

Semantic Approximation for Reducing Code Bloat in Genetic Programming

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Supplement : Post-hoc analysis of Friedman's test.

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Table 12: Post-hoc analysis of Friedman’s test using symmetry test conducted on training errors. If the result of the method in the first column is better than that of the method in the second column, p-value of this post-hoc test is printed in bold face. Significant results marked in italic face ($\alpha = 0.05$).

Problems		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
Friedman		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
RDO	GP	.119	.000	.015	.007	.196	.596	.028	1	.991	.000	.217	.000	.004	.000	.000	.020	.017	.000
PP	GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.094</i>	<i>.014</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.535</i>	<i>.000</i>	<i>.066</i>	<i>.000</i>	<i>.001</i>	<i>.002</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S	GP	<i>.020</i>	1	<i>.000</i>	<i>.767</i>	1	<i>.012</i>	<i>.000</i>	<i>.911</i>	1	1	<i>.001</i>	1	<i>.000</i>	1	<i>.768</i>	<i>.026</i>	<i>.000</i>	1
SA10	GP	1	.162	<i>.938</i>	.416	.984	1	1	1	.967	.000	<i>.879</i>	.017	<i>.958</i>	.995	.504	1	1	.997
SA20	GP	<i>.039</i>	<i>.997</i>	<i>.074</i>	<i>.998</i>	<i>.118</i>	.075	.027	<i>.000</i>	<i>.001</i>	.416	<i>.000</i>	.995	<i>.045</i>	<i>.179</i>	1	<i>.000</i>	<i>.000</i>	<i>.004</i>
SAD	GP	<i>.000</i>	<i>.000</i>	<i>.566</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	.333	<i>.000</i>	1	<i>.040</i>	<i>.000</i>	<i>.685</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10	GP	1	.179	.998	.003	.991	.993	.991	1	.859	.000	1	.000	.023	.260	.000	.859	.911	.084
DA20	GP	<i>.030</i>	<i>.991</i>	<i>.949</i>	.131	<i>.444</i>	.179	<i>.000</i>	<i>.259</i>	<i>.793</i>	.000	<i>.145</i>	.000	1	.991	.013	<i>.878</i>	<i>.685</i>	1
DAD	GP	<i>.000</i>	<i>.003</i>	<i>.991</i>	<i>.997</i>	<i>.000</i>	.005	<i>.000</i>	<i>.000</i>	<i>.003</i>	.000	<i>.000</i>	.009	1	1	.307	<i>.004</i>	<i>.132</i>	<i>.387</i>
PP	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.565</i>	<i>.000</i>	<i>.066</i>	<i>.566</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SA10	RDO	<i>.026</i>	<i>.260</i>	<i>.000</i>	<i>.895</i>	<i>.878</i>	<i>.656</i>	.089	<i>.998</i>	1	<i>.017</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.012</i>	<i>.000</i>	<i>.015</i>	<i>.106</i>	<i>.004</i>
SA20	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SAD	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10	RDO	<i>.387</i>	<i>.238</i>	<i>.179</i>	1	<i>.839</i>	<i>.991</i>	<i>.373</i>	1	1	<i>.859</i>	<i>.656</i>	<i>.816</i>	1	<i>.596</i>	<i>.565</i>	<i>.685</i>	<i>.566</i>	<i>.741</i>
DA20	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.995</i>	<i>.000</i>	<i>.000</i>	<i>.986</i>	<i>.059</i>	<i>.162</i>	<i>.015</i>	<i>.000</i>	<i>.045</i>	<i>.035</i>	<i>.017</i>	<i>.026</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DAD	RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.008</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S	PP	<i>.000</i>	<i>.000</i>	1	.973	<i>.001</i>	<i>.026</i>	<i>.982</i>	<i>.000</i>	<i>.000</i>	.333	.333	.106	<i>.991</i>	.011	.415	.028	.741	<i>.000</i>
SA10	PP	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SA20	PP	<i>.000</i>	<i>.000</i>	.238	.534	1	<i>.003</i>	<i>.001</i>	1	.084	<i>.001</i>	1	.002	.197	.839	.013	.976	.973	.180
SAD	PP	.949	1	<i>.015</i>	<i>.967</i>	<i>.535</i>	.938	1	<i>.967</i>	.505	<i>.000</i>	1	.059	.217	1	.504	1	.998	.626
DA10	PP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA20	PP	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	.949	<i>.001</i>	.058	<i>.006</i>	<i>.000</i>	<i>.000</i>	<i>.004</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DAD	PP	.284	.859	<i>.000</i>	.566	<i>.817</i>	.058	1	1	<i>.035</i>	<i>.000</i>	.415	<i>.000</i>	<i>.000</i>	<i>.003</i>	<i>.000</i>	.124	.002	.001
SA10	TS-S	.095	.444	.013	.003	1	<i>.009</i>	<i>.000</i>	.967	.998	<i>.000</i>	.145	<i>.009</i>	<i>.000</i>	.839	.004	.035	<i>.000</i>	.878
SA20	TS-S	1	<i>.925</i>	.657	.997	<i>.020</i>	1	.070	<i>.000</i>	<i>.000</i>	.627	<i>.387</i>	.984	<i>.009</i>	<i>.596</i>	.949	<i>.475</i>	1	<i>.039</i>
SAD	TS-S	<i>.017</i>	<i>.000</i>	.105	<i>.308</i>	<i>.000</i>	.596	.827	<i>.000</i>	<i>.000</i>	.535	<i>.106</i>	1	.011	<i>.002</i>	1	<i>.013</i>	.995	<i>.003</i>
DA10	TS-S	.002	.475	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	.596	.973	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	.045	<i>.000</i>	<i>.000</i>	<i>.000</i>	.011
DA20	TS-S	1	<i>.878</i>	.011	<i>.000</i>	<i>.131</i>	.997	.611	<i>.988</i>	<i>.536</i>	<i>.000</i>	.879	<i>.000</i>	<i>.000</i>	.793	<i>.000</i>	.714	.052	1
DAD	TS-S	<i>.359</i>	<i>.000</i>	.004	<i>.998</i>	<i>.000</i>	1	.970	<i>.000</i>	<i>.001</i>	<i>.000</i>	1	.005	<i>.000</i>	1	.001	1	.445	<i>.816</i>
SA20	SA10	<i>.162</i>	<i>.011</i>	<i>.817</i>	<i>.058</i>	<i>.003</i>	.058	<i>.083</i>	<i>.000</i>	<i>.000</i>	<i>.011</i>	<i>.000</i>	<i>.238</i>	<i>.656</i>	<i>.011</i>	<i>.238</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SAD	SA10	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.017</i>	<i>.000</i>	<i>.019</i>	<i>.626</i>	<i>.000</i>	<i>.002</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10	SA10	.988	1	.444	<i>.816</i>	1	.997	1	.999	1	.656	.445	.066	.000	.859	.146	.816	.998	.535
DA20	SA10	<i>.131</i>	<i>.007</i>	1	1	<i>.030</i>	.147	<i>.002</i>	<i>.387</i>	<i>.095</i>	1	<i>.967</i>	.878	.685	1	.911	<i>.911</i>	<i>.283</i>	<i>.938</i>
DAD	SA10	<i>.000</i>	<i>.000</i>	1	<i>.051</i>	<i>.000</i>	.003	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.993</i>	<i>.106</i>	1	.911	<i>.949</i>	1	<i>.006</i>	<i>.023</i>	<i>.045</i>
SAD	SA20	<i>.008</i>	<i>.002</i>	.993	<i>.030</i>	<i>.146</i>	<i>.239</i>	<i>.000</i>	<i>.896</i>	<i>.998</i>	1	1	<i>.997</i>	1	<i>.535</i>	<i>.911</i>	<i>.932</i>	1	<i>.999</i>
DA10	SA20	.006	.013	.004	<i>.000</i>	.004	<i>.002</i>	<i>.360</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA20	SA20	1	1	.793	<i>.009</i>	1	1	<i>.988</i>	.014	.260	.013	.005	.002	.006	.008	.002	.002	.006	.023
DAD	SA20	<i>.238</i>	<i>.074</i>	.596	1	<i>.360</i>	<i>.998</i>	<i>.001</i>	1	1	.198	.475	.162	.026	.387	.118	.816	.132	.859
DA10	SAD	<i>.000</i>	<i>.000</i>	.105	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA20	SAD	.011	.003	.999	<i>.000</i>	.023	.105	.011	<i>.000</i>	.026	.020	<i>.000</i>	<i>.000</i>	.005	<i>.000</i>	<i>.000</i>	<i>.000</i>	.002	.001
DAD	SAD	.979	.991	.991	.034	1	.768	1	.896	.979	.260	.145	.011	.023	<i>.000</i>	<i>.001</i>	.070	.052	.387
DA20	DA10	<i>.004</i>	<i>.008</i>	<i>.475</i>	<i>.984</i>	<i>.039</i>	.009	.023	<i>.066</i>	<i>.035</i>	<i>.627</i>	<i>.020</i>	<i>.878</i>	<i>.132</i>	<i>.896</i>	<i>.949</i>	<i>.058</i>	<i>.030</i>	<i>.020</i>
DAD	DA10	<i>.000</i>	<i>.000</i>	<i>.685</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.106</i>	<i>.000</i>	<i>.106</i>	<i>.040</i>	<i>.106</i>	<i>.282</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>
DAD	DA20	<i>.284</i>	<i>.106</i>	1	<i>.008</i>	<i>.085</i>	<i>.979</i>	<i>.045</i>	<i>.014</i>	<i>.445</i>	<i>.995</i>	<i>.816</i>	<i>.938</i>	1	<i>.925</i>	<i>.979</i>	<i>.360</i>	<i>.995</i>	<i>.714</i>

Table 13: Post-hoc analysis of Friedman’s test using symmetry test conducted on testing errors. If the result of the method in the first column is better than that of the method in the second column, p-value of this post-hoc test is printed in bold face. Significant results marked in italic face ($\alpha = 0.05$).

Problems	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
Friedman	.000	.000	.415	.000	.000	.000	.000	.023	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
RDO GP	<i>.012</i>	.000		.000	<i>.034</i>	1	.805	1	.958	.058	.131	.000	.656	.000	.979	.307	1	.118
PP GP	1	.997		.878	1	1	.000	1	.817	.596	.009	.180	.685	.741	.958	.154	.001	.058
TS-S GP	.046	.106		1	1	.938	.805	.839	.998	1	.044	1	.132	1	.938	.995	.046	.793
SA10 GP	.030	.000		.008	.967	.535	.925	1	1	.001	1	.026	.000	.839	.009	.949	.002	.020
SA20 GP	.001	.000		1	.007	.030	.035	.993	.009	.001	.005	.949	.000	1	.030	.000	.000	.973
SAD GP	.504	.004		.260	.332	.001	.000	.991	.008	.011	.118	1	.000	.197	.596	.000	.000	1
DA10 GP	.000	.000		.000	.332	.973	.534	1	.993	.000	1	.000	.000	.003	.000	.386	.006	.000
DA20 GP	.656	.000		.002	.000	.002	.118	.839	.993	.000	.003	.000	.000	.009	.000	.000	.001	.035
DAD GP	.967	.002		1	.034	.001	.000	.741	.445	.000	.013	.000	.000	.333	.000	.000	.045	.535
PP RDO	.004	.000		.000	.058	.995	.001	1	1	.000	.000	.000	1	.000	.307	.000	.000	.000
TS-S RDO	.000	.000		.000	.009	.995	1	.535	.505	.019	.000	.000	.997	.000	1	.026	.009	.000
SA10 RDO	.000	.008		.999	.566	.816	1	1	1	.984	.095	.000	.000	.074	.259	.007	.000	1
SA20 RDO	.000	.009		.004	1	.105	.849	1	.333	.988	.000	.000	.000	.000	.475	.000	.000	.816
SAD RDO	.000	.000		.000	.997	.004	.001	1	.307	1	.000	.000	.000	.000	.998	.000	.000	.093
DA10 RDO	.000	.023		1	.997	.999	1	1	.415	.793	.030	.911	.008	.999	.000	.000	.000	.878
DA20 RDO	.000	.163		1	.656	.011	.976	.979	1	.027	.000	.361	.000	.993	.000	.000	.000	1
DAD RDO	.360	.000		.002	1	.006	.000	.949	.995	.938	.000	.017	.000	.415	.000	.000	.006	.999
TS-S PP	.283	.596		.967	1	.686	.001	.816	.260	.816	1	.596	.995	.714	.196	.728	.958	.925
SA10 PP	.075	.001		.000	.988	.217	.000	1	.993	.000	.015	.000	.000	.022	.000	.919	1	.000
SA20 PP	.003	.001		.504	.013	.005	.217	.995	.596	.000	1	.002	.000	.911	.000	.320	.535	.001
SAD PP	.714	.074		.993	.444	.000	1	.993	.565	.000	.998	.026	.000	.998	.034	.162	.118	.074
DA10 PP	.001	.000		.000	.444	.793	.006	1	.197	.000	.051	.000	.007	.000	.000	1	1	.000
DA20 PP	.839	.000		.000	.000	.000	.075	.859	1	.000	1	.000	.000	.000	.000	.780	1	.000
DAD PP	.878	.045		.626	.058	.000	1	.768	1	.000	1	.000	.000	.001	.000	.037	.979	.000
SA10 TS-S	1	.416		.002	.839	.999	1	.656	.878	.000	.106	.002	.001	.859	.387	1	.991	.000
SA20 TS-S	.878	.387		.997	.001	.626	.849	.217	.000	.000	.998	.596	.009	1	.626	.001	.026	.106
SAD TS-S	1	.991		.445	.146	.094	.001	.198	.000	.003	1	.938	.005	.179	1	.000	.001	.839
DA10 TS-S	.741	.237		.000	.146	1	1	.793	1	.000	.259	.000	.132	.004	.001	.938	.999	.000
DA20 TS-S	.998	.040		.001	.000	.179	.976	.039	.714	.000	.995	.000	.000	.011	.000	.015	.973	.000
DAD TS-S	.003	.973		.999	.009	.118	.000	.023	.065	.000	1	.000	.000	.359	.000	.000	1	.006
SA20 SA10	.993	1		.058	.259	.967	.686	1	.084	1	.008	.565	1	.626	1	.005	.360	.416
SAD SA10	.973	.967		.000	.979	.445	.000	.999	.074	1	.162	.180	1	.001	.816	.001	.058	.015
DA10 SA10	.967	1		.991	.979	.997	1	1	.817	1	1	.058	.938	.387	.596	.993	1	.995
DA20 SA10	.925	.993		1	.003	.626	.911	.949	1	.416	.005	.444	.839	.565	.118	.051	1	1
DAD SA10	.000	.988		.034	.566	.504	.000	.896	.878	1	.020	.988	1	.999	.105	.000	.997	.938
SAD SA20	.474	.958		.058	.938	.993	.146	1	1	1	.993	1	1	.387	.949	1	.999	.958
DA10 SA20	1	1		.002	.938	.504	.973	.997	.000	1	.030	.000	.998	.001	.359	.117	.198	.045
DA20 SA20	.333	.995		.020	.911	.999	1	1	.179	.387	1	.001	.505	.002	.045	1	.476	.535
DAD SA20	.000	.984		1	1	.997	.106	.998	.911	1	1	.058	.979	.161	.039	.998	.039	.997
DA10 SAD	.307	.878		.000	1	.058	.003	.995	.000	.973	.359	.000	.991	.000	.009	.048	.023	.000
DA20 SAD	1	.445		.000	.131	1	.045	1	.162	.118	.984	.000	.627	.000	.000	.992	.095	.026
DAD SAD	.026	1		.094	.997	1	1	.999	.896	.998	.999	.007	.993	.000	.000	1	.002	.474
DA20 DA10	.197	1		1	.131	.118	.999	.878	.626	.816	.020	.997	.084	1	.998	.474	1	.984
DAD DA10	.000	.938		.001	.997	.074	.002	.793	.045	1	.066	.565	.596	.878	.997	.008	1	.387
DAD DA20	.051	.565		.011	.656	1	.030	1	.967	.596	1	.979	.993	.958	1	.878	.988	.973

Table 14: Post-hoc analysis of Friedman’s test using symmetry test conducted on solution size. If the result of the method in the first column is better than that of the method in the second column, p-value of this post-hoc test is printed in bold face. Significant results marked in italic face ($\alpha = 0.05$).

Problems	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
Friedman	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
RDO GP	.895	.488	.910	<i>.009</i>	.875	<i>.057</i>	<i>.000</i>	.815	<i>.066</i>	.998	1	.999	<i>.571</i>	.666	1	1	1	1
PP GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S GP	.117	.625	<i>.000</i>	<i>.026</i>	.930	<i>.137</i>	<i>.000</i>	.984	.998	1	<i>.068</i>	1	<i>.054</i>	.789	<i>.003</i>	<i>.000</i>	<i>.001</i>	.986
SA10 GP	<i>.001</i>	<i>.004</i>	<i>.005</i>	<i>.017</i>	<i>.042</i>	<i>.010</i>	.457	.083	<i>.010</i>	<i>.001</i>	<i>.004</i>	<i>.027</i>	<i>.000</i>	<i>.010</i>	<i>.007</i>	.068	<i>.043</i>	<i>.004</i>
SA20 GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SAD GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10 GP	<i>.000</i>	<i>.000</i>	.087	<i>.001</i>	<i>.008</i>	<i>.004</i>	.473	<i>.010</i>	<i>.008</i>	.053	.109	.316	.418	.103	.437	.224	.091	<i>.036</i>
DA20 GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DAD GP	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
PP RDO	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.017</i>	<i>.000</i>	<i>.000</i>	<i>.026</i>	<i>.000</i>	<i>.010</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.018</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S RDO	.938	1	<i>.000</i>	1	1	1	1	1	<i>.412</i>	<i>.989</i>	<i>.303</i>	1	<i>.000</i>	1	<i>.003</i>	<i>.001</i>	<i>.004</i>	.996
SA10 RDO	.196	.779	<i>.331</i>	1	.812	1	<i>.293</i>	<i>.949</i>	1	<i>.024</i>	<i>.038</i>	<i>.002</i>	<i>.001</i>	.764	<i>.007</i>	.110	.115	<i>.008</i>
SA20 RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.003</i>	<i>.000</i>	<i>.000</i>	.549	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SAD RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.013</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10 RDO	.055	.372	<i>.886</i>	1	.482	.999	.282	<i>.610</i>	1	.370	.410	.057	1	.992	.437	.316	.212	.060
DA20 RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	.070	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DAD RDO	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.032</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
TS-S PP	<i>.130</i>	<i>.000</i>	<i>.918</i>	.005	<i>.000</i>	<i>.000</i>	<i>.044</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.064</i>	<i>.000</i>	<i>.003</i>	<i>.000</i>	<i>.007</i>	<i>.000</i>
SA10 PP	<i>.878</i>	<i>.153</i>	<i>.196</i>	<i>.009</i>	<i>.038</i>	<i>.002</i>	<i>.000</i>	<i>.000</i>	<i>.066</i>	<i>.895</i>	<i>.000</i>	<i>.047</i>	<i>.998</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.097</i>
SA20 PP	.169	.827	1	1	.989	1	<i>.953</i>	1	<i>.877</i>	<i>.019</i>	1	.993	<i>.002</i>	1	<i>.999</i>	.998	<i>.893</i>	.545
SAD PP	<i>.002</i>	<i>.017</i>	.998	.662	<i>.042</i>	.457	1	1	<i>.088</i>	<i>.012</i>	.986	.803	<i>.007</i>	.991	.679	1	.559	.073
DA10 PP	<i>.989</i>	<i>.488</i>	<i>.015</i>	<i>.094</i>	<i>.149</i>	<i>.003</i>	<i>.000</i>	<i>.000</i>	<i>.073</i>	<i>.235</i>	<i>.000</i>	<i>.002</i>	<i>.036</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.014</i>
DA20 PP	.048	.887	1	<i>.810</i>	.574	1	1	1	1	.984	.439	1	<i>.988</i>	<i>.738</i>	<i>.649</i>	<i>.185</i>	<i>.884</i>	1
DAD PP	<i>.000</i>	<i>.013</i>	.988	.172	.277	.894	1	1	<i>.027</i>	.487	.993	<i>.918</i>	.335	.999	1	<i>.638</i>	1	<i>.991</i>
SA10 TS-S	.958	.655	<i>.002</i>	1	.722	.998	.206	<i>.684</i>	.123	<i>.000</i>	.998	<i>.019</i>	.418	<i>.637</i>	1	<i>.937</i>	<i>.989</i>	<i>.135</i>
SA20 TS-S	<i>.000</i>	<i>.000</i>	.979	<i>.001</i>	<i>.000</i>	<i>.000</i>	.669	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	.995	<i>.000</i>	<i>.000</i>	<i>.003</i>	<i>.000</i>	<i>.000</i>
SAD TS-S	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.023</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10 TS-S	.753	.258	<i>.000</i>	<i>.997</i>	.380	.988	.196	<i>.247</i>	.110	<i>.025</i>	1	<i>.256</i>	<i>.000</i>	<i>.973</i>	.775	<i>.711</i>	<i>.953</i>	<i>.469</i>
DA20 TS-S	<i>.000</i>	<i>.000</i>	.815	<i>.000</i>	<i>.000</i>	<i>.000</i>	.110	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.013</i>	<i>.000</i>	.587	<i>.000</i>	.574	.501	.438	<i>.000</i>
DAD TS-S	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.054</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	1	<i>.000</i>	<i>.001</i>	.116	<i>.006</i>	<i>.000</i>
SA20 SA10	<i>.001</i>	<i>.001</i>	.098	<i>.001</i>	<i>.001</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.043</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
SAD SA10	<i>.000</i>	<i>.000</i>	<i>.017</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	.103	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA10 SA10	1	1	<i>.997</i>	<i>.999</i>	1	1	1	1	1	.988	<i>.993</i>	<i>.995</i>	<i>.002</i>	<i>.999</i>	<i>.884</i>	1	1	1
DA20 SA10	<i>.000</i>	<i>.001</i>	.318	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.007</i>	.215	.151	.186	1	.040	.422	.016	.036	.222
DAD SA10	<i>.000</i>	<i>.000</i>	<i>.008</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.010</i>	<i>.003</i>	<i>.000</i>	.867	<i>.001</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.003</i>
SAD SA20	.938	.699	1	.915	.482	.472	.886	1	<i>.917</i>	1	<i>.958</i>	.999	1	<i>.953</i>	.981	.931	1	.994
DA10 SA20	<i>.007</i>	<i>.006</i>	<i>.006</i>	<i>.022</i>	<i>.005</i>	<i>.003</i>	<i>.000</i>	<i>.003</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA20 SA20	1	1	1	<i>.972</i>	.993	1	.993	1	.997	<i>.356</i>	<i>.576</i>	<i>.894</i>	<i>.087</i>	<i>.885</i>	<i>.182</i>	<i>.711</i>	<i>.076</i>	<i>.315</i>
DAD SA20	.779	.640	.999	.434	.917	.903	.966	.998	.725	.953	<i>.999</i>	1	.824	1	1	<i>.984</i>	<i>.909</i>	<i>.989</i>
DA10 SAD	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DA20 SAD	.997	<i>.610</i>	<i>.986</i>	1	.976	<i>.639</i>	1	1	.383	<i>.269</i>	<i>.031</i>	<i>.456</i>	<i>.188</i>	<i>.128</i>	<i>.005</i>	<i>.041</i>	<i>.013</i>	<i>.025</i>
DAD SAD	1	1	1	.999	.999	<i>.999</i>	1	1	1	.911	<i>.545</i>	1	.943	<i>.724</i>	<i>.845</i>	<i>.268</i>	<i>.590</i>	<i>.591</i>
DA20 DA10	<i>.001</i>	<i>.009</i>	<i>.034</i>	<i>.000</i>	<i>.000</i>	<i>.001</i>	<i>.000</i>	<i>.000</i>	<i>.008</i>	<i>.009</i>	<i>.007</i>	<i>.012</i>	<i>.001</i>	<i>.003</i>	<i>.006</i>	<i>.003</i>	<i>.015</i>	<i>.043</i>
DAD DA10	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>	<i>.000</i>
DAD DA20	.962	.549	.953	.990	1	.966	1	.4	.177	.989	.966	.638	.949	.992	.452	.999	.866	.936

Table 15: Post-hoc analysis of Friedman’s test using symmetry test conducted on running time. If the result of the method in the first column is better than that of the method in the second column, p-value of this post-hoc test is printed in bold face. Significant results marked in italic face ($\alpha = 0.05$).

Problems		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
Friedman		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
RDO	GP	.911	.896	.002	.925	.878	.938	.896	.839	.713	.627	.896	.714	.896	.938	.445	.685	.656	.767
PP	GP	.988	.595	.997	.084	.051	.000	.026	.006	.118	.131	.002	.030	.003	.006	.685	.714	.474	.026
TS-S	GP	.030	.360	.000	.474	.999	.896	.035	1	1	1	.000	1	.000	.896	.000	.000	.000	1
SA10	GP	.000	.000	.000	.005	.000	.030	.020	.002	.002	.000	.000	.000	.000	.000	.000	.001	.001	.000
SA20	GP	.000	.000	.006	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
SAD	GP	.000	.000	.333	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
DA10	GP	.000	.000	.741	.023	.009	.030	.535	.093	.039	.307	.714	.179	.714	.013	1	1	1	.162
DA20	GP	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
DAD	GP	.000	.000	.967	.000	.000	.000	.000	.000	.000	.000	.030	.000	.359	.000	.359	.000	.000	.000
PP	RDO	.259	.017	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	.008	.002	.000
TS-S	RDO	.000	.005	.000	.012	.387	.118	.000	.415	.445	.685	.000	.566	.000	.118	.000	.000	.000	.387
SA10	RDO	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
SA20	RDO	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
SAD	RDO	.000	.000	.839	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
DA10	RDO	.000	.000	.000	.000	.000	.000	.012	.000	.000	.000	.030	.000	.031	.000	.105	.238	.307	.000
DA20	RDO	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
DAD	RDO	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005	.000	.000	.000	.000	.000
TS-S	PP	.415	1	.000	.998	.333	.074	1	.051	.283	.106	.993	.059	.002	.388	.000	.026	.074	.131
SA10	PP	.012	.180	.002	.998	.926	.974	1	1	.973	.066	.714	.626	.000	1	.023	.360	.565	.032
SA20	PP	.000	.000	.105	.000	.000	.013	.000	.000	.000	.000	.000	.000	.002	.000	.000	.000	.000	.000
SAD	PP	.000	.008	.034	.000	.000	.001	.000	.002	.000	.000	.878	.000	1	.002	.012	.146	.170	.058
DA10	PP	.000	.008	.997	1	1	.974	.958	.998	1	1	.414	1	.504	1	.974	.979	.817	1
DA20	PP	.000	.000	.000	.000	.000	.006	.009	.002	.000	.001	.000	.003	.105	.000	.000	.000	.000	.000
DAD	PP	.000	.002	1	.011	.105	.074	.000	.178	.010	.146	.999	.360	.838	.445	1	.000	.010	.958
SA10	TS-S	.949	.360	.998	.817	.006	.714	1	.017	.010	.000	.998	.000	1	.094	.505	.991	.993	.000
SA20	TS-S	.001	.000	.597	.000	.000	.000	.000	.000	.000	.000	.001	.000	1	.000	1	.009	.015	.000
SAD	TS-S	.009	.026	.000	.000	.000	.000	.000	.000	.000	.000	1	.000	.019	.000	.627	1	1	.000
DA10	TS-S	.520	.026	.002	.967	.105	.714	.973	.388	.118	.260	.039	.283	.000	.535	.000	.000	.000	.473
DA20	TS-S	.000	.000	1	.000	.000	.000	.007	.000	.000	.000	.005	.000	.976	.000	.999	.006	.015	.000
DAD	TS-S	.320	.008	.000	.000	.000	.000	.000	.000	.000	.000	.768	.000	.000	.000	.000	.984	1	.002
SA20	SA10	.084	.045	.974	.000	.000	.000	.001	.000	.000	.058	.023	.020	1	.000	.237	.000	.000	.196
SAD	SA10	.373	.991	.000	.007	.030	.000	.000	.009	.003	.938	1	.217	.004	.019	1	1	1	1
DA10	SA10	.999	.991	.045	1	.997	1	.938	.973	.998	.020	.002	.217	.000	.998	.000	.017	.008	.003
DA20	SA10	.000	.000	1	.000	.007	.000	.012	.007	.026	.979	.084	.626	.859	.001	.925	.000	.000	.932
DAD	SA10	.986	.938	.007	.147	.896	.001	.001	.360	.283	1	.217	1	.000	.859	.094	.504	.849	.581
SAD	SA20	1	.474	.000	.685	.911	1	.938	.896	1	.767	.008	.998	.016	.878	.333	.001	.004	.125
DA10	SA20	.459	.474	.597	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
DA20	SA20	.550	.714	.859	1	.991	1	.998	.926	.984	.627	1	.896	.970	.999	.979	1	1	.963
DAD	SA20	.670	.714	.238	.118	.035	1	1	.130	.596	.022	.000	.066	.000	.022	.000	.238	.100	.000
DA10	SAD	.878	1	.001	.001	.001	.000	.000	.000	.000	.000	.006	.000	.162	.001	.000	.003	.001	.007
DA20	SAD	.161	.003	.000	.967	1	1	.475	1	1	1	.034	1	.388	.999	.967	.000	.004	.859
DAD	SAD	.967	1	.011	.993	.714	.984	.938	.949	.878	.817	.387	.445	.444	.685	.058	.793	.995	.714
DA20	DA10	.001	.003	.013	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000
DAD	DA10	1	1	1	.045	.333	.001	.000	.015	.035	.051	.896	.084	1	.308	.816	.000	.000	.656
DAD	DA20	.003	.009	.001	.445	.415	.999	.998	.926	.997	.911	.000	.859	.000	.198	.001	.180	.100	.022