

Results of the Strategic Oscillation for the Capacitated Hub Location Problem with Modular Links

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Instance	PrevTS			SO		
	Value	Dev	CPU	Value	Dev	CPU
10_600_89_60_40_1_60_CAB	237701	0.0%	0.0	237701	0.0%	0.0
10_700_50_60_8_1_60_AP	302921	10.6%	0.0	273801	0.0%	0.0
10_700_50_60_8_1_60_CAB	243854	0.0%	0.0	243854	0.0%	0.0
10_700_69_40_8_1_50_CAB	246610	0.0%	0.0	246610	0.0%	0.0
10_800_60_60_6_1_69_AP	283138	15.3%	0.0	245513	0.0%	0.0
10_800_60_60_6_1_69_CAB	238144	0.0%	0.0	238144	0.0%	0.0
10_800_60_80_8_1_80_CAB	240872	0.0%	0.0	240872	0.0%	0.0
15_500_50_60_40_1_60_CAB	290334	0.3%	0.0	289339	0.0%	0.0
15_600_80_89_6_1_69_CAB	291191	0.0%	0.1	291780	0.2%	0.0
15_600_80_89_8_1_60_CAB	302735	0.0%	0.0	302735	0.0%	0.0
15_700_89_60_40_1_60_CAB	289953	0.0%	0.0	289953	0.0%	0.0
15_800_50_60_40_1_60_CAB	295521	1.9%	0.1	290026	0.0%	0.0
15_900_80_89_40_1_60_CAB	290970	0.3%	0.1	290134	0.0%	0.0
20_700_50_60_8_1_60_AP	405786	3.0%	0.2	393788	0.0%	0.1
20_700_50_60_8_1_60_CAB	205817	17.5%	0.2	175103	0.0%	0.1
20_700_50_60_8_1_60_USA	137854	8.5%	0.1	127058	0.0%	0.1
20_700_69_40_8_1_50_AP	432081	3.6%	0.3	417187	0.0%	0.1
20_700_69_40_8_1_50_CAB	214323	17.2%	0.2	182900	0.0%	0.3
20_800_60_60_6_1_69_CAB	191608	16.6%	0.2	164351	0.0%	0.3
20_800_60_80_8_1_80_AP	385461	4.5%	0.6	368951	0.0%	0.2
20_800_60_80_8_1_80_CAB	197141	14.3%	0.2	172460	0.0%	0.3
20_800_60_80_8_1_80_USA	130508	7.8%	0.2	121071	0.0%	0.0
20_900_80_89_40_1_80_CAB	157723	4.0%	0.1	151598	0.0%	0.1
25_600_80_60_6_1_40_CAB	245429	16.5%	0.5	210724	0.0%	0.4
25_600_80_89_6_1_69_CAB	223798	9.4%	0.4	204602	0.0%	0.1
25_600_80_89_8_1_60_CAB	242246	16.8%	0.5	207446	0.0%	0.4
25_650_69_69_6_1_50_CAB	235844	16.7%	0.4	202119	0.0%	0.1
25_650_69_69_6_1_70_CAB	221333	40.5%	0.8	157539	0.0%	0.5
25_800_89_60_40_1_80_CAB	182474	1.1%	0.2	180408	0.0%	0.3
25_900_80_89_40_1_80_CAB	190129	5.3%	0.2	180586	0.0%	0.3
30_600_80_89_8_1_60_AP	392149	6.9%	0.1	366726	0.0%	0.2
30_700_69_40_8_1_50_USA	246833	26.6%	0.8	194970	0.0%	0.2
35_600_80_89_8_1_60_AP	478595	10.1%	0.3	434611	0.0%	0.6
35_600_80_89_8_1_60_USA	232360	12.8%	1.3	206063	0.0%	0.9
35_700_80_50_8_1_69_AP	482376	7.9%	1.5	447032	0.0%	0.3
40_600_80_89_8_1_60_USA	339760	23.2%	1.5	275732	0.0%	0.4
40_700_80_50_8_1_69_AP	511799	10.4%	2.3	463568	0.0%	1.2
40_700_80_50_8_1_69_USA	330583	18.2%	3.1	279572	0.0%	2.5
45_600_80_89_8_1_60_AP	578870	7.8%	2.3	536953	0.0%	2.5
45_700_69_40_8_1_50_AP	611473	0.6%	2.5	607672	0.0%	1.8
45_700_69_40_8_1_50_USA	339338	5.7%	3.3	320991	0.0%	3.0
50_600_80_89_8_1_60_USA	518779	48.5%	3.2	349460	0.0%	3.4
50_700_69_40_8_1_50_AP	669803	7.7%	9.1	622172	0.0%	3.0
50_700_80_50_8_1_69_AP	608050	7.6%	5.3	565087	0.0%	2.5
50_700_80_50_8_1_69_USA	374127	12.9%	7.4	331514	0.0%	2.9

Table 1: SO and PrevTS on small size instances

Instance	PrevTS			SO		
	Value	Dev	CPU	Value	Dev	CPU
55_500_60_69_60_1_50_AP	525642	0.0%	8.7	542146	3.1%	3.7
55_500_60_69_60_1_50_USA	378822	15.6%	9.6	327659	0.0%	5.2
55_800_69_50_80_1_60_AP	609771	0.0%	7.1	633097	3.8%	4.8
55_800_69_50_80_1_60_USA	416346	18.4%	5.3	351759	0.0%	3.2
60_500_60_69_60_1_50_AP	643461	10.9%	1.9	580361	0.0%	4.1
60_500_60_69_60_1_50_USA	615449	11.0%	5.9	554635	0.0%	6.3
60_600_60_69_60_1_69_USA	391313	19.1%	18.1	328468	0.0%	5.1
60_800_69_50_80_1_60_AP	702917	7.0%	4.9	656894	0.0%	5.8
60_800_69_50_80_1_60_USA	424505	20.4%	18.9	352466	0.0%	7.7
65_500_60_69_60_1_50_AP	665600	10.6%	12.3	601984	0.0%	10.4
65_600_60_69_60_1_69_AP	616365	6.2%	4.1	580367	0.0%	7.0
65_600_60_69_60_1_69_USA	435220	26.3%	8.3	344542	0.0%	7.5
65_800_69_50_80_1_60_USA	402210	8.2%	19.0	371628	0.0%	9.1
70_500_60_69_60_1_50_AP	733741	11.3%	8.2	659281	0.0%	8.7
70_600_60_69_60_1_69_AP	658758	8.4%	22.7	607509	0.0%	8.6
70_600_60_69_60_1_69_USA	428069	15.8%	38.4	369507	0.0%	14.0
70_800_69_50_80_1_60_AP	728949	0.0%	27.7	742895	1.9%	14.5
75_500_60_69_60_1_50_USA	698370	25.7%	14.7	555545	0.0%	11.2
75_600_60_69_60_1_69_AP	747985	4.3%	14.6	717444	0.0%	13.4
75_600_60_69_60_1_69_USA	568456	15.8%	77.6	491048	0.0%	21.0
75_800_69_50_80_1_60_AP	868528	5.9%	37.0	820259	0.0%	20.7
80_500_60_69_60_1_50_AP	780236	11.5%	58.8	699835	0.0%	35.5
80_500_60_69_60_1_50_USA	724155	15.6%	92.9	626601	0.0%	30.1
80_800_69_50_80_1_60_AP	988201	15.6%	15.7	854957	0.0%	15.2
80_800_69_50_80_1_60_USA	690769	5.8%	94.4	653204	0.0%	32.4
85_500_60_69_60_1_50_AP	886289	14.7%	152.4	772714	0.0%	91.2
85_500_60_69_60_1_50_USA	948813	22.2%	38.5	776354	0.0%	17.9
85_800_69_50_80_1_60_AP	1003536	16.0%	96.6	865260	0.0%	104.7
90_500_60_69_60_1_50_USA	904709	23.7%	278.0	731210	0.0%	40.1
90_600_60_69_60_1_69_AP	840072	3.6%	33.0	810722	0.0%	27.2
90_600_60_69_60_1_69_USA	742016	5.6%	166.9	702336	0.0%	84.9
90_800_69_50_80_1_60_AP	1124161	20.0%	23.4	936606	0.0%	29.0
95_500_60_69_60_1_50_AP	972840	15.7%	68.4	841016	0.0%	70.9
95_500_60_69_60_1_50_USA	964716	20.6%	55.3	800139	0.0%	26.7
95_600_60_69_60_1_69_AP	859425	6.5%	86.8	807075	0.0%	89.3
95_600_60_69_60_1_69_USA	723454	7.1%	284.4	675503	0.0%	140.5
100_500_60_69_60_1_50_USA	877730	13.1%	516.4	776085	0.0%	171.0

Table 2: SO and PrevTS on medium size instances

Instance	PrevTS			SO		
	Value	Dev	CPU	Value	Dev	CPU
110.500.60.69.60.1.50_AP	1451493	38.1%	67.4	1051407	0.0%	44.8
110.600.60.69.60.1.69_AP	1174251	25.2%	154.4	938250	0.0%	52.6
110.700.80.60.89.1.60_USA	1316582	13.4%	261.8	1161100	0.0%	67.7
110.800.69.50.80.1.60_USA	1296900	20.2%	103.6	1079127	0.0%	36.1
110.900.69.50.89.1.60_USA	1204417	4.6%	354.3	1151693	0.0%	61.2
120.500.60.69.60.1.50_AP	1349557	27.1%	113.1	1061782	0.0%	56.8
120.500.60.69.60.1.50_USA	1497383	28.6%	97.0	1164523	0.0%	48.2
120.700.80.60.89.1.60_USA	1247937	0.0%	281.2	1256590	0.7%	94.7
120.900.69.50.89.1.60_USA	1359133	10.9%	377.3	1226069	0.0%	100.7
125.500.60.69.60.1.50_AP	1498128	28.4%	208.4	1167146	0.0%	94.1
125.800.69.50.80.1.60_AP	1713025	23.8%	119.3	1383157	0.0%	66.4
130.600.60.69.60.1.69_AP	1426980	26.7%	146.0	1126476	0.0%	160.2
130.600.60.69.60.1.69_USA	1723043	35.0%	225.1	1276450	0.0%	74.8
130.800.69.50.80.1.60_USA	1663758	36.7%	537.6	1216964	0.0%	150.9
135.600.60.69.60.1.69_AP	1610997	33.0%	263.5	1211303	0.0%	209.3
135.800.69.50.80.1.60_USA	1584036	21.3%	4960.6	1306124	0.0%	180.1
140.500.60.69.60.1.50_AP	1691066	27.7%	579.7	1323974	0.0%	202.5
140.700.80.60.89.1.60_USA	1553768	0.0%	482.1	1561410	0.5%	185.0
140.800.69.50.80.1.60_AP	2130072	36.5%	293.3	1560792	0.0%	215.0
140.900.69.50.89.1.60_USA	1517790	0.0%	325.9	1517822	0.0%	179.4
145.600.80.69.60.1.50_AP	1825162	26.4%	379.8	1443675	0.0%	223.4
145.600.80.69.60.1.50_USA	609564	14.5%	256.3	532241	0.0%	233.0
145.800.69.50.80.1.60_AP	2114457	28.7%	381.0	1643198	0.0%	218.9
145.800.69.50.80.1.60_USA	715853	14.7%	227.1	624365	0.0%	230.2
150.1000.69.60.80.1.69_USA	614369	0.0%	299.1	666691	8.5%	278.6
150.800.69.50.80.1.60_AP	2200307	31.5%	698.3	1672925	0.0%	221.4
150.800.69.50.89.1.60_USA	594115	5.6%	437.9	562570	0.0%	257.6
150.900.69.50.89.1.60_AP	1822301	2.2%	232.0	1782301	0.0%	150.6
150.900.69.60.80.1.89_USA	584419	5.6%	272.3	553654	0.0%	258.1
155.1000.69.60.80.1.69_USA	727403	18.2%	430.0	615630	0.0%	232.5
155.500.60.69.60.1.50_AP	2061735	21.8%	166.2	1692582	0.0%	209.0
155.800.69.50.80.1.60_AP	2049217	28.1%	1408.1	1599216	0.0%	270.6
155.900.69.50.89.1.60_AP	2017260	14.0%	390.2	1769092	0.0%	226.9
155.900.69.50.89.1.60_USA	602944	2.5%	621.3	587975	0.0%	313.8
160.600.60.69.60.1.69_AP	711981	0.0%	183.6	721829	1.4%	363.1
160.800.69.50.80.1.60_AP	749451	0.0%	221.5	869439	16.0%	278.3
160.900.69.50.89.1.60_USA	636074	0.0%	270.2	636298	0.0%	333.4
160.900.80.50.60.1.69_AP	831947	6.7%	883.9	779805	0.0%	365.8
165.1000.69.60.80.1.69_USA	712118	8.5%	784.0	656114	0.0%	272.9
165.800.69.50.80.1.60_AP	1143618	16.9%	166.4	978268	0.0%	246.1
165.800.69.50.80.1.60_USA	767748	11.8%	838.5	686531	0.0%	302.7
170.500.60.69.60.1.50_AP	588784	0.0%	207.8	688647	17.0%	296.1
170.900.69.60.80.1.89_USA	623614	0.0%	872.5	623614	0.0%	298.3
170.900.80.50.60.1.69_AP	882645	6.8%	928.4	826445	0.0%	387.5
175.500.60.69.60.1.50_AP	889474	3.3%	615.2	860907	0.0%	315.0
175.600.60.69.60.1.69_AP	710911	5.2%	695.6	675774	0.0%	283.1
175.800.69.50.80.1.60_USA	790880	2.4%	1358.1	772340	0.0%	367.4
175.900.69.60.80.1.89_USA	652884	7.4%	1466.3	607724	0.0%	360.6
180.1000.69.60.80.1.69_USA	754360	8.2%	1536.1	697158	0.0%	379.5
180.600.60.69.60.1.69_AP	840658	10.0%	764.8	764080	0.0%	380.4
180.600.89.60.69.1.80_USA	594721	10.7%	1510.2	537212	0.0%	367.2
180.800.89.69.89.1.89_AP	1043978	17.8%	796.1	885947	0.0%	310.7
185.500.60.69.60.1.50_AP	885253	0.0%	282.6	885253	0.0%	486.7
185.600.80.89.89.1.89_AP	851397	8.0%	840.7	788688	0.0%	437.3
185.600.89.60.69.1.80_USA	522188	5.4%	782.2	495212	0.0%	417.0
185.800.69.50.80.1.60_AP	796454	0.0%	1595.3	885195	11.1%	510.2
185.900.69.60.80.1.89_USA	615474	0.0%	576.8	615474	0.0%	390.2
190.600.60.69.60.1.69_AP	970614	18.2%	558.1	821318	0.0%	311.4
190.600.80.89.89.1.89_AP	731291	0.0%	1648.0	731127	0.0%	590.1
190.600.89.60.69.1.80_USA	626170	16.5%	1491.6	537256	0.0%	571.5
190.700.89.69.89.1.89_USA	552331	0.0%	1276.5	552331	0.0%	577.8
190.800.69.50.80.1.60_AP	1212471	16.0%	631.8	1045263	0.0%	559.3
195.600.60.69.60.1.69_AP	759008	6.4%	1971.1	713616	0.0%	618.1
195.800.69.50.80.1.60_AP	1580425	35.3%	617.6	1168347	0.0%	491.6
195.900.89.89.89.1.69_AP	1254423	18.9%	1839.4	1055289	0.0%	623.6
200.500.60.69.60.1.50_AP	868511	25.3%	1641.4	693180	0.0%	766.3
200.700.80.60.89.1.60_USA	866749	6.4%	2353.8	814716	0.0%	660.6
200.800.69.50.80.1.60_AP	815087	6.8%	2419.5	763349	0.0%	745.8

Table 3: SO and PrevTS on large size instances of the testing set