

1. Analysis on Standard-Weight Instances

The following figure, comparing the computation times of the five algorithmic configurations conducted on the 14 most challenging standard-weight instances in S_A .

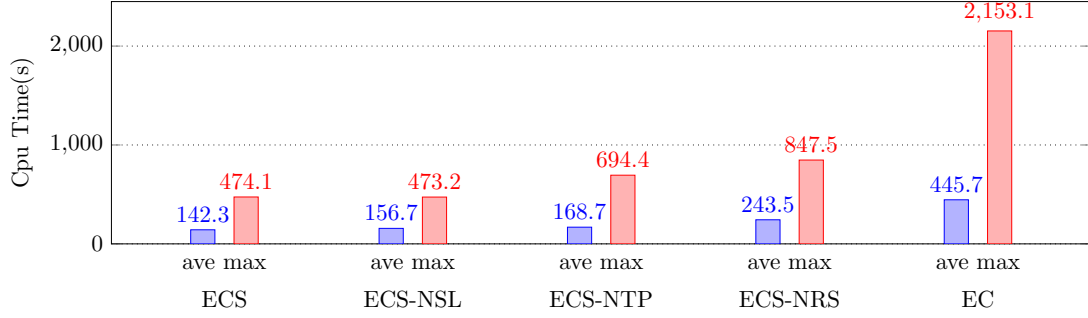


Figure 1 Computation Times of the Five Algorithm Configurations on the 14 Most Challenging Standard-Weight Instances

The following table, comparing the number of tours enumerated for EC and ECS conducted on the 14 most challenging standard-weight instances in S_A).

Table 1 The Number of Tours Comparison between EC and ECS on the 14 Most Challenging Standard-Weight Instances

Name	EC						ECS					
	Cost	$ \mathcal{U}^1 $	$ \mathcal{U}^2 $	$ \mathcal{U}^3 $	$ \mathcal{U}^4 $	CPU	Cost	$ \mathcal{U}^1 $	$ \mathcal{U}^2 $	$ \mathcal{U}^3 $	$ \mathcal{U}^4 $	CPU
120-30-0.5-1	13038	8077	5979998	148462	109488	229.5	13038	5399	1008839	167166	121729	99.2
120-30-0.5-2	11922	12328	12766186	16082	12767	316.3	11922	12328	12766186	16082	12767	326.7
120-30-0.5-3	11191	13666	6044254	34521	27747	161.8	11191	10234	856061	29653	21488	47.0
120-30-0.5-4	11440	19859	11893932	11081	8564	456.6	11440	19859	11893932	11081	8564	474.1
120-30-0.6-1	12967	11552	9077630	73302	58522	305.4	12967	7027	1039136	92586	64516	57.0
120-30-0.6-2	11896	13343	11473223	16327	12379	273.4	11896	6105	146727	13473	8605	9.3
120-30-0.6-3	11156	14967	8190603	368086	176319	271.2	11156	10227	813807	95361	79742	45.0
120-30-0.6-4	11382	26728	12749952	56593	27534	572.5	11382	13199	929176	73184	25016	47.2
120-30-0.6-5	13314	16217	10297040	46370	34087	304.0	13314	7132	423032	62877	37942	29.3
120-30-0.7-1	12955	12324	8491512	195709	67217	306.4	12955	6929	719502	61302	61293	30.4
120-30-0.7-2	11886	11959	12010382	213092	167224	405.3	11886	11959	12010382	213092	167224	424.1
120-30-0.7-3	11152	0	0	0	0	3.6	11152	0	0	0	0	3.2
120-30-0.7-4	11366	26728	14887523	2472178	M	2153.1(M)	11366	10356	1511057	714172	604041	271.5
120-30-0.7-5	13285	14851	11693291	220091	160989	382.2	13285	6747	516305	147966	90602	33.2

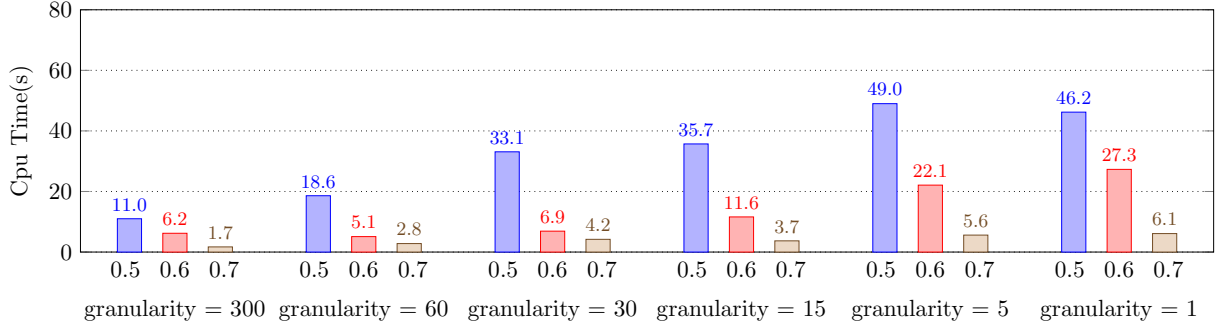
The following table, containing the summarized results for the standard-weight instances in S_A :

Table 2 Summary of the Results for Standard-Weight Instances in S_A

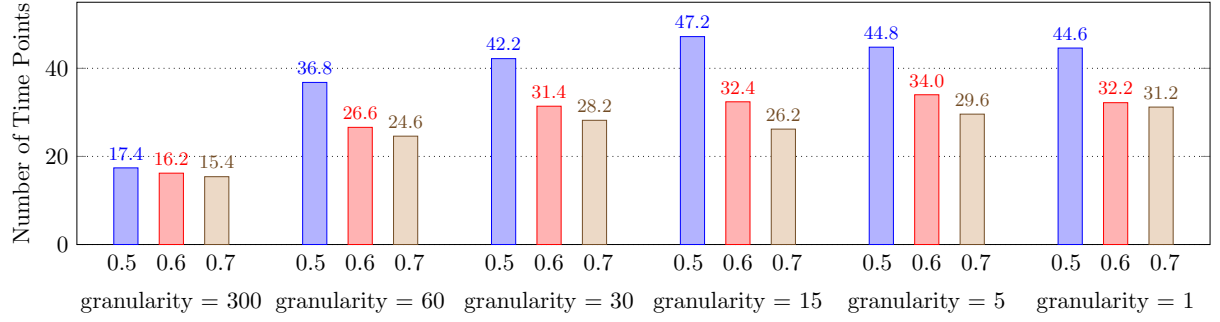
Name	Inst	Switch	<i>Step 1</i>			<i>Step 2</i>	<i>Step 3</i>			<i>Step 4</i>		CPU
			LB% ₀₀	$ \mathcal{T}^1 $	$ \mathcal{U}^1 $		$ \mathcal{U}^2 $	$ \mathcal{U}^3 $	$ \mathcal{U}^4 $	$ \hat{\mathcal{T}} $	$ \hat{\mathcal{U}} $	
60-10-0.5	5	0	5.0	6.2	132.8	0.0	81.6	38.0	31.6	0.0	0.0	0.1
60-10-0.6	5	0	4.5	5.2	121.0	0.0	77.2	38.2	35.8	0.0	0.0	0.1
60-10-0.7	5	0	3.6	4.6	101.0	0.0	81.2	40.6	33.2	0.0	0.0	0.1
60-20-0.5	5	0	3.0	8.4	447.2	0.0	159.4	52.0	48.0	0.0	0.0	0.2
60-20-0.6	5	1	1.1	7.6	750.2	0.0	110.0	37.6	25.4	0.0	0.0	0.2
60-20-0.7	5	0	0.3	7.0	421.2	0.0	39.2	15.0	9.6	0.0	0.0	0.1
60-30-0.5	2	0	4.6	12.0	746.5	0.0	1933.5	444.0	339.0	0.0	0.0	0.6
60-30-0.6	5	0	1.8	10.4	847.0	1.4	1559.6	525.6	451.0	0.0	0.0	0.7
60-30-0.7	5	1	1.5	9.6	1465.2	0.0	933.6	271.4	232.4	0.0	0.0	0.6
90-10-0.5	4	0	9.5	7.8	278.8	0.0	281.8	154.8	136.3	0.0	0.0	0.1
90-10-0.6	5	0	3.9	6.8	265.8	0.0	207.4	89.6	68.2	0.0	0.0	0.1
90-10-0.7	5	0	5.6	6.0	260.8	0.7	367.6	210.8	184.4	0.0	0.0	0.1
90-20-0.5	4	0	2.3	13.3	1074.5	0.0	3689.0	433.5	342.5	0.0	0.0	0.7
90-20-0.6	5	0	2.3	12.4	1073.0	0.0	2961.4	900.0	766.6	0.0	0.0	0.6
90-20-0.7	5	1	0.3	11.0	1905.4	0.3	17278.6	1468.2	1162.4	0.0	0.0	0.8
90-30-0.5	5	1	3.4	17.2	3695.4	0.6	213176.4	8205.2	6130.0	0.0	0.0	10.2
90-30-0.6	5	2	1.7	15.6	5053.8	0.2	201542.4	4919.2	3727.8	0.0	0.0	6.2
90-30-0.7	5	0	1.6	14.2	2588.8	0.0	19322.8	4950.4	4555.4	0.0	0.0	1.9
120-10-0.5	4	1	13.5	11.8	1161.8	1.3	12578.5	3710.0	2881.5	0.0	0.0	2.2
120-10-0.6	5	0	9.1	9.6	665.0	0.0	5233.8	2510.4	2241.8	0.0	0.0	0.5
120-10-0.7	5	0	7.9	7.6	688.0	0.0	4084.8	2812.4	2403.4	0.0	0.0	0.4
120-20-0.5	4	1	8.4	18.0	3811.3	0.5	270699.3	11684.5	9843.5	0.0	0.0	12.1
120-20-0.6	5	0	2.5	14.2	2904.0	0.0	44484.2	12432.8	10639.8	0.0	0.0	3.7
120-20-0.7	5	0	4.1	12.0	2338.2	0.0	74247.4	26794.6	21685.6	0.0	0.0	5.8
120-30-0.5	4	2	3.1	21.3	11955.0	0.2	6631254.5	55995.5	41137.0	0.0	0.0	236.8
120-30-0.6	5	0	1.7	18.2	8738.0	0.0	670375.6	67496.2	43164.2	0.0	0.0	37.6
120-30-0.7	5	1	1.8	16.6	8638.4	0.2	2951449.2	227306.4	184632.0	0.4	193.8	152.5

1.1 Results for the WTRP on Standard-Weight Instances with Various Granularities in S_B

The following figures using standard-weight instances with various time granularities :



(a) Average Computation Time



(b) Average Number of Discovered Time-Points

Figure 2 The Computation Time and Discovered Time-Points of the Obtained Solutions for Standard-Weight Instances with Different Time Granularities

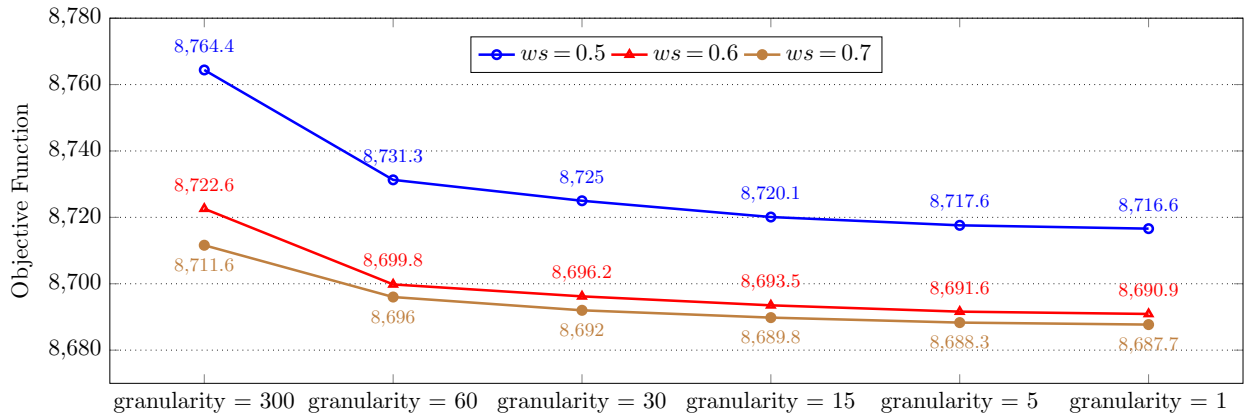


Figure 3 The Average Optimal Objective Value (in 5 Minutes) for Standard-Weight Instances with Different Granularities

1.2 Summary of the Results for the Standard-Weight Instances with 1-Second Granularity in S_B

Table 3 Summary of the Results for the WTFRP on Standard-Weight Instances with 1-Second Granularity in

S_B												
Name	Inst	Switch	Step 1			Step 2	Step 3			Step 4		CPU
			LB‰	$ \mathcal{T}^1 $	$ \mathcal{U}^1 $		$ \mathcal{U}^2 $	$ \mathcal{U}^3 $	$ \mathcal{U}^4 $	$ \hat{\mathcal{T}} $	$ \hat{\mathcal{U}} $	
60-10-0.5	5	0	2.22	8.0	118.6	0.00	69.2	27.2	24.8	0.0	0.0	0.1
60-10-0.6	5	0	0.71	5.6	137.6	0.00	55.0	19.4	16.4	0.0	0.0	0.0
60-10-0.7	5	0	0.93	5.8	115.6	0.00	85.6	32.0	25.6	0.0	0.0	0.0
60-20-0.5	5	2	3.63	18.2	407.4	0.92	3398.6	410.6	392.8	0.2	1.0	0.9
60-20-0.6	5	0	1.54	16.6	276.0	0.09	516.2	136.4	122.8	0.2	0.4	0.2
60-20-0.7	5	1	1.23	12.0	364.4	0.00	2364.4	134.8	120.8	0.0	0.0	0.2
60-30-0.5	5	2	5.26	38.6	938.6	1.10	28055.4	4427.4	4212.2	5.2	79.0	9.4
60-30-0.6	5	2	1.92	29.2	704.0	0.21	27567.2	1484.0	1426.0	0.6	50.0	4.8
60-30-0.7	5	1	0.81	23.4	548.0	0.63	8540.4	728.2	708.0	0.6	1.4	0.7
90-10-0.5	5	0	4.06	11.6	271.6	0.00	480.0	177.0	170.8	0.0	0.0	0.3
90-10-0.6	5	1	5.40	9.6	287.6	0.08	1429.2	281.6	266.4	0.0	0.0	0.7
90-10-0.7	5	0	5.14	6.8	234.0	0.03	513.0	280.6	274.2	0.4	0.2	0.1
90-20-0.5	5	0	1.97	31.8	977.8	0.17	10391.2	1168.4	1120.8	0.0	0.0	1.7
90-20-0.6	5	0	1.82	24.6	763.8	0.45	14598.4	2452.2	2191.8	0.0	0.0	1.7
90-20-0.7	5	1	0.33	18.4	737.6	0.01	31487.2	667.8	623.4	0.0	0.0	2.4
90-30-0.5	5	2	3.11	43.8	2883.8	0.52	899433.2	16069.0	14187.2	0.8	195.8	46.2
90-30-0.6	5	1	1.04	32.0	1908.6	0.00	662659.8	13131.2	10977.0	0.2	5.2	27.4
90-30-0.7	5	0	1.18	31.2	2376.4	0.00	85556.2	12388.8	11213.4	0.0	0.0	6.1
120-10-0.5	5	1	8.52	17.6	630.8	2.66	17778.6	4439.0	4124.0	0.4	5.0	2.9
120-10-0.6	5	0	6.73	12.2	523.0	0.00	6176.4	3473.4	3400.0	0.0	0.0	1.0
120-10-0.7	5	0	7	11.2	555.0	0.35	5562.8	3631.4	3593.4	0.0	0.0	1.1
120-20-0.5	5	2	6.43	45.8	2329.8	0.26	1903651.0	90525.2	82959.4	0.8	48.8	149.3
120-20-0.6	5	1	3.12	29.4	2228.2	0.23	560746.8	43610.6	41767.0	0.4	360.0	26.0
120-20-0.7	5	0	2.50	26.2	1580.4	0.07	203563.2	53741.8	52106.6	0.0	0.0	20.8
120-30-0.5	4(1)	1	2.23	58.8	8793.3	0.00	7419707.5	235912.0	217170.8	1.0	64.0	1750.6
120-30-0.6	5	0	0.67	41.6	7692.2	0.09	3539465.2	95743.8	87028.8	0.8	36.4	655.6
120-30-0.7	5(1)	0	1.02	42.0	8128.2	0.00	490823.6	83160.4	81834.0	0.0	0.0	277.4