

Results

May 7, 2024

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

Table 1: Average Rankings of the algorithms

Algorithm	Ranking
LWRK	5.43
MS	7.59
SPT	3.93
WINQ	8.02
—(5) Reward—DDQN—Surrogate Tardiness-model-0	2.76
—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	2.23
—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	10.28
—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	10.47
—(5) Reward—DDQN—Global Tardiness-model-4	8.54
—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	10.06
—(5) Reward—DDQN—Makespan-model-6	4.77
—(5) Reward—All not Noisy not 3-step—Makespan-model-7	3.93

Friedman statistic considering reduction performance (distributed according to chi-square with 11 degrees of freedom: 2309.1399999999944.
P-value computed by Friedman Test: 0.0.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 11 and 3289 degrees of freedom: 696.8016268695825.
P-value computed by Iman and Daveport Test: 1.1102230246251565E-16.

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

i	algorithm	$z = (R_0 - R_i) / SE$	p	Holm/Hochberg/Hommel
11	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	28.00121105439581	1.5705333359801975E-172	0.004545454545454546
10	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	27.367135915274837	6.7531648225184375E-165	0.005
9	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	26.59718753205654	7.316095053645367E-156	0.005555555555555556
8	—(5) Reward—DDQN—Global Tardiness-model-4	21.456649797040093	3.958174181827914E-102	0.00625
7	WINQ	19.678974853433065	3.265407079585866E-86	0.0071428571428571435
6	MS	18.229660249727974	3.0018006706610033E-74	0.008333333333333333
5	LWRK	10.869859527788115	1.6044768956075757E-27	0.01
4	—(5) Reward—DDQN—Makespan-model-6	8.627951000181767	6.246082562570496E-18	0.0125
3	—(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.785935644478848	7.2109819185362035E-9	0.016666666666666666
2	SPT	5.774612874137438	7.713021082425E-9	0.025
1	—(5) Reward—DDQN—Surrogate Tardiness-model-0	1.800320484289899	0.0718100482492432	0.05

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.004545454545454546$.

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

i	algorithm	$z = (R_0 - R_i) / SE$	p	Holm/Hochberg/Hommel
11	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	28.00121105439581	1.5705333359801975E-172	0.009090909090909092
10	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	27.367135915274837	6.7531648225184375E-165	0.01
9	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	26.59718753205654	7.316095053645367E-156	0.011111111111111112
8	—(5) Reward—DDQN—Global Tardiness-model-4	21.456649797040093	3.958174181827914E-102	0.0125
7	WINQ	19.678974853433065	3.265407079585866E-86	0.014285714285714287
6	MS	18.229660249727974	3.0018006706610033E-74	0.016666666666666666
5	LWRK	10.869859527788115	1.6044768956075757E-27	0.02
4	—(5) Reward—DDQN—Makespan-model-6	8.627951000181767	6.246082562570496E-18	0.025
3	—(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.785935644478848	7.2109819185362035E-9	0.03333333333333333
2	SPT	5.774612874137438	7.713021082425E-9	0.05
1	—(5) Reward—DDQN—Surrogate Tardiness-model-0	1.800320484289899	0.0718100482492432	0.1

Bonferroni-Dunn’s procedure rejects those hypotheses that have a p-value ≤ 0.0090909090909092 .

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_{Homm}
1	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	1.5705333359801975E-172	1.7275866695782172E-171	1.7275866695782172E-171	1.7275866695782172E-171	1.7275866695782172E-171
2	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	6.7531648225184375E-165	7.428481304770282E-164	6.753164822518438E-164	6.753164822518438E-164	6.753164822518438E-164
3	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	7.316095053645367E-156	8.047704559009905E-155	6.58448554828083E-155	6.58448554828083E-155	6.58448554828083E-155
4	—(5) Reward—DDQN—Global Tardiness-model-4	3.958174181827914E-102	4.353991600010706E-101	3.1665393454623314E-101	3.1665393454623314E-101	3.1665393454623314E-101
5	WINQ	3.265407079585866E-86	3.5919477875444526E-85	2.2857849557101064E-85	2.2857849557101064E-85	2.2857849557101064E-85
6	MS	3.0018006706610033E-74	3.301980737727104E-73	1.801080402396602E-73	1.801080402396602E-73	1.801080402396602E-73
7	LWRK	1.6044768956075757E-27	1.7649245851683334E-26	8.022384478037879E-27	8.022384478037879E-27	8.022384478037879E-27
8	—(5) Reward—DDQN—Makespan-model-6	6.246082562570496E-18	6.870690818827546E-17	2.4984330250281984E-17	2.4984330250281984E-17	2.4984330250281984E-17
9	—(5) Reward—All not Noisy not 3-step—Makespan-model-7	7.2109819185362035E-9	7.932080110389824E-8	2.163294575560861E-8	1.542604216485E-8	1.4421963837072407E-8
10	SPT	7.713021082425E-9	8.4843231906675E-8	2.163294575560861E-8	1.542604216485E-8	1.542604216485E-8
11	—(5) Reward—DDQN—Surrogate Tardiness-model-0	0.0718100482492432	0.7899105307416752	0.0718100482492432	0.0718100482492432	0.0718100482492432

Nemenyi’s procedure rejects those hypotheses that have a p-value $\leq 7.575757575757576E - 4$.

Holm’s procedure rejects those hypotheses that have a p-value ≤ 0.00625 .

Shaffer’s procedure rejects those hypotheses that have a p-value $\leq 7.575757575757576E - 4$.

Nemenyi’s procedure rejects those hypotheses that have a p-value $\leq 0.0015151515151515152$.

Holm’s procedure rejects those hypotheses that have a p-value ≤ 0.0125 .

Shaffer’s procedure rejects those hypotheses that have a p-value $\leq 0.0015151515151515152$.

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	
66	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	28.00121105439581	1.5705333359801975E-172	7.575757575757576E-4	7.5757
65	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	27.367135915274837	6.7531648225184375E-165	7.692307692307692E-4	9.0909
64	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	26.59718753205654	7.316095053645367E-156	7.8125E-4	9.0909
63	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	26.200890570105912	2.5960200684203956E-151	7.936507936507937E-4	9.0909
62	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	25.566815430984935	3.5701839602392024E-144	8.064516129032258E-4	9.0909
61	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	24.796867047766643	9.690407941445081E-136	8.19672131147451E-4	9.0909
60	SPT vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	22.226598180258375	1.8999863508163888E-109	8.33333333333334E-4	9.0909
59	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	22.215275409916963	2.4447840044293965E-109	8.474576271186442E-4	9.0909
58	SPT vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	21.5925230411374	2.1116445144588104E-103	8.620689655172415E-4	9.0909
57	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	21.58120027079599	2.6977346587071206E-103	8.771929824561404E-4	9.0909
56	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Global Tardiness-model-4	21.456649797040093	3.958174181827914E-102	8.928571428571429E-4	9.0909
55	SPT vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	20.822574657919105	2.7026668461458364E-96	9.090909090909091E-4	9.0909
54	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	20.811251887577694	3.4228909477271758E-96	9.25925925925926E-4	0.0010
53	WINQ vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	19.678974853433065	3.265407079585866E-86	9.433962264150943E-4	0.0010
52	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Global Tardiness-model-4	19.656329312750195	5.103438779513083E-86	9.615384615384616E-4	0.0010
51	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—DDQN—Makespan-model-6	19.373260054214047	1.2977450509095873E-83	9.80392156862745E-4	0.0010
50	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—DDQN—Makespan-model-6	18.73918491509307	2.372337472536066E-78	0.001	0.0010
49	MS vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	18.229660249727974	3.0018006706610033E-74	0.0010204081632653062	0.0010
48	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs. —(5) Reward—DDQN—Makespan-model-6	17.969236531874778	3.393527642096516E-72	0.0010416666666666667	0.0010
47	WINQ vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	17.87654369143167	1.729612434203607E-71	0.0010638297872340426	0.0010
46	LWRK vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	17.1313515266077	8.661892325715942E-66	0.0010869565217391304	0.0010
45	LWRK vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	16.49727638748672	3.8381818007989186E-61	0.0011111111111111111	0.0011
44	MS vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	16.429339765438076	1.1793599320553013E-60	0.0011363636363636365	0.0011
43	LWRK vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	15.727328004268427	9.827141891808938E-56	0.0011627906976744186	0.0011
42	SPT vs. —(5) Reward—DDQN—Global Tardiness-model-4	15.682036922902657	2.0071305098194908E-55	0.0011904761904761906	0.0011
41	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	15.670714152561246	2.3986896650659277E-55	0.0012195121951219512	0.0011
40	SPT vs. WINQ	13.904361979295631	5.95959116186651E-44	0.00125	0.0011
39	WINQ vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	13.89303920895422	6.980915833543656E-44	0.001282051282051282	0.0011
38	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—DDQN—Makespan-model-6	12.828698796858328	1.1325019874695399E-37	0.0013157894736842105	0.0013
37	MS vs. SPT	12.455047375590537	1.312735109366828E-35	0.0013513513513513514	0.0013
36	MS vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	12.443724605249127	1.512815521317573E-35	0.001388888888888889	0.0013
35	WINQ vs. —(5) Reward—DDQN—Makespan-model-6	11.0510238853251301	2.16728875221825E-28	0.0014285714285714286	0.0014
34	LWRK vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	10.869859527788115	1.6044768956075757E-27	0.0014705882325941176	0.0014
33	LWRK vs. —(5) Reward—DDQN—Global Tardiness-model-4	10.58679026925198	3.4315721889864093E-26	0.0015151515151515152	0.0016
32	MS vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	9.771550804667838	1.4915128020967013E-22	0.0015625	0.0016
31	MS vs. —(5) Reward—DDQN—Makespan-model-6	9.601709249546209	7.8629509808395455E-22	0.0016129032258064516	0.0016
30	MS vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	9.13747566554686	6.392706007973724E-20	0.0016666666666666668	0.0016
29	LWRK vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	9.069539043498215	1.1952157494529354E-19	0.001724137931034483	0.0017
28	LWRK vs. WINQ	8.809115325644953	1.2613736384667424E-18	0.0017857142857142859	0.0017
27	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Makespan-model-6	8.627951000181767	6.246082562570496E-18	0.001851851851851852	0.0017
26	MS vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	8.367527282328567	5.883990241829328E-17	0.0019230769230769232	0.0017
25	WINQ vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	8.322236200962745	8.631907809885239E-17	0.002	0.0017
24	WINQ vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	7.68816106184177	1.492648332505821E-14	0.0020833333333333333	0.0020
23	LWRK vs. MS	7.359800721939861	1.8418497817216497E-13	0.002173913043478261	0.002
22	WINQ vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	6.918212678623475	4.573727987235022E-12	0.002272727272727273	0.002
21	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Makespan-model-6	6.827630515891867	8.632857775961996E-12	0.002380952380952381	0.002
20	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—DDQN—Global Tardiness-model-4	6.544561257355718	5.967030269284628E-11	0.0025	0.002
19	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—DDQN—Global Tardiness-model-4	5.910486118234742	3.4109959856125836E-9	0.002631578947368421	0.002
18	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.785935644478848	7.2109819185362035E-9	0.002777777777777778	0.002
17	SPT vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	5.774612874137438	7.713021082425E-9	0.0029411764705882353	0.0029
16	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	5.140537735016447	2.739532962648937E-7	0.003125	0.003
15	LWRK vs. SPT	5.095246653650676	3.4828749788912644E-7	0.0033333333333333335	0.0033
14	LWRK vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.083923883309266	3.6971614987874587E-7	0.0035714285714285718	0.0035
13	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	3.98561516018895	6.730552374949803E-5	0.0038461538461538464	0.0038
12	SPT vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	3.9742923898475397	7.058880382337269E-5	0.004166666666666667	0.004
11	MS vs. —(5) Reward—DDQN—Global Tardiness-model-4	3.2269895473121193	0.0012510003005977769	0.0045454545454545456	0.004
10	SPT vs. —(5) Reward—DDQN—Makespan-model-6	2.85338126044328	0.004326256244849688	0.005	0.005
9	—(5) Reward—DDQN—Makespan-model-6 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	2.8420153557029177	0.004482933229761039	0.005555555555555556	0.005
8	LWRK vs. —(5) Reward—DDQN—Makespan-model-6	2.2419085276063484	0.02496728479184817	0.00625	0.007
7	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	1.800320484289899	0.0718100482492432	0.0071428571428571435	0.0071
6	WINQ vs. —(5) Reward—DDQN—Global Tardiness-model-4	1.7776749436070276	0.075457257213952	0.008333333333333333	0.008
5	MS vs. WINQ	1.449314603705092	0.14724974459811188	0.01	0.016
4	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	1.4040235223392707	0.16031184519332708	0.0125	
3	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	0.7699483832182946	0.4413305118272063	0.016666666666666666	0.016
2	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	0.6340751391209761	0.5260317864344614	0.025	
1	SPT vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	0.011322770341410014	0.9909659293951814	0.05	

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

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	
66	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	28.00121105439581	1.5705333359801975E-172	0.00151515151515151512	0.0015
65	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	27.367135915274837	6.7531648225184375E-165	0.0015384615384615385	0.0018
64	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	26.59718753205654	7.316095053645367E-156	0.0015625	0.0018
63	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	26.200890570105912	2.5960200684203956E-151	0.0015873015873015873	0.0018
62	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	25.566815430984935	3.5701839602392024E-144	0.0016129032258064516	0.0018
61	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	24.796867047766643	9.690407941445081E-136	0.001639344262295082	0.0018
60	SPT vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	22.226598180258375	1.8999863508163888E-109	0.0016666666666666668	0.0018
59	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	22.215275409916963	2.4447840044293965E-109	0.0016949152542372883	0.0018
58	SPT vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	21.5925230411374	2.1116445144588104E-103	0.001724137931034483	0.0018
57	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	21.58120027079599	2.6977346587071206E-103	0.0017543859649122807	0.0018
56	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Global Tardiness-model-4	21.456649797040093	3.958174181827914E-102	0.0017857142857142859	0.0018
55	SPT vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	20.822574657919105	2.702666461458364E-96	0.0018181818181818182	0.0018
54	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	20.811251887577694	3.4228909477217586E-96	0.001851851851851852	0.002
53	WINQ vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	19.678974853433065	3.265407079585866E-86	0.0018867924528301887	0.002
52	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Global Tardiness-model-4	19.656329312750195	5.103438779513083E-86	0.0019230769230769232	0.002
51	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—DDQN—Makespan-model-6	19.373260054214047	1.2977450509095873E-83	0.00196078431372549	0.002
50	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—DDQN—Makespan-model-6	18.73918491509307	2.372337472536066E-78	0.002	0.002
49	MS vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	18.229660249727974	3.0018006706610033E-74	0.0020408163265306124	0.002
48	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs. —(5) Reward—DDQN—Makespan-model-6	17.969236531874778	3.393527642096516E-72	0.0020833333333333333	0.002
47	WINQ vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	17.87654369143167	1.729612434203607E-71	0.002127659574468085	0.002
46	LWRK vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	17.1313515266077	8.661892325715942E-66	0.002173913043478261	0.002
45	LWRK vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	16.49727638748672	3.8381818007989186E-61	0.0022222222222222222	0.0022
44	MS vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	16.429339765438076	1.1793599320553013E-60	0.0022727272727272723	0.002
43	LWRK vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	15.727328004268427	9.827141891808938E-56	0.002325581395348837	0.002
42	SPT vs. —(5) Reward—DDQN—Global Tardiness-model-4	15.682036922902657	2.0071305098194908E-55	0.002380952380952381	0.002
41	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	15.670714152561246	2.3986896650659277E-55	0.0024390243902439024	0.002
40	SPT vs. WINQ	13.904361979295631	5.95959116186651E-44	0.0025	0.002
39	WINQ vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	13.89303920895422	6.980915833543656E-44	0.002564102564102564	0.002
38	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—DDQN—Makespan-model-6	12.828698796858328	1.1325019874695399E-37	0.002631578947368421	0.002
37	MS vs. SPT	12.455047375590537	1.312735109366828E-35	0.002702702702702703	0.002
36	MS vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	12.443724605249127	1.512815521317573E-35	0.0027777777777777778	0.002
35	WINQ vs. —(5) Reward—DDQN—Makespan-model-6	11.0510238853251301	2.16728875221825E-28	0.002857142857142857	0.0029
34	LWRK vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	10.869859527788115	1.6044768956075757E-27	0.0029411764705882353	0.0029
33	LWRK vs. —(5) Reward—DDQN—Global Tardiness-model-4	10.58679026925198	3.4315721889864093E-26	0.0030303030303030303	0.0032
32	MS vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	9.771550804667838	1.4915128020967013E-22	0.003125	0.0032
31	MS vs. —(5) Reward—DDQN—Makespan-model-6	9.601709249546209	7.8629509808395455E-22	0.0032258064516129032	0.0032
30	MS vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	9.13747566554686	6.392706007973724E-20	0.0033333333333333335	0.0033
29	LWRK vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	9.069539043498215	1.1952157494529354E-19	0.003448275862068966	0.0033
28	LWRK vs. WINQ	8.809115325644953	1.2613736384667424E-18	0.0035714285714285718	0.0035
27	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—DDQN—Makespan-model-6	8.627951000181767	6.246082562570496E-18	0.0037037037037037034	0.0035
26	MS vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	8.367527282328567	5.883990241829328E-17	0.0038461538461538464	0.0035
25	WINQ vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	8.322236200962745	8.631907809885239E-17	0.004	0.004
24	WINQ vs. —(5) Reward—DDQN—Global Decomposed Tardiness-model-2	7.68816106184177	1.492648332505821E-14	0.004166666666666667	0.004
23	LWRK vs. MS	7.359800721939861	1.8418497817216497E-13	0.004347826086956522	0.004
22	WINQ vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	6.918212678623475	4.573772987235022E-12	0.004545454545454546	0.004
21	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—DDQN—Makespan-model-6	6.827630515891867	8.632857775961996E-12	0.004761904761904762	0.004
20	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—DDQN—Global Tardiness-model-4	6.544561257355718	5.967030269284628E-11	0.005	0.005
19	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—DDQN—Global Tardiness-model-4	5.910486118234742	3.4109959856125836E-9	0.005263157894736842	0.005
18	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.785935644478848	7.2109819185362035E-9	0.005555555555555556	0.005
17	SPT vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	5.774612874137438	7.713021082425E-9	0.0058823529411764705	0.0058
16	—(5) Reward—DDQN—Global Tardiness-model-4 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	5.140537735016447	2.739532962648937E-7	0.00625	0.006
15	LWRK vs. SPT	5.095246653650676	3.4828749788912644E-7	0.006666666666666667	0.006
14	LWRK vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	5.083923883309266	3.6971614987874587E-7	0.0071428571428571435	0.0071
13	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	3.98561516018895	6.730552374949803E-5	0.007692307692307693	0.007
12	SPT vs. —(5) Reward—DDQN—Surrogate Tardiness-model-0	3.9742923898475397	7.058880382337269E-5	0.008333333333333333	0.008
11	MS vs. —(5) Reward—DDQN—Global Tardiness-model-4	3.2269895473121193	0.0012510003005977769	0.009090909090909092	0.009
10	SPT vs. —(5) Reward—DDQN—Makespan-model-6	2.85338126044328	0.004326256244849688	0.01	0.01
9	—(5) Reward—DDQN—Makespan-model-6 vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	2.8420153557029177	0.004482933229761039	0.011111111111111112	0.011
8	LWRK vs. —(5) Reward—DDQN—Makespan-model-6	2.2419085276063484	0.02496728479184817	0.0125	0.016
7	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs. —(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	1.800320484289899	0.0718100482492432	0.014285714285714287	0.014
6	WINQ vs. —(5) Reward—DDQN—Global Tardiness-model-4	1.7776749436070276	0.075457257213952	0.016666666666666666	0.016
5	MS vs. WINQ	1.449314603705092	0.14724974459811188	0.02	0.03
4	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	1.4040235223392707	0.16031184519332708	0.025	0.03
3	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	0.7699483832182946	0.4413305118272063	0.03333333333333333	0.033
2	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs. —(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	0.6340751391209761	0.5260317864344614	0.05	
1	SPT vs. —(5) Reward—All not Noisy not 3-step—Makespan-model-7	0.011322770341410014	0.9909659293951814	0.1	

Table 7: Adjusted p -values

i	hypothesis	unadjusted p	P_{Neme}	P_{Holm}
1	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	1.5705333359801975E-172	1.0365520017469304E-170	1.0365520017469304E-170
2	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	6.7531648225184375E-165	4.457088782862169E-163	4.3895571346369844E-163
3	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	7.316095053645367E-156	4.8286227354059426E-154	4.682300834333035E-154
4	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	2.5960200684203956E-151	1.713373245157461E-149	1.6354926431048491E-149
5	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	3.5701839602392024E-144	2.3563214137578735E-142	2.2135140553483056E-142
6	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	9.690407941445081E-136	6.395669241353753E-134	5.911148844281499E-134
7	SPT vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	1.899986350816388E-109	1.2539909915388165E-107	1.1399918104898332E-107
8	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	2.4447840044293965E-109	1.6135574429234017E-107	1.44242256262133438E-107
9	SPT vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	2.1116445144588104E-103	1.3936853795428148E-101	1.22475381838611E-101
10	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	2.6977346587071206E-103	1.7805048747466997E-101	1.537708755463059E-101
11	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—DDQN—Global Tardiness-model-4	3.958174181827914E-102	2.6123949600064233E-100	2.216577541823632E-100
12	SPT vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	2.7026666461458364E-96	1.783759986456252E-94	1.48646665538021E-94
13	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	3.4228909477217586E-96	2.2591080254963606E-94	1.848361117697497E-94
14	WINQ vs .—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	3.265407079585866E-86	2.1551686725266715E-84	1.730665752180509E-84
15	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—DDQN—Global Tardiness-model-4	5.103438779513083E-86	3.3682695944786345E-84	2.6537881653468033E-84
16	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs .—(5) Reward—DDQN—Makespan-model-6	1.2977450509095873E-83	8.565117336003276E-82	6.618499759638895E-82
17	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs .—(5) Reward—DDQN—Makespan-model-6	2.372337472536066E-78	1.5657427317838038E-76	1.186168736268033E-76
18	MS vs .—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	3.0018006706610033E-74	1.9811884426362623E-72	1.4708823286238916E-72
19	—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5 vs .—(5) Reward—DDQN—Makespan-model-6	3.393527642096516E-72	2.2397282437837006E-70	1.6288932682063276E-70
20	WINQ vs .—(5) Reward—DDQN—Surrogate Tardiness-model-0	1.729612434203607E-71	1.1415442065743806E-69	8.129178440756953E-69
21	LWRK vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	8.661892325715942E-66	5.716848934972522E-64	3.984470469829335E-64
22	LWRK vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	3.8381818007989186E-61	2.5331999885272863E-59	1.7271818103595134E-59
23	MS vs .—(5) Reward—DDQN—Surrogate Tardiness-model-0	1.1793599320553013E-60	7.783775551564988E-59	5.189183701043326E-59
24	LWRK vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	9.827141891808938E-56	6.485913648593899E-54	4.225671013477843E-54
25	SPT vs .—(5) Reward—DDQN—Global Tardiness-model-4	2.0071305098194908E-55	1.324706136480864E-53	8.429948141241861E-54
26	—(5) Reward—DDQN—Global Tardiness-model-4 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	2.398689650659277E-55	1.5831351789435123E-53	9.834627626770304E-54
27	SPT vs .WINQ	5.95959116186651E-44	3.9333301668318965E-42	2.383836464746604E-42
28	WINQ vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	6.98091583354365E-44	4.6074044501388126E-42	2.722557175082025E-42
29	—(5) Reward—DDQN—Global Tardiness-model-4 vs .—(5) Reward—DDQN—Makespan-model-6	1.1325019874695399E-37	7.474513117298963E-36	4.3035075523842516E-36
30	MS vs .SPT	1.312735109368628E-35	8.664051721832945E-34	4.857119904663924E-34
31	MS vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	1.512815521317573E-35	9.984582440695982E-34	5.446135876743263E-34
32	WINQ vs .—(5) Reward—DDQN—Makespan-model-6	2.16728875221825E-28	1.4304105764640448E-26	7.585510632763875E-27
33	LWRK vs .—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	1.6044768956075757E-27	1.058954751101E-25	5.455221445065758E-26
34	LWRK vs .—(5) Reward—DDQN—Global Tardiness-model-4	3.4315721889864093E-26	2.2648376447310302E-24	1.1324188223655151E-24
35	MS vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	1.4915128020967013E-22	9.843984493838228E-21	4.772840966709444E-21
36	MS vs .—(5) Reward—DDQN—Makespan-model-6	7.8629509808395455E-22	5.1895476473541E-20	2.437514804060259E-20
37	MS vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	6.392706007973724E-20	4.219185965262658E-18	1.9178118023921172E-18
38	LWRK vs .—(5) Reward—DDQN—Surrogate Tardiness-model-0	1.1952157494529354E-19	7.888423946389374E-18	3.4661256734135127E-18
39	LWRK vs .WINQ	1.2613736384667424E-18	8.3250660138805E-17	3.531846187706879E-17
40	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—DDQN—Makespan-model-6	6.246082562570496E-18	4.1224144912965273E-16	1.6864422918940338E-16
41	MS vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	5.88399024182932E-17	3.8834335596073565E-15	1.5298374628756253E-15
42	WINQ vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	8.631907809885239E-17	5.697059154524257E-15	2.1579769524713097E-15
43	WINQ vs .—(5) Reward—DDQN—Global Decomposed Tardiness-model-2	1.492648332505821E-14	9.851478994538418E-13	3.58235599801397E-13
44	LWRK vs .MS	1.8418497817216497E-13	1.215620855936288E-11	4.2362544979597046E-12
45	WINQ vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	4.573772987235022E-12	3.0186901715751143E-10	1.0062300571917048E-10
46	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—DDQN—Makespan-model-6	8.632857775961996E-12	5.697686132134917E-10	1.8129001329520192E-10
47	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs .—(5) Reward—DDQN—Global Tardiness-model-4	5.967030269284628E-11	3.938239977727854E-9	1.1934060538569255E-9
48	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs .—(5) Reward—DDQN—Global Tardiness-model-4	3.4109959856125836E-9	2.251257350504305E-7	6.480892372663909E-8
49	—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	7.2109819185362035E-9	4.759248066233894E-7	1.2979767453365166E-7
50	SPT vs .—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	7.713021082425E-9	5.0905939144005E-7	1.31121358401225E-7
51	—(5) Reward—DDQN—Global Tardiness-model-4 vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	2.739532962648937E-7	1.8080917553482985E-5	4.383252740238299E-6
52	LWRK vs .SPT	3.4828749788912644E-7	2.2986974860682345E-5	5.224312468336896E-6
53	LWRK vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	3.6971614987874587E-7	2.4401265891997228E-5	5.224312468336896E-6
54	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	6.730552374949803E-5	0.00444216456746687	8.749718087434744E-4
55	SPT vs .—(5) Reward—DDQN—Surrogate Tardiness-model-0	7.058880382337269E-5	0.0046588610523425975	8.749718087434744E-4
56	MS vs .—(5) Reward—DDQN—Global Tardiness-model-4	0.0012510003005977769	0.08256601983945328	0.013761003306575545
57	SPT vs .—(5) Reward—DDQN—Makespan-model-6	0.004326256244849688	0.2855329121600794	0.04326256244849688
58	—(5) Reward—DDQN—Makespan-model-6 vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	0.004482933292761039	0.29587359316422857	0.04326256244849688
59	LWRK vs .—(5) Reward—DDQN—Makespan-model-6	0.02496728479184817	1.6478407962619792	0.1997382783478536
60	—(5) Reward—DDQN—Surrogate Tardiness-model-0 vs .—(5) Reward—All not Noisy not 3-step—Surrogate Tardiness-model-1	0.0718100482492432	4.7394631844500055	0.5026703377447024
61	WINQ vs .—(5) Reward—DDQN—Global Tardiness-model-4	0.075457257213952	4.980178976120832	0.5026703377447024
62	MS vs .WINQ	0.14724974459811188	9.718483143475384	0.7362487229905594
63	—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3 vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	0.16031184519332708	10.580581782759587	0.7362487229905594
64	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs .—(5) Reward—All not Noisy not 3-step—Global Tardiness-model-5	0.4413305118272063	29.127813780595616	1.323991535481619
65	—(5) Reward—DDQN—Global Decomposed Tardiness-model-2 vs .—(5) Reward—All not Noisy not 3-step—Global Decomposed Tardiness-model-3	0.5260317864344614	34.71809790467445	1.323991535481619
66	SPT vs .—(5) Reward—All not Noisy not 3-step—Makespan-model-7	0.9909659293951814	65.40375134008197	1.323991535481619