejects those hypotheses that have a p-value  $\leq 0.004761904761904762$ .

Bergmann's procedure rejects these hypotheses:

- IRS vs. KULLBACKLEIBLER
- IRS vs. HELLINGER
- IRS vs. TOTALVARIATION
- CHEBYSHEV vs. HELLINGER
- CHEBYSHEV vs. TOTALVARIATION
- HELLINGER vs. CHISQUARE
- TOTALVARIATION vs. CHISQUARE

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Table 7: Adjusted  $p$ -values

i	hypothesis	unadjusted $p$	$p_{Neme}$	$p_{Holm}$	$p_{Shaf}$	$p_{Berg}$
1	IRS vs .HELLINGER	1.4122651246579272E-4	0.0029657567617816473	0.0029657567617816473	0.0029657567617816473	0.0029657567617816473
2	IRS vs .TOTALVARIATION	4.4267698634329765E-4	0.00929621671320925	0.008853539726865953	0.006640154795149465	0.006640154795149465
3	CHEBYSHEV vs .HELLINGER	7.603058428726023E-4	0.01596642270032465	0.014445811014579443	0.011404587643089034	0.011404587643089034
4	CHEBYSHEV vs .TOTALVARIATION	0.0021114910066706385	0.04434131114008341	0.038006838120071496	0.03167236510005958	0.021114910066706384
5	HELLINGER vs .CHISQUARE	0.003414791178117856	0.07171061474047498	0.05805145002800355	0.05122186767176784	0.037562702959296417
6	TOTALVARIATION vs .CHISQUARE	0.008415458738002115	0.1767246334980444	0.13464733980803384	0.12623188107003172	0.0589082111660148
7	IRS vs .KULLBACKLEIBLER	0.008415458738002124	0.1767246334980446	0.13464733980803384	0.12623188107003186	0.09257004611802336
8	CHEBYSHEV vs .KULLBACKLEIBLER	0.028108040147151837	0.5902688430901886	0.3935125620601257	0.3091884416186702	0.19675628103006285
9	IRS vs .EUCLIDEAN	0.04042397933690863	0.8489035660750812	0.525511731798122	0.44466377270599494	0.36381581403217766
10	EUCLIDEAN vs .HELLINGER	0.0789825792637829	1.658634164539441	0.9477909511653948	0.8688083719016119	0.7108432133740461
11	KULLBACKLEIBLER vs .CHISQUARE	0.0789825792637829	1.658634164539441	0.9477909511653948	0.8688083719016119	0.7108432133740461
12	EUCLIDEAN vs .CHEBYSHEV	0.10734653699381101	2.2542772768700314	1.07346536993811	1.07346536993811	0.7108432133740461
13	EUCLIDEAN vs .TOTALVARIATION	0.14323490752466958	3.007933058018061	1.2891141677220261	1.2891141677220261	0.8594094451480174
14	EUCLIDEAN vs .CHISQUARE	0.24156658696897293	5.072898326348431	1.9325326957517834	1.6909661087828105	1.2078329348448646
15	KULLBACKLEIBLER vs .HELLINGER	0.24156658696897293	5.072898326348431	1.9325326957517834	1.6909661087828105	1.4493995218138376
16	KULLBACKLEIBLER vs .TOTALVARIATION	0.379775474840949	7.975284971659929	2.278652849045694	2.278652849045694	1.519101899363796
17	IRS vs .CHISQUARE	0.3797754748409493	7.975284971659936	2.278652849045694	2.278652849045694	1.8988773742047464
18	EUCLIDEAN vs .KULLBACKLEIBLER	0.5581846494226572	11.721877637875801	2.278652849045694	2.278652849045694	1.8988773742047464
19	IRS vs .CHEBYSHEV	0.660549205201673	13.871533309235133	2.278652849045694	2.278652849045694	1.8988773742047464
20	CHEBYSHEV vs .CHISQUARE	0.660549205201673	13.871533309235133	2.278652849045694	2.278652849045694	1.8988773742047464
21	HELLINGER vs .TOTALVARIATION	0.7696979437812898	16.163656819407084	2.278652849045694	2.278652849045694	1.8988773742047464