

Results

May 6, 2024

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

Table 1: Average Rankings of the algorithms

Algorithm	Ranking
CRSPT	1.26
SPT	2.39
LWRK	3.29
CR	4.03
MS	4.97
WINQ	5.18
LIFO	6.88

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 454.9799999999999.
P-value computed by Friedman Test: 1.630212631553718E-10.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 6 and 594 degrees of freedom: 310.59867604468064.
P-value computed by Iman and Daveport Test: 1.7483717238658274E-179.

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

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
6	LIFO	18.395768146894174	1.4203361831609202E-75	0.008333333333333333
5	WINQ	12.831211945876335	1.0963562408413921E-37	0.01
4	MS	12.143825591632961	6.1864493211553555E-34	0.0125
3	CR	9.06695333930547	1.2239130032004769E-19	0.016666666666666666
2	LWRK	6.644734757685957	3.037635965606681E-11	0.025
1	SPT	3.6987932395000698	2.166269750207351E-4	0.05

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.008333333333333333$.
Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.05 .
Hommel's procedure rejects all hypotheses.

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

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
6	LIFO	18.395768146894174	1.4203361831609202E-75	0.016666666666666666
5	WINQ	12.831211945876335	1.0963562408413921E-37	0.02
4	MS	12.143825591632961	6.1864493211553555E-34	0.025
3	CR	9.06695333930547	1.2239130032004769E-19	0.033333333333333333
2	LWRK	6.644734757685957	3.037635965606681E-11	0.05
1	SPT	3.6987932395000698	2.166269750207351E-4	0.1

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.1 .
Hommel's procedure rejects all hypotheses.

Table 4: Adjusted p -values

i	algorithm	unadjusted p	P_{Bonf}	P_{Holm}	P_{Hoch}	P_{Hommel}
1	LIFO	1.4203361831609202E-75	8.522017098965522E-75	8.522017098965522E-75	8.522017098965522E-75	8.522017098965522E-75
2	WINQ	1.0963562408413921E-37	6.578137445048353E-37	5.481781204206961E-37	5.481781204206961E-37	5.481781204206961E-37
3	MS	6.186449321155355E-34	3.711869592693213E-33	2.4745797284621422E-33	2.4745797284621422E-33	2.4745797284621422E-33
4	CR	1.2239130032004769E-19	7.343478019202861E-19	3.6717390096014306E-19	3.6717390096014306E-19	3.6717390096014306E-19
5	LWRK	3.037635965606681E-11	1.8225815793640086E-10	6.075271931213361E-11	6.075271931213361E-11	6.075271931213361E-11
6	SPT	2.166269750207351E-4	0.0012997618501244107	2.166269750207351E-4	2.166269750207351E-4	2.166269750207351E-4

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
21	CRSPT vs. LIFO	18.395768146894174	1.4203361831609202E-75	0.002380952380952381	0.002380952380952381
20	SPT vs. LIFO	14.696974907394102	6.740429164400005E-49	0.0025	0.0033333333333333335
19	CRSPT vs. WINQ	12.831211945876335	1.0963562408413921E-37	0.002631578947368421	0.0033333333333333335
18	CRSPT vs. MS	12.143825591632961	6.186449321155355E-34	0.002777777777777778	0.0033333333333333335
17	LWRK vs. LIFO	11.751033389208215	6.97604691102719E-32	0.0029411764705882353	0.0033333333333333335
16	CR vs. LIFO	9.328814807588703	1.0706133691691547E-20	0.003125	0.0033333333333333335
15	SPT vs. WINQ	9.132418706376264	6.698567895913119E-20	0.0033333333333333335	0.0033333333333333335
14	CRSPT vs. CR	9.06695333930547	1.2239130032004769E-19	0.0035714285714285718	0.004545454545454546
13	SPT vs. MS	8.445032352132891	3.039612600338651E-17	0.0038461538461538464	0.004545454545454546
12	CRSPT vs. LWRK	6.644734757685957	3.037635965606681E-11	0.004166666666666667	0.004545454545454546
11	MS vs. LIFO	6.251942555261212	4.053785113250897E-10	0.004545454545454546	0.004545454545454546
10	LWRK vs. WINQ	6.186477188190377	6.152358282771574E-10	0.005	0.005
9	WINQ vs. LIFO	5.564556201017838	2.6282041744792282E-8	0.005555555555555556	0.005555555555555556
8	LWRK vs. MS	5.499090833947005	3.817544534886102E-8	0.00625	0.0071428571428571435
7	SPT vs. CR	5.3681600998054	7.954392931595842E-8	0.0071428571428571435	0.0071428571428571435
6	CR vs. WINQ	3.764258606570864	1.6704394413917723E-4	0.008333333333333333	0.008333333333333333
5	CRSPT vs. SPT	3.6987932395000698	2.166269750207351E-4	0.01	0.01
4	CR vs. MS	3.076872252327491	0.0020918492890084897	0.0125	0.0125
3	SPT vs. LWRK	2.9459415181858866	0.0032197326909219233	0.016666666666666666	0.016666666666666666
2	LWRK vs. CR	2.4222185816195134	0.015426068688276055	0.025	0.025
1	MS vs. WINQ	0.687386354243373	0.49183929436869095	0.05	0.05

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 ≤ 0.05 .
Shaffer's procedure rejects those hypotheses that have a p-value $\leq 0.002380952380952381$.
Bergmann's procedure rejects these hypotheses:

- CRSPT vs. SPT
- CRSPT vs. LWRK
- CRSPT vs. CR
- CRSPT vs. MS
- CRSPT vs. WINQ
- CRSPT vs. LIFO
- SPT vs. LWRK
- SPT vs. CR
- SPT vs. MS
- SPT vs. WINQ
- SPT vs. LIFO

- LWRK vs. CR
- LWRK vs. MS
- LWRK vs. WINQ
- LWRK vs. LIFO
- CR vs. MS
- CR vs. WINQ
- CR vs. LIFO
- MS vs. LIFO
- WINQ vs. LIFO

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
21	CRSPT vs. LIFO	18.395768146894174	1.4203361831609202E-75	0.004761904761904762	0.004761904761904762
20	SPT vs. LIFO	14.696974907394102	6.740429164400005E-49	0.005	0.006666666666666667
19	CRSPT vs. WINQ	12.831211945876335	1.0963562408413921E-37	0.005263157894736842	0.006666666666666667
18	CRSPT vs. MS	12.143825591632961	6.1864493211553555E-34	0.005555555555555556	0.006666666666666667
17	LWRK vs. LIFO	11.751033389208215	6.97604691102719E-32	0.0058823529411764705	0.006666666666666667
16	CR vs. LIFO	9.328814807588703	1.0706133691691547E-20	0.00625	0.006666666666666667
15	SPT vs. WINQ	9.132418706376264	6.698567895913119E-20	0.006666666666666667	0.006666666666666667
14	CRSPT vs. CR	9.06695333930547	1.2239130032004769E-19	0.0071428571428571435	0.009090909090909092
13	SPT vs. MS	8.445032352132891	3.039612600338651E-17	0.007692307692307693	0.009090909090909092
12	CRSPT vs. LWRK	6.644734757685957	3.037635965606681E-11	0.008333333333333333	0.009090909090909092
11	MS vs. LIFO	6.251942555261212	4.053785113250897E-10	0.009090909090909092	0.009090909090909092
10	LWRK vs. WINQ	6.186477188190377	6.152358282771574E-10	0.01	0.01
9	WINQ vs. LIFO	5.564556201017838	2.6282041744792282E-8	0.011111111111111112	0.011111111111111112
8	LWRK vs. MS	5.499090833947005	3.817544534886102E-8	0.0125	0.014285714285714287
7	SPT vs. CR	5.3681600998054	7.954392931595842E-8	0.014285714285714287	0.014285714285714287
6	CR vs. WINQ	3.764258606570864	1.6704394413917723E-4	0.016666666666666666	0.016666666666666666
5	CRSPT vs. SPT	3.6987932395000698	2.166269750207351E-4	0.02	0.02
4	CR vs. MS	3.076872232327491	0.0020918492890084897	0.025	0.025
3	SPT vs. LWRK	2.9459415181858866	0.0032197326909219233	0.03333333333333333	0.03333333333333333
2	LWRK vs. CR	2.4222185816195134	0.015426068688276055	0.05	0.05
1	MS vs. WINQ	0.687386354243373	0.49183929436869095	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 ≤ 0.1 .

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

Bergmann's procedure rejects these hypotheses:

- CRSPT vs. SPT
- CRSPT vs. LWRK
- CRSPT vs. CR
- CRSPT vs. MS
- CRSPT vs. WINQ
- CRSPT vs. LIFO
- SPT vs. LWRK
- SPT vs. CR

- SPT vs. MS
- SPT vs. WINQ
- SPT vs. LIFO
- LWRK vs. CR
- LWRK vs. MS
- LWRK vs. WINQ
- LWRK vs. LIFO
- CR vs. MS
- CR vs. WINQ
- CR vs. LIFO
- MS vs. LIFO
- WINQ vs. LIFO

Table 7: Adjusted p -values						
i	hypothesis	unadjusted p	P_{Neme}	P_{Holm}	P_{Shaf}	P_{Berg}
1	CRSPT vs .LIFO	1.4203361831609202E-75	2.9827059846379326E-74	2.9827059846379326E-74	2.9827059846379326E-74	2.9827059846379326E-74
2	SPT vs .LIFO	6.740429164400005E-49	1.415490124524001E-47	1.3480858328800011E-47	1.0110643746600008E-47	1.0110643746600008E-47
3	CRSPT vs .WINQ	1.0963562408413921E-37	2.3023481057669235E-36	2.083076857598645E-36	1.6445343612620883E-36	1.6445343612620883E-36
4	CRSPT vs .MS	6.186449321155355E-34	1.2991543574426248E-32	1.1135608778079639E-32	9.279673981733034E-33	6.805094253270891E-33
5	LWRK vs .LIFO	6.97604691102719E-32	1.4649698513157099E-30	1.1859279748746223E-30	1.0464070366540784E-30	7.673651602129909E-31
6	CR vs .LIFO	1.0706133691691547E-20	2.2482880752552247E-19	1.7129813906706476E-19	1.6059200537537322E-19	9.635520322522392E-20
7	SPT vs .WINQ	6.698567895913119E-20	1.406699258141755E-18	1.004785184386968E-18	1.004785184386968E-18	6.698567895913119E-19
8	CRSPT vs .CR	1.2239130032004769E-19	2.5702173067210016E-18	1.7134782044806677E-18	1.3463043035205246E-18	1.1015217028804291E-18
9	SPT vs .MS	3.039612600338651E-17	6.383186460711168E-16	3.9514963804402465E-16	3.3435738603725166E-16	2.1277288202370558E-16
10	CRSPT vs .LWRK	3.037635965606681E-11	6.37903552777403E-10	3.645163158728017E-10	3.3413995621673486E-10	1.8225815793640086E-10
11	MS vs .LIFO	4.053785113250897E-10	8.512948737826883E-9	4.4591636245759864E-9	4.4591636245759864E-9	2.4322710679505384E-9
12	LWRK vs .WINQ	6.152358282771574E-10	1.2919952393820305E-8	6.152358282771574E-9	6.152358282771574E-9	4.3066507979401015E-9
13	WINQ vs .LIFO	2.6282041744792282E-8	5.51922876640638E-7	2.3653837570313053E-7	2.3653837570313053E-7	1.314102087239614E-7
14	LWRK vs .MS	3.817544534886102E-8	8.016843523260814E-7	3.0540356279088813E-7	2.672281174420271E-7	1.5270178139544407E-7
15	SPT vs .CR	7.954392931595842E-8	1.6704225156351269E-6	5.56807505211709E-7	5.56807505211709E-7	3.181757172638337E-7
16	CR vs .WINQ	1.6704394413917723E-4	0.003507922826922722	0.0010022636648350635	0.0010022636648350635	6.681757765567089E-4
17	CRSPT vs .SPT	2.166269750207351E-4	0.004549166475435437	0.0010831348751036756	0.0010831348751036756	6.681757765567089E-4
18	CR vs .MS	0.002091849289084897	0.04392883506917828	0.008367397156033959	0.008367397156033959	0.004183698578016979
19	SPT vs .LWRK	0.0032197326909219233	0.06761438650936039	0.00965919807276577	0.00965919807276577	0.006439465381843847
20	LWRK vs .CR	0.015426068688276055	0.32394744245379714	0.03085213737655211	0.03085213737655211	0.03085213737655211
21	MS vs .WINQ	0.49183929436869095	10.32862518174251	0.49183929436869095	0.49183929436869095	0.49183929436869095