

Appendix A: Detailed Experimental results on 40 classical instances

Ins.	SA-FVSP			BPS			IDTS			DiVerSeS			TRSA		
	f_{min}	f_{avg}	Time (s)	f_{min}	f_{avg}	Time (s)	f_{min}	f_{avg}	Time (s)	f_{min}	f_{avg}	Time (s)	f_{min}	f_{avg}	Time (s)
P50-100	3	3	0.02	3	3.2	0.01	3	3	0.01	3	3	0.00	3	3	0.00
P50-150	9	9	0.03	9	9.2	0.02	9	9	0.01	9	9	0.01	9	9	0.00
P50-200	13	13	0.04	13	13.1	0.04	13	13	0.01	13	13	9.76	13	13	0.00
P50-250	17	17	0.03	17	17.5	0.06	17	17	0.01	17	17	9.88	17	17	0.00
P50-300	19	19	0.03	19	19.5	0.08	19	19	0.01	19	19	9.32	19	19	0.00
P50-500	28	28	0.05	28	29.3	0.16	28	28	0.01	28	28	10.06	28	28	0.00
P50-600	31	32	0.06	31	32.6	0.2	31	31	0.01	31	31	12.31	31	31	0.01
P50-700	33	33	0.06	33	33.3	0.24	33	33	0.01	33	33	13.42	33	33	0.01
P50-800	34	34	0.05	34	35.4	0.29	34	34	0.01	34	34	13.53	34	34	0.00
P50-900	36	36	0.05	36	36.4	0.32	36	36	0.01	36	36	17.54	36	36	0.01
P100-200	9	9	0.04	9	10	0.03	9	9	0.01	9	9	19.82	9	9	0.00
P100-300	17	17.3	0.05	17	17.3	0.11	17	17	0.01	17	17	19.51	17	17	0.16
P100-400	23	23	0.09	23	23.5	0.18	23	23	0.01	23	23	13.18	23	23	0.01
P100-500	32	32	0.12	33	34.4	0.33	32	32	0.03	32	32	18.52	32	32	0.01
P100-600	36	37.2	0.12	37	38.9	0.45	37	37	0.56	36	36	15.66	36	36	2.43
P100-1000	53	53.2	0.22	54	55.5	1.07	53	53	0.15	53	53	14.56	53	53	0.32
P100-1100	54	55	0.19	55	55.8	1.26	54	54.7	0.11	54	54	17.59	54	54	2.15
P100-1200	57	57.4	0.27	58	59.4	1.4	57	57	0.23	57	57	19.66	57	57	0.03
P100-1300	60	60	0.35	61	62.7	1.55	60	60	0.02	60	60	16.88	60	60	0.01
P100-1400	61	61	0.27	62	63	1.8	61	61	0.09	61	61	19.28	61	61	0.01
P500-1000	31	31	1.07	31	32.3	0.93	31	31	0.05	31	31	5.73	31	31	0.02
P500-1500	63	64.8	1.78	65	66.9	3.44	63	63.8	1.36	63	63.2	10.14	63	63	3.17
P500-2000	102	103.8	2.12	104	105.5	7.27	101	102.8	0.39	101	102.4	11.62	100	100	14.14
P500-2500	133	134.8	2.23	137	140	12.88	132	135.1	1.62	133	134	11.94	131	131.3	20.30
P500-3000	163	165.1	2.53	165	168.2	19.04	163	164.9	1.91	163	163.9	17.24	161	161.5	25.84
P500-5000	237	239.2	2.99	240	243.8	54.91	237	240.1	0.87	237	237	13.70	237	237	10.28
P500-5500	252	253.6	3.67	254	256.8	68.2	252	254.7	2.68	251	252.2	14.38	251	251.4	15.80
P500-6000	265	266.9	4.04	268	270.2	81.39	264	267.6	2.62	265	265.1	12.89	264	264.3	17.72
P500-6500	276	278.6	4.73	279	283	93.33	276	278.5	2.91	276	276.3	10.82	276	276	11.92
P500-7000	287	289	4.83	288	292.5	109.96	287	288.7	5.15	286	286.9	11.04	286	286	13.81
P1000-3000	130	132.1	10.23	130	133.4	12.84	128	129.9	10.98	128	129	14.31	127	127	11.90
P1000-3500	165	167.3	11.51	163	167.4	20.1	162	164.3	5.44	162	164.5	28.74	159	159.7	28.26
P1000-4000	192	195.9	11.63	195	199.3	29.03	193	195.5	9.27	192	194.3	28.90	190	190.3	24.63
P1000-4500	230	231.7	10.42	230	233.2	40.14	229	231.5	8.26	229	230.5	29.11	226	226.2	19.79
P1000-5000	260	265.5	18.45	261	263.8	52.53	261	263.2	6.79	259	261	20.88	256	256.3	19.16
P1000-10000	472	476.7	12.99	474	478	243.24	472	475.1	11.41	469	471.9	22.37	466	468.7	19.03
P1000-15000	582	584.4	15.45	584	589.4	508.33	580	585.6	15.31	579	581.4	19.12	578	579.7	27.37
P1000-20000	653	655.7	16.43	654	660	840.2	652	657.3	13.06	651	652.5	20.26	650	651.8	26.63
P1000-25000	702	704.7	21.31	704	710	1224.58	700	704.4	18.73	699	701.4	19.65	699	701.5	20.80
P1000-30000	741	744.1	22.26	745	749.9	1698.77	741	744.1	19.82	740	741	26.83	739	740	16.64
#better	16	25		26	40		16	21		13	17				
#equal	24	15		14	0		24	19		27	22				
#worse	0	0		0	0		0	0		0	1				
p -value	4.40E-4	1.24E-5		8.39E-6	3.66E-8		4.40E-4	6.00E-5		1.48E-3	2.34E-4				
#best	24	15		14	0		24	19		27	23		40	39	
gap(%)	19.56	49.45		50.83	148.61		16.42	35.99		11.48	18.94		0	0.01	

TABLE I: Detailed Experimental results on 40 classical instances

Appendix B: Computational results of TRSA-A, TRSA-B, TRSA-C and our TRSA on 100 instances in the PACE 2022 competition

Ins.	TRSA		TRSA-A		TRSA-B		TRSA-C	
	f_{min}	f_{avg}	f_{min}	f_{avg}	f_{min}	f_{avg}	f_{min}	f_{avg}
h_001	46	46.0	46	46.0	46	46.0	46	46.0
h_003	38	38.0	38	38.0	38	38.0	38	38.0
h_005	235	235.0	235	235.0	235	235.0	235	235.0
h_007	77	77.0	77	77.0	77	77.0	77	77.0
h_009	33	33.0	33	33.0	33	33.0	33	33.0
h_011	73	73.0	73	73.0	73	73.0	73	73.2
h_013	167	167.0	167	167.0	167	167.0	167	167.6
h_015	70	70.0	70	70.8	70	70.4	71	71.0
h_017	182	182.0	182	182.0	182	182.0	182	182.4
h_019	121	121.0	121	121.0	121	121.0	121	121.0
h_021	61	61.0	61	61.0	61	61.0	61	61.0
h_023	126	126.0	126	126.0	126	126.0	126	126.0
h_025	190	190.2	190	190.6	191	191.0	191	191.0
h_027	124	124.0	124	124.0	124	124.0	124	124.0
h_029	251	251.0	251	251.0	251	251.4	251	251.8
h_031	186	186.0	186	186.0	186	186.0	186	186.0
h_033	190	190.0	190	190.0	190	190.0	190	190.0
h_035	3933	3933.0	3933	3933.0	3933	3933.0	3933	3933.0
h_037	3922	3922.0	3922	3922.0	3922	3922.0	3922	3922.0
h_039	2416	2416.8	2417	2419.4	2416	2416.8	2421	2422.0
h_041	4019	4019.0	4019	4019.0	4019	4019.0	4019	4019.0
h_043	3914	3914.0	3914	3914.0	3914	3914.0	3914	3914.0
h_045	3937	3937.8	3938	3938.0	3937	3937.8	3938	3938.0
h_047	3886	3886.0	3886	3886.0	3886	3886.0	3886	3886.0
h_049	3889	3889.0	3889	3889.0	3889	3889.0	3889	3889.0
h_051	3999	3999.0	3999	3999.0	3999	3999.0	3999	3999.0
h_053	4014	4014.0	4014	4014.0	4014	4014.0	4014	4014.0
h_055	4478	4479.6	4480	4481.0	4478	4479.2	4483	4486.0
h_057	3884	3884.0	3884	3884.0	3884	3884.0	3884	3884.0
h_059	496	496.0	496	496.0	496	496.2	496	496.8
h_061	3744	3744.0	3744	3744.0	3744	3744.0	3744	3744.0
h_063	881	881.6	883	886.2	881	884.2	891	895.2
h_065	3683	3683.0	3683	3683.0	3683	3683.0	3683	3683.0
h_067	5422	5422.0	5422	5422.0	5422	5422.0	5422	5422.0
h_069	6305	6306.4	6306	6306.8	6307	6308.4	6306	6307.4
h_071	6259	6259.0	6259	6259.0	6259	6259.0	6259	6259.0
h_073	9077	9077.4	9077	9077.4	9078	9079.2	9078	9078.6
h_075	10121	10124.4	10123	10127.0	10123	10127.2	10145	10147.2
h_077	1190	1191.4	1191	1194.8	1189	1191.8	1209	1211.6
h_079	10941	10942.4	10942	10942.8	10944	10944.6	10943	10944.6
h_081	21867	21867.0	21870	21870.8	21867	21867.0	21867	21867.0
h_083	20628	20628.0	20628	20628.0	20628	20628.0	20628	20628.0
h_085	12807	12808.4	12808	12809.6	12810	12812.2	12810	12811.2
h_087	14655	14660.8	14653	14657.4	14656	14658.6	14734	14738.4
h_089	7228	7229.0	7228	7229.4	7230	7231.6	7231	7232.4
h_091	12099	12099.8	12098	12101.0	12103	12104.4	12103	12105.6
h_093	21948	21950.2	21949	21951.4	21955	21957.0	21951	21953.2
h_095	23812	23815.6	23815	23816.2	23816	23818.6	23814	23816.8
h_097	12275	12279.2	12276	12277.6	12278	12282.0	12291	12292.8
h_099	24320	24329.2	24318	24328.8	24319	24327.8	24458	24473.0
h_101	46473	46473.0	46478	46478.8	46473	46473.0	46473	46473.0
h_103	13303	13303.0	13303	13303.0	13303	13303.0	13303	13303.0

h_105	48880	48880.0	48883	48886.2	48880	48880.0	48880	48880.0
h_107	23722	23726.6	23722	23726.8	23734	23738.6	23738	23742.2
h_109	7621	7621.6	7622	7623.0	7622	7624.6	7625	7627.6
h_111	22658	22658.0	22658	22658.0	22658	22658.0	22658	22658.0
h_113	18574	18574.0	18574	18574.0	18574	18574.0	18574	18574.0
h_115	130675	130675.0	130675	130675.0	130675	130675.0	130675	130675.0
h_117	41111	41111.0	41111	41111.2	41111	41111.0	41111	41111.0
h_119	93427	93488.8	93427	93489.1	93452	93490.2	93584	93583.6
h_121	15473	15474.4	15476	15477.0	15479	15480.6	15475	15478.2
h_123	4002	4002.4	4001	4002.9	4001	4002.8	4005	4005.8
h_125	15028	15039.2	15034	15038.4	15029	15044.6	15090	15093.8
h_127	29514	29521.6	29512	29516.8	29534	29536.8	29532	29537.6
h_129	28008	28023.8	28014	28034.4	28029	28043.2	28089	28099.8
h_131	15738	15740.2	15738	15740.2	15742	15745.8	15739	15743.8
h_133	93222	93226.6	93223	93229.4	93272	93285.4	93359	93364.0
h_135	27983	27988.6	27978	27986.0	27985	27992.2	28069	28082.4
h_137	27968	27982.8	27966	27973.6	27981	27989.8	28056	28068.8
h_139	15852	15853.6	15853	15853.8	15854	15855.8	15854	15855.2
h_141	56864	56870.4	56865	56876.0	56897	56902.2	56879	56893.8
h_143	30210	30213.8	30211	30214.6	30221	30228.6	30222	30225.8
h_145	30226	30228.6	30222	30227.4	30240	30243.6	30235	30240.4
h_147	28648	28655.0	28645	28656.8	28655	28666.0	28714	28724.0
h_149	91607	91607.0	91607	91607.0	91607	91607.0	91607	91607.0
h_151	57920	57928.0	57924	57928.4	57947	57954.0	57935	57941.6
h_153	30547	30551.6	30548	30553.2	30561	30567.4	30558	30562.2
h_155	100310	100312.4	100312	100314.4	100367	100376.6	100374	100383.0
h_157	89626	89626.0	89626	89626.0	89626	89626.0	89626	89626.0
h_159	29165	29172.0	29163	29169.5	29175	29179.2	29226	29234.8
h_161	28850	28872.2	28857	28875.6	28857	28869.0	28899	28817.4
h_163	30901	30904.2	30899	30905.4	30912	30916.4	30904	30911.4
h_165	103451	103461.8	103452	103459.4	103514	103528.0	103514	103518.6
h_167	61301	61309.0	61308	61312.0	61333	61336.4	61307	61314.2
h_169	29630	29634.6	29631	29632.8	29642	29645.6	29669	29673.8
h_171	90647	90647.0	90647	90647.4	90647	90647.0	90647	90647.0
h_173	31684	31688.4	31683	31688.7	31693	31698.2	31688	31695.4
h_175	100540	100541.6	100541	100543.4	100543	100545.6	100541	100543.8
h_177	100468	100468.2	100468	100469.2	100469	100470.8	100468	100470.6
h_179	95730	95730.0	95730	95730.2	95730	95730.0	95730	95730.0
h_181	109290	109300.2	109297	109302.4	109354	109364.2	109328	109335.6
h_183	112344	112349.6	112356	112358.0	112393	112413.4	112366	112374.8
h_185	29365	29378.2	29372	29382.6	29372	29387.0	29426	29436.4
h_187	110074	110074.0	110074	110074.0	110074	110074.0	110074	110074.0
h_189	213495	213504.4	213637	213690.4	213530	213539.0	213505	213516.4
h_191	116156	116156.0	116156	116156.0	116156	116156.0	116156	116156.0
h_193	31431	31433.6	31433	31436.0	31440	31442.2	31434	31438.0
h_195	4049	4049.6	4049	4049.6	4049	4050.0	4050	4051.4
h_197	7998	7999.4	7998	7999.2	7996	7999.2	8004	8005.6
h_199	178686	178686.0	178686	178686.0	178686	178686.0	178686	178686.0
#best	85	84	63	55	55	49	46	40
gap(%)	0.2	0.3	1	2.9	2.1	3.3	10.3	11.8

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