Electronic Companion—"A Branch-Price-and-Cut Algorithm for the Vehicle Routing Problem with Release and Due Dates"

EC.1. Detailed results for the instances of class A by CG1 and CG2

In section 4.2, we have reported the aggregated results of the linear relaxation by CG1 and CG2. In this section, the corresponding detailed results are presented in Tables EC.1-EC.5. Each name of instance gives the number of vertices including the depot and the number of available vehicles. The subscript 1 (or 2, 3, 4, 5) indicates that the instance is generated by using parameter $\theta = 0.05$ (or 0.10, 0.15, 0.20, 0.25). For example, the instance '$A - n32 - k5_1$' has 31 customers and 5 available vehicles. The instance is generated by using parameter $\theta = 0.05$. Column f^L_{opt} reports the optimal value of the linear relaxation for the respective instance. The other columns have the same meaning as in Table 1.

Table EC. 1: Detailed results for the instances of class A with $\theta = 0.05$ by CG1 and CG2

Instances	f^L_{opt}	CG1		CG2	
		#iter	$t_{lp}(s)$	#iter	$t_{lp}(s)$
$A - n32 - k5_1$	1127.17	24	1.1	24	3.1
$A - n33 - k5_1$	813.75	26	1.6	35	26.1
$A - n33 - k6_1$	896.21	18	0.9	26	8.5
$A - n34 - k5_1$	893.76	28	2.4	36	22.4
$A - n36 - k5_1$	1051.30	27	1.8	39	38.6
$A - n37 - k5_1$	813.38	28	2.5	45	48.9
$A - n37 - k6_1$	1226.00	31	2.7	60	53.4
$A - n38 - k5_1$	851.53	49	17.7	89	420.5
$A - n39 - k5_1$	1004.50	39	11.3	65	360.4
$A - n39 - k6_1$	1071.50	24	1.8	22	9.3
$A - n44 - k6_1$	1140.90	36	8.8	94	385.1
$A - n45 - k6_1$	1103.77	61	67.6	107	1074.4
$A - n45 - k7_1$	1617.88	25	2.1	40	27.6
$A - n46 - k7_1$	1201.06	26	1.4	31	6.2
$A - n48 - k7_1$	1384.30	26	3.0	40	31.2
$A - n53 - k7_1$	1302.22	48	36.2	82	638.8
$A - n54 - k7_1$	1511.56	44	14.1	74	451.2
$A - n55 - k9_1$	1317.96	36	2.6	46	75.1
$A - n60 - k9_1$	1698.61	45	5.7	52	87.5
$A - n61 - k9_1$	1151.30	61	63.5	121	1736.9
$A - n62 - k8_1$	1664.17	55	28.7	79	663.6
$A - n63 - k9_1$	2203.38	60	48.2	104	1398.7
$A - n63 - k10_1$	1714.65	43	7.2	46	61.6
$A - n64 - k9_1$	1818.20	48	11.8	47	339.9
$A - n65 - k9_1$	1335.38	52	58.5	90	966.0
$A - n69 - k9_1$	1369.55	71	41.2	163	3455.9
$A - n80 - k10_1$	2314.03	58	82.4	–	–

Table EC. 2: Detailed results for the instances of class A with $\theta = 0.10$ by CG1 and CG2

Instances	f_{opt}^L	CG1		CG2	
		#iter	$t_{lp}(s)$	#iter	$t_{lp}(s)$
$A - n32 - k5_2$	1111.00	19	0.9	19	2.8
$A - n33 - k5_2$	825.83	18	1.1	23	7.6
$A - n33 - k6_2$	950.55	19	0.9	21	7.0
$A - n34 - k5_2$	862.41	23	1.7	33	18.4
$A - n36 - k5_2$	1098.07	34	3.2	37	65.4
$A - n37 - k5_2$	831.25	28	2.5	41	59.3
$A - n37 - k6_2$	1215.46	37	3.8	61	75.4
$A - n38 - k5_2$	851.34	49	19.8	80	369.2
$A - n39 - k5_2$	1020.71	62	33.7	95	422.9
$A - n39 - k6_2$	1117.25	29	2.2	21	8.3
$A - n44 - k6_2$	1170.29	29	7.1	50	211.3
$A - n45 - k6_2$	1098.32	62	40.5	–	–
$A - n45 - k7_2$	1626.08	28	2.4	67	82.5
$A - n46 - k7_2$	1197.50	27	1.3	23	4.1
$A - n48 - k7_2$	1465.00	29	3.8	51	84.5
$A - n53 - k7_2$	1330.17	45	19.2	95	545.3
$A - n54 - k7_2$	1568.46	46	27.1	58	431.6
$A - n55 - k9_2$	1364.23	35	3.1	48	68.7
$A - n60 - k9_2$	1731.66	33	4.9	46	70.1
$A - n61 - k9_2$	1174.13	59	50.6	107	1580.8
$A - n62 - k8_2$	1757.05	57	36.8	87	557.3
$A - n63 - k9_2$	2285.87	46	32.9	102	796.9
$A - n63 - k10_2$	1735.13	38	6.3	40	59.1
$A - n64 - k9_2$	1904.07	46	13.9	65	673.3
$A - n65 - k9_2$	1402.72	78	92.1	220	2150.4
$A - n69 - k9_2$	1377.69	66	35.1	141	1874.2
$A - n80 - k10_2$	2401.32	57	66.3	106	2023.2

Table EC. 3: Detailed results for the instances of class A with $\theta = 0.15$ by CG1 and CG2

Instances	f_{opt}^L	CG1		CG2	
		#iter	$t_{lp}(s)$	#iter	$t_{lp}(s)$
$A - n32 - k5_3$	1136.63	27	1.2	22	3.8
$A - n33 - k5_3$	807.42	21	1.4	36	24.6
$A - n33 - k6_3$	930.00	26	1.2	26	9.8
$A - n34 - k5_3$	936.21	26	2.5	44	42.3
$A - n36 - k5_3$	1094.75	31	2.3	35	30.3
$A - n37 - k5_3$	847.87	38	5.4	36	62.2
$A - n37 - k6_3$	1300.17	33	3.3	74	83.4
$A - n38 - k5_3$	848.11	62	29.7	90	569.4
$A - n39 - k5_3$	1072.52	41	18.3	56	516.3
$A - n39 - k6_3$	1158.00	25	2.3	20	8.6
$A - n44 - k6_3$	1180.94	30	6.4	43	138.4
$A - n45 - k6_3$	1134.75	58	61.4	110	3516.5
$A - n45 - k7_3$	1614.17	27	3.4	40	53.3
$A - n46 - k7_3$	1238.33	33	1.7	34	13.3
$A - n48 - k7_3$	1468.75	34	4.2	30	21.7
$A - n53 - k7_3$	1350.21	47	26.0	126	988.0
$A - n54 - k7_3$	1575.56	46	41.6	71	421.8
$A - n55 - k9_3$	1418.25	32	2.8	43	74.0
$A - n60 - k9_3$	1723.09	40	6.9	63	100.4
$A - n61 - k9_3$	1216.06	51	58.1	89	1797.4
$A - n62 - k8_3$	1730.78	54	38.7	73	813.2
$A - n63 - k9_3$	2434.97	35	38.4	82	1318.3
$A - n63 - k10_3$	1778.74	52	13.4	57	366.0
$A - n64 - k9_3$	1973.66	47	16.2	60	572.1
$A - n65 - k9_3$	1421.83	81	116.9	238	2699.5
$A - n69 - k9_3$	1380.82	77	57.3	–	–
$A - n80 - k10_3$	2488.87	47	151.9	98	3085.8

Table EC. 4: Detailed results for the instances of class A with $\theta = 0.20$ by CG1 and CG2

Instances	f_{opt}^L	CG1		CG2	
		#iter	$t_{lp}(s)$	#iter	$t_{lp}(s)$
$A - n32 - k5_4$	1185.83	20	1.0	21	2.9
$A - n33 - k5_4$	876.08	21	1.5	30	21.4
$A - n33 - k6_4$	955.60	19	1.0	18	6.1
$A - n34 - k5_4$	903.19	22	2.8	28	15.7
$A - n36 - k5_4$	1055.58	29	3.1	52	86.1
$A - n37 - k5_4$	838.80	27	3.3	34	102.0
$A - n37 - k6_4$	1293.11	34	3.6	71	80.7
$A - n38 - k5_4$	962.49	53	26.0	112	589.6
$A - n39 - k5_4$	1156.15	30	15.2	67	591.8
$A - n39 - k6_4$	1156.50	32	2.0	30	23.2
$A - n44 - k6_4$	1182.77	33	6.5	48	156.1
$A - n45 - k6_4$	1160.67	66	80.8	109	1080.8
$A - n45 - k7_4$	1732.37	29	3.1	56	79.0
$A - n46 - k7_4$	1252.35	27	1.6	24	5.0
$A - n48 - k7_4$	1496.42	31	4.4	38	36.2
$A - n53 - k7_4$	1376.97	49	33.3	75	445.6
$A - n54 - k7_4$	1610.55	40	33.2	60	655.1
$A - n55 - k9_4$	1413.69	43	4.8	79	171.1
$A - n60 - k9_4$	1758.60	42	6.2	55	114.8
$A - n61 - k9_4$	1257.79	55	53.7	91	2290.6
$A - n62 - k8_4$	1842.07	48	66.2	65	1212.7
$A - n63 - k9_4$	2370.99	49	60.3	–	–
$A - n63 - k10_4$	1811.28	35	5.4	52	109.7
$A - n64 - k9_4$	2035.84	43	17.4	68	1642.9
$A - n65 - k9_4$	1472.94	79	206.0	207	1917.0
$A - n69 - k9_4$	1479.77	71	68.3	–	–
$A - n80 - k10_4$	2504.54	49	158.7	–	–

Table EC. 5: Detailed results for the instances of class A with $\theta = 0.25$ by CG1 and CG2

Instances	f_{opt}^L	CG1		CG2	
		#iter	$t_{lp}(s)$	#iter	$t_{lp}(s)$
$A - n32 - k5_5$	1156.60	23	1.3	23	4.7
$A - n33 - k5_5$	921.65	22	1.3	35	30.4
$A - n33 - k6_5$	941.36	20	1.1	26	9.8
$A - n34 - k5_5$	925.62	26	2.9	37	24.3
$A - n36 - k5_5$	1138.25	25	2.8	33	57.5
$A - n37 - k5_5$	832.00	31	3.5	40	103.5
$A - n37 - k6_5$	1335.12	28	3.4	50	86.2
$A - n38 - k5_5$	922.33	61	40.8	75	542.7
$A - n39 - k5_5$	1107.12	36	18.1	60	622.3
$A - n39 - k6_5$	1192.50	28	2.7	27	17.4
$A - n44 - k6_5$	1195.63	33	8.4	75	395.4
$A - n45 - k6_5$	1149.25	62	63.2	–	–
$A - n45 - k7_5$	1755.04	25	3.5	44	99.3
$A - n46 - k7_5$	1307.67	28	1.6	31	8.2
$A - n48 - k7_5$	1509.21	31	4.7	38	72.7
$A - n53 - k7_5$	1402.72	46	41.3	84	968.0
$A - n54 - k7_5$	1670.89	43	45.3	69	899.2
$A - n55 - k9_5$	1432.66	44	4.0	49	57.8
$A - n60 - k9_5$	1838.45	38	8.0	55	199.9
$A - n61 - k9_5$	1274.86	51	63.0	110	2993.2
$A - n62 - k8_5$	1832.64	52	55.9	77	1505.0
$A - n63 - k9_5$	2533.70	50	60.9	88	1992.2
$A - n63 - k10_5$	1849.63	33	6.0	32	97.1
$A - n64 - k9_5$	2077.46	48	15.9	53	606.8
$A - n65 - k9_5$	1519.32	73	163.1	242	3332.7
$A - n69 - k9_5$	1503.68	52	50.4	110	2455.8
$A - n80 - k10_5$	2657.40	61	207.1	–	–

EC.2. Detailed results for the selected instances by BPC1 and BPC2

Tables EC.6-EC.10 report the detailed results for the selected instances that can not be solved to optimality in the root node. Column f_{opt}^I reports the objective function value of the optimal solution for each instance. The other columns have the same meaning as in Table 2.

Table EC. 6: Detailed results for the selected instances of class A with $\theta = 0.05$ by BPC1 and BPC2

Instances	f_{opt}^I	BPC1		BPC2			
		#Nodes	$t_T(s)$	#Nodes	$t_T(s)$	$\Delta_{Nodes}(\%)$	$\Delta_{t_T}(\%)$
$A - n36 - k5_1$	1081.0	2	19.4	3	24.1	50.00	24.23
$A - n45 - k7_1$	1636.0	5	18.4	3	14.7	-40.00	-20.11
$A - n46 - k7_1$	1214.5	9	14.4	7	12.3	-22.22	-14.58
$A - n55 - k9_1$	1344.5	7	21.7	8	26.7	14.29	23.04
$A - n61 - k9_1$	1178.5	15	1285.5	22	1096.3	46.67	-14.72
$A - n63 - k9_1$	2234.5	17	310.8	24	393.4	41.18	26.58
$A - n64 - k9_1$	1854.0	105	1178.0	163	1738.3	55.24	47.56
$A - n65 - k9_1$	1360.0	3	171.0	3	157.6	0.00	-7.84

Table EC. 7: Detailed results for the selected instances of class A with $\theta = 0.10$ by BPC1 and BPC2

Instances	f_{opt}^I	BPC1		BPC2			
		#Nodes	$t_T(s)$	#Nodes	$t_T(s)$	$\Delta_{Nodes}(\%)$	$\Delta_{t_T}(\%)$
$A - n33 - k6_2$	966.0	5	6.1	5	6.0	0.00	-1.64
$A - n34 - k5_2$	890.0	3	8.2	3	8.1	0.00	-1.22
$A - n36 - k5_2$	1125.5	3	17.0	3	15.7	0.00	-7.65
$A - n53 - k7_2$	1360.0	3	299.8	3	279.5	0.00	-6.77
$A - n54 - k7_2$	1596.0	7	339.0	7	324.3	0.00	-4.34
$A - n55 - k9_2$	1387.5	2	11.6	2	11.9	0.00	2.59
$A - n60 - k9_2$	1770.0	25	187.4	37	264.2	48.00	40.98
$A - n61 - k9_2$	1217.5	21	3124.5	31	2985.3	47.62	-4.46
$A - n63 - k9_2$	2317.5	5	241.4	5	204.2	0.00	-15.41
$A - n63 - k10_2$	1769.0	9	120.7	12	113.9	33.33	-5.63
$A - n64 - k9_2$	1937.0	41	613.4	69	881.3	68.29	43.67
$A - n69 - k9_2$	1420.5	17	762.7	11	516.4	-35.29	-32.29

Table EC. 8: Detailed results for the selected instances of class A with $\theta = 0.15$ by BPC1 and BPC2

Instances	f_{opt}^I	BPC1		BPC2			
		#Nodes	$t_T(s)$	#Nodes	$t_T(s)$	$\Delta_{Nodes}(\%)$	$\Delta_{t_T}(\%)$
$A - n45 - k7_3$	1633.0	4	25.0	3	24.0	-25.00	-4.00
$A - n53 - k7_3$	1381.5	9	503.5	9	448.8	0.00	-10.86
$A - n54 - k7_3$	1595.0	3	143.5	5	153.0	66.67	6.62
$A - n55 - k9_3$	1444.5	3	19.5	3	18.9	0.00	-3.08
$A - n60 - k9_3$	1762.0	7	99.1	7	96.2	0.00	-2.93
$A - n61 - k9_3$	1254.5	15	1473.6	19	1586.2	26.67	7.64
$A - n63 - k9_3$	2474.5	24	732.3	22	589.8	-8.33	-19.46
$A - n63 - k10_3$	1800.0	3	35.8	5	41.3	66.67	15.36
$A - n64 - k9_3$	2005.5	39	512.8	87	818.5	123.08	59.61
$A - n65 - k9_3$	1449.5	3	184.5	3	185.2	0.00	0.38
$A - n69 - k9_3$	1406.0	11	381.9	12	367.8	9.09	-3.69

Table EC. 9: Detailed results for the selected instances of class A with $\theta = 0.20$ by BPC1 and BPC2

Instances	f_{opt}^I	BPC1		BPC2			
		#Nodes	$t_T(s)$	#Nodes	$t_T(s)$	$\Delta_{Nodes}(\%)$	$\Delta_{t_T}(\%)$
$A-n33-k6_4$	965.0	3	5.1	3	5.0	0.00	-1.96
$A-n60-k9_4$	1786.0	4	69.5	5	68.0	25.00	-2.16
$A-n62-k8_4$	1870.5	13	1954.4	11	1834.0	-15.38	-6.16
$A-n64-k9_4$	2072.5	147	1618.4	281	3243.0	91.16	100.38
$A-n65-k9_4$	1502.5	6	351.4	6	428.0	0.00	21.80
$A-n69-k9_4$	1506.0	5	331.7	5	342.0	0.00	3.11
$A-n80-k10_4$	2539.5	7	1616.7	11	2173.0	57.14	34.41

Table EC. 10: Detailed results for the selected instances of class A with $\theta = 0.25$ by BPC1 and BPC2

Instances	f_{opt}^I	BPC1		BPC2			
		#Nodes	$t_T(s)$	#Nodes	$t_T(s)$	$\Delta_{Nodes}(\%)$	$\Delta_{t_T}(\%)$
$A-n37-k6_5$	1370.0	3	27.7	3	28.5	0.00	2.89
$A-n39-k5_5$	1134.0	6	287.3	12	267.1	100.00	-7.03
$A-n45-k7_5$	1779.5	3	49.2	5	65.1	66.67	32.32
$A-n46-k7_5$	1326.0	4	11.0	5	11.5	25.00	4.55
$A-n53-k7_5$	1438.5	3	925.4	3	821.7	0.00	-11.21
$A-n54-k7_5$	1706.0	27	3580.5	29	2423.2	7.41	-32.32
$A-n62-k8_5$	1857.0	13	945.2	17	976.7	30.77	3.33
$A-n63-k9_5$	2558.5	5	230.1	3	176.2	-40.00	-23.42
$A-n63-k10_5$	1877.5	9	172.8	7	129.5	-22.22	-25.06
$A-n64-k9_5$	2104.0	17	472.6	35	665.1	105.88	40.73
$A-n69-k9_5$	1529.5	21	663.2	19	451.7	-9.52	-31.89

EC.3. Detailed results for all VRPRD instances

Tables EC.11-EC.30 report the detailed results for all VRPRD instances. Column f_{opt}^I has the same meaning as in section EC.2. The other columns have the same meaning as in Table 3.

Table EC. 11: Detailed results for the instances of class A with $\theta = 0.05$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$A-n32-k5_1$	1138.5	5.0	3	7	1	5.0
$A-n33-k5_1$	827.5	5.1	18	7	1	5.1
$A-n33-k6_1$	904.5	3.0	7	15	1	3.0
$A-n34-k5_1$	915.0	9.6	22	9	1	9.6
$A-n36-k5_1$	1081.0	15.0	8	37	2	19.4
$A-n37-k5_1$	839.0	10.6	13	15	1	10.7
$A-n37-k6_1$	1251.5	9.9	25	7	1	9.9
$A-n38-k5_1$	894.0	45.3	34	13	1	45.3
$A-n39-k5_1$	1018.5	26.8	18	13	1	26.8
$A-n39-k6_1$	1071.5	2.0	0	1	1	2.0
$A-n44-k6_1$	1147.0	12.7	6	7	1	12.7
$A-n45-k6_1$	1122.0	180.1	28	25	1	180.1
$A-n45-k7_1$	1636.0	10.9	25	19	5	18.4
$A-n46-k7_1$	1214.5	5.9	21	13	9	14.4
$A-n48-k7_1$	1406.0	15.6	20	25	1	15.6
$A-n53-k7_1$	1325.5	304.7	33	37	1	304.7
$A-n54-k7_1$	1532.0	77.5	18	27	1	77.5
$A-n55-k9_1$	1344.5	10.4	35	19	7	21.7
$A-n60-k9_1$	1731.0	77.3	44	27	1	77.3
$A-n61-k9_1$	1178.5	285.4	36	37	15	1285.5
$A-n62-k8_1$	1684.0	165.4	50	7	1	165.4
$A-n63-k9_1$	2234.5	123.5	61	31	17	310.8
$A-n63-k10_1$	1741.0	32.4	20	21	1	32.4
$A-n64-k9_1$	1854.0	55.9	21	31	105	1178.0
$A-n65-k9_1$	1360.0	134.8	47	37	3	171.0

Table EC. 12: Detailed results for the instances of class A with $\theta = 0.10$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$A - n32 - k5_2$	1111.0	1.0	0	1	1	1.0
$A - n33 - k5_2$	849.5	4.7	20	9	1	4.7
$A - n33 - k6_2$	966.0	3.3	8	19	5	6.1
$A - n34 - k5_2$	890.0	6.2	17	13	3	8.2
$A - n36 - k5_2$	1125.5	10.8	10	19	3	17.0
$A - n37 - k5_2$	860.5	14.5	8	25	1	14.5
$A - n37 - k6_2$	1244.0	18.3	22	19	1	18.3
$A - n38 - k5_2$	888.0	50.5	23	15	1	50.6
$A - n39 - k5_2$	1034.5	55.2	16	7	1	55.2
$A - n39 - k6_2$	1123.0	3.5	3	3	1	3.5
$A - n44 - k6_2$	1177.0	12.1	10	7	1	12.1
$A - n45 - k6_2$	1108.0	88.5	25	5	1	88.5
$A - n45 - k7_2$	1644.0	6.6	18	7	1	6.6
$A - n46 - k7_2$	1211.0	6.9	22	19	1	6.9
$A - n48 - k7_2$	1492.5	20.3	18	21	1	20.3
$A - n53 - k7_2$	1360.0	233.6	38	37	3	299.8
$A - n54 - k7_2$	1596.0	152.1	22	43	7	339.0
$A - n55 - k9_2$	1387.5	10.3	33	13	2	11.6
$A - n60 - k9_2$	1770.0	44.2	38	25	25	187.4
$A - n61 - k9_2$	1217.5	828.2	60	50	21	3124.5
$A - n62 - k8_2$	1765.5	176.8	28	7	1	176.8
$A - n63 - k9_2$	2317.5	143.7	48	49	5	241.4
$A - n63 - k10_2$	1769.0	48.1	28	37	9	120.7
$A - n64 - k9_2$	1937.0	85.3	14	31	41	613.4
$A - n65 - k9_2$	1429.5	186.9	49	19	1	186.9
$A - n69 - k9_2$	1420.5	222.4	45	43	17	762.7

Table EC. 13: Detailed results for the instances of class A with $\theta = 0.15$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$A - n32 - k5_3$	1139.5	1.3	1	1	1	1.3
$A - n33 - k5_3$	828.0	7.7	22	15	1	7.7
$A - n33 - k6_3$	936.0	2.4	8	3	1	2.4
$A - n34 - k5_3$	951.5	8.8	21	3	1	8.8
$A - n36 - k5_3$	1115.5	7.9	5	21	1	7.9
$A - n37 - k5_3$	879.5	23.8	10	23	1	23.8
$A - n37 - k6_3$	1320.5	13.0	21	17	1	13.1
$A - n38 - k5_3$	895.5	68.4	27	25	1	68.4
$A - n39 - k5_3$	1090.0	58.7	12	15	1	58.7
$A - n39 - k6_3$	1158.0	2.3	0	1	1	2.3
$A - n44 - k6_3$	1195.5	28.0	15	25	1	28.0
$A - n45 - k6_3$	1154.0	227.3	17	19	1	227.4
$A - n45 - k7_3$	1633.0	17.1	32	25	4	25.0
$A - n46 - k7_3$	1245.0	3.7	1	11	1	3.7
$A - n48 - k7_3$	1483.5	8.2	10	1	1	8.2
$A - n53 - k7_3$	1381.5	182.0	32	31	9	503.5
$A - n54 - k7_3$	1595.0	103.2	26	25	3	143.5
$A - n55 - k9_3$	1444.5	14.9	39	25	3	19.5
$A - n60 - k9_3$	1762.0	62.1	48	31	7	99.1
$A - n61 - k9_3$	1254.5	445.5	39	49	15	1473.6
$A - n62 - k8_3$	1746.0	240.3	40	9	1	240.3
$A - n63 - k9_3$	2474.5	146.8	39	37	24	732.3
$A - n63 - k10_3$	1800.0	28.4	12	25	3	35.8
$A - n64 - k9_3$	2005.5	60.0	19	19	39	512.8
$A - n65 - k9_3$	1449.5	160.6	35	13	3	184.5
$A - n69 - k9_3$	1406.0	159.8	26	25	11	381.9

Table EC. 14: Detailed results for the instances of class A with $\theta = 0.20$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$A - n32 - k5_4$	1188.0	1.6	2	3	1	1.6
$A - n33 - k5_4$	887.5	4.2	9	3	1	4.2
$A - n33 - k6_4$	965.0	3.8	7	19	3	5.1
$A - n34 - k5_4$	927.0	14.1	20	15	1	14.2
$A - n36 - k5_4$	1079.0	16.2	9	25	1	16.2
$A - n37 - k5_4$	875.0	24.8	17	23	1	24.8
$A - n37 - k6_4$	1319.5	20.7	15	35	1	20.7
$A - n38 - k5_4$	995.0	65.1	21	19	1	65.1
$A - n39 - k5_4$	1181.5	164.3	19	35	1	164.3
$A - n39 - k6_4$	1156.5	2.2	0	1	1	2.2
$A - n44 - k6_4$	1200.5	42.5	11	17	1	42.5
$A - n45 - k6_4$	1184.5	289.3	20	17	1	289.3
$A - n45 - k7_4$	1747.5	9.2	19	7	1	9.2
$A - n46 - k7_4$	1255.0	2.6	1	7	1	2.6
$A - n48 - k7_4$	1516.5	20.1	14	15	1	20.1
$A - n53 - k7_4$	1405.0	444.5	28	43	1	444.5
$A - n55 - k9_4$	1436.5	18.0	35	15	1	18.0
$A - n60 - k9_4$	1786.0	49.4	48	13	4	69.5
$A - n62 - k8_4$	1870.5	640.8	29	37	13	1954.4
$A - n63 - k9_4$	2384.5	110.9	23	19	1	110.9
$A - n63 - k10_4$	1833.5	33.9	34	19	1	34.0
$A - n64 - k9_4$	2072.5	63.7	21	13	147	1618.4
$A - n65 - k9_4$	1502.5	280.4	48	19	6	351.4
$A - n69 - k9_4$	1506.0	232.7	31	31	5	331.7
$A - n80 - k10_4$	2539.5	875.8	22	43	7	1616.7

Table EC. 15: Detailed results for the instances of class A with $\theta = 0.25$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$A - n32 - k5_5$	1177.5	3.7	6	7	1	3.7
$A - n33 - k5_5$	945.0	5.2	11	11	1	5.2
$A - n33 - k6_5$	951.0	2.6	8	9	1	2.6
$A - n34 - k5_5$	956.0	18.2	25	19	1	18.2
$A - n36 - k5_5$	1156.5	6.6	4	13	1	6.6
$A - n37 - k5_5$	854.0	13.4	13	7	1	13.4
$A - n37 - k6_5$	1370.0	19.5	19	25	3	27.7
$A - n38 - k5_5$	969.0	94.0	20	25	1	94.0
$A - n39 - k5_5$	1134.0	94.1	11	25	12	287.3
$A - n39 - k6_5$	1192.5	2.9	0	1	1	2.9
$A - n44 - k6_5$	1209.0	28.3	14	15	1	28.3
$A - n45 - k6_5$	1185.0	300.2	30	17	1	300.2
$A - n45 - k7_5$	1779.5	37.8	24	37	3	49.2
$A - n46 - k7_5$	1326.0	7.4	8	25	4	11.0
$A - n48 - k7_5$	1530.0	13.2	13	5	1	13.2
$A - n53 - k7_5$	1438.5	571.4	30	50	3	925.4
$A - n54 - k7_5$	1706.0	400.6	20	37	27	3580.5
$A - n55 - k9_5$	1462.5	19.4	38	25	1	19.4
$A - n60 - k9_5$	1873.5	54.3	29	15	1	54.3
$A - n62 - k8_5$	1857.0	358.8	27	13	13	945.2
$A - n63 - k9_5$	2558.5	149.2	27	25	5	230.1
$A - n63 - k10_5$	1877.5	76.1	24	49	9	172.8
$A - n64 - k9_5$	2104.0	112.5	16	43	17	472.6
$A - n65 - k9_5$	1521.5	160.7	5	1	1	160.7

Table EC. 16: Detailed results for the instances of class B with $\theta = 0.05$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$B - n31 - k5_1$	1218.5	4.0	11	7	5	6.8
$B - n34 - k5_1$	1252.0	23.9	20	3	1	23.9
$B - n35 - k5_1$	1831.0	3.3	14	7	1	3.3
$B - n38 - k6_1$	1298.0	4.1	12	9	1	4.1
$B - n39 - k5_1$	990.5	27.2	12	7	3	34.2
$B - n41 - k6_1$	1317.0	16.9	8	13	1	16.9
$B - n43 - k6_1$	1058.0	9.5	9	1	1	9.5
$B - n44 - k7_1$	1526.5	9.6	12	19	1	9.6
$B - n45 - k5_1$	927.0	697.8	29	13	3	902.0
$B - n45 - k6_1$	966.5	697.6	23	31	12	2625.3
$B - n50 - k7_1$	1098.5	9.8	22	11	1	9.8
$B - n50 - k8_1$	1951.0	64.3	36	25	4	88.0
$B - n52 - k7_1$	1367.5	56.4	6	1	1	56.4
$B - n56 - k7_1$	1286.5	37.1	14	13	20	169.6
$B - n57 - k9_1$	3038.0	11.0	21	11	1	11.0
$B - n57 - k7_1$	2046.0	3474.3	22	9	1	3474.3
$B - n63 - k10_1$	2725.0	62.2	42	13	1	62.2
$B - n66 - k9_1$	2177.5	333.2	25	13	30	2122.9
$B - n68 - k9_1$	2244.5	550.1	35	25	3	636.2

Table EC. 17: Detailed results for the instances of class B with $\theta = 0.10$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$B - n31 - k5_2$	1243.0	2.3	4	3	1	2.3
$B - n34 - k5_2$	1276.5	21.3	14	5	1	21.3
$B - n35 - k5_2$	1803.0	2.4	9	7	1	2.4
$B - n38 - k6_2$	1303.0	2.5	6	1	1	2.5
$B - n39 - k5_2$	1027.0	33.9	12	7	10	105.8
$B - n41 - k6_2$	1271.5	15.6	6	1	1	15.6
$B - n43 - k6_2$	1088.5	27.9	19	19	3	51.2
$B - n44 - k7_2$	1583.0	19.5	22	13	3	24.0
$B - n45 - k5_2$	917.0	994.3	21	5	1	994.3
$B - n45 - k6_2$	1024.0	910.1	21	31	7	1946.7
$B - n50 - k7_2$	1121.5	7.0	8	3	1	7.0
$B - n50 - k8_2$	1978.5	50.7	27	19	3	60.5
$B - n51 - k7_2$	1612.0	989.0	49	15	1	989.0
$B - n52 - k7_2$	1364.0	119.7	6	1	1	119.7
$B - n56 - k7_2$	1327.0	41.2	12	19	5	56.7
$B - n57 - k9_2$	3105.0	13.9	14	13	4	24.1
$B - n63 - k10_2$	2799.5	102.7	46	15	1	102.7
$B - n68 - k9_2$	2365.0	301.3	25	13	35	1968.4

Table EC. 18: Detailed results for the instances of class B with $\theta = 0.15$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$B - n31 - k5_3$	1265.5	5.3	9	13	1	5.3
$B - n34 - k5_3$	1302.5	24.2	7	3	1	24.2
$B - n35 - k5_3$	1921.0	31.3	15	27	1	31.3
$B - n38 - k6_3$	1387.5	3.7	13	3	1	3.7
$B - n39 - k5_3$	1022.5	76.1	15	7	1	76.1
$B - n41 - k6_3$	1294.0	17.7	9	7	1	17.7
$B - n43 - k6_3$	1133.0	11.7	6	1	1	11.7
$B - n44 - k7_3$	1546.5	6.4	5	1	1	6.4
$B - n45 - k5_3$	939.0	1667.5	23	21	1	1667.5
$B - n45 - k6_3$	1011.5	541.4	20	25	3	743.8
$B - n50 - k7_3$	1153.5	23.5	10	11	2	27.1
$B - n50 - k8_3$	2024.0	44.1	29	25	4	65.9
$B - n52 - k7_3$	1452.0	139.9	16	1	1	139.9
$B - n56 - k7_3$	1330.0	49.2	8	7	1	49.2
$B - n57 - k9_3$	3216.0	19.0	15	25	32	113.2
$B - n63 - k10_3$	2869.5	155.7	28	37	1	155.7
$B - n66 - k9_3$	2300.5	978.2	32	19	7	1714.7
$B - n68 - k9_3$	2406.5	496.0	27	19	33	3430.9

Table EC. 19: Detailed results for the instances of class B with $\theta = 0.20$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$B - n31 - k5_4$	1308.5	4.1	4	7	1	4.1
$B - n34 - k5_4$	1306.0	15.4	5	1	1	15.4
$B - n35 - k5_4$	1884.0	24.3	15	21	1	24.3
$B - n38 - k6_4$	1389.5	4.0	13	11	1	4.0
$B - n39 - k5_4$	1038.5	104.2	15	19	3	152.9
$B - n41 - k6_4$	1316.0	28.2	5	7	1	28.2
$B - n43 - k6_4$	1138.5	44.8	19	19	6	80.0
$B - n44 - k7_4$	1641.5	13.0	9	13	7	25.6
$B - n45 - k5_4$	987.5	1395.5	27	9	1	1395.5
$B - n45 - k6_4$	1060.5	115.5	3	1	1	115.5
$B - n50 - k7_4$	1191.0	8.6	10	3	1	8.6
$B - n50 - k8_4$	2040.5	47.6	47	17	1	47.6
$B - n51 - k7_4$	1753.0	717.1	37	7	1	717.1
$B - n52 - k7_4$	1499.5	114.3	9	1	1	114.3
$B - n56 - k7_4$	1387.5	55.0	12	19	13	149.6
$B - n57 - k7_4$	2237.0	2909.4	13	1	1	2909.4
$B - n57 - k9_4$	3193.0	15.7	14	17	1	15.7
$B - n63 - k10_4$	2895.0	126.6	32	25	1	126.7
$B - n66 - k9_4$	2336.0	730.2	31	19	19	3592.1
$B - n67 - k10_4$	1516.5	69.5	35	31	167	2795.2
$B - n68 - k9_4$	2423.0	823.2	26	25	6	1450.8

Table EC. 20: Detailed results for the instances of class B with $\theta = 0.25$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$B - n31 - k5_5$	1337.0	6.2	1	13	11	36.2
$B - n34 - k5_5$	1380.5	25.2	8	3	1	25.2
$B - n35 - k5_5$	1926.0	3.5	11	5	1	3.5
$B - n38 - k6_5$	1446.0	9.9	16	31	4	14.0
$B - n39 - k5_5$	1021.0	17.3	8	1	1	17.3
$B - n41 - k6_5$	1391.5	27.7	5	13	1	27.7
$B - n43 - k6_5$	1151.0	18.6	15	7	3	25.8
$B - n44 - k7_5$	1696.0	19.5	10	19	2	22.9
$B - n45 - k5_5$	1014.0	1117.4	16	13	1	1117.4
$B - n45 - k6_5$	1114.5	328.7	12	13	1	328.8
$B - n50 - k7_5$	1246.5	14.2	10	13	1	14.2
$B - n50 - k8_5$	2108.0	27.0	19	9	1	27.0
$B - n51 - k7_5$	1835.5	2306.7	17	31	1	2306.7
$B - n52 - k7_5$	1531.5	865.3	13	19	1	865.3
$B - n56 - k7_5$	1409.0	40.0	9	13	15	187.5
$B - n57 - k9_5$	3282.5	38.5	16	37	9	153.7
$B - n63 - k10_5$	2970.0	175.0	30	31	5	442.3
$B - n66 - k9_5$	2389.5	774.4	27	31	4	1053.6
$B - n68 - k9_5$	2492.0	314.7	21	19	3	380.6

Table EC. 21: Detailed results for the instances of class E-M-F with $\theta = 0.05$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$E - n51 - k5_1$	568.0	1610.8	9	9	1	1610.8
$E - n76 - k8_1$	779.0	1630.2	14	31	2	1760.6
$E - n76 - k14_1$	1162.0	24.4	22	13	22	88.6
$M - n101 - k10_1$	942.0	534.3	1	1	1	534.3

Table EC. 22: Detailed results for the instances of class E-M-F with $\theta = 0.10$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$E - n51 - k5_2$	614.0	3133.9	6	19	1	3134.0
$E - n76 - k7_2$	723.0	922.3	3	19	8	1940.1
$E - n76 - k14_2$	1170.5	41.1	29	37	27	142.7
$E - n101 - k14_2$	1277.5	129.1	23	37	155	3028.1
$M - n101 - k10_2$	953.5	1590.3	0	1	1	1590.3

Table EC. 23: Detailed results for the instances of class E-M-F with $\theta = 0.15$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$E - n51 - k5_3$	632.0	2851.0	12	13	1	2851.0
$E - n76 - k14_3$	1182.5	35.2	25	25	3	42.9
$M - n101 - k10_3$	1017.0	1409.1	1	7	1	1409.1
$F - n45 - k4_3$	845.0	2585.3	0	7	1	2585.3

Table EC. 24: Detailed results for the instances of class E-M-F with $\theta = 0.20$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$E - n76 - k14_4$	1196.50	31.1	22	15	1	31.1
$M - n101 - k10_4$	1031.50	1013.8	0	1	1	1013.8

Table EC. 25: Detailed results for the instances of class E-M-F with $\theta = 0.25$

Instances	f_{opt}^I	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$E - n76 - k14_5$	1255.0	45.4	29	37	81	485.8
$M - n101 - k10_5$	1056.5	1351.3	0	1	1	1351.3

Table EC. 26: Detailed results for the instances of class P with $\theta = 0.05$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$P - n16 - k8_1$	589.0	0.6	3	1	1	0.6
$P - n19 - k2_1$	321.5	18.4	2	7	1	18.4
$P - n20 - k2_1$	278.5	15.9	2	1	1	15.9
$P - n21 - k2_1$	290.0	11.2	0	1	1	11.2
$P - n22 - k2_1$	301.5	16.7	0	1	1	16.7
$P - n22 - k8_1$	763.0	0.7	7	9	3	0.8
$P - n23 - k8_1$	680.0	0.5	0	1	1	0.5
$P - n40 - k5_1$	550.5	8.5	0	1	1	8.5
$P - n45 - k5_1$	585.0	134.5	5	13	1	134.5
$P - n50 - k7_1$	638.5	11.6	14	7	1	11.6
$P - n50 - k8_1$	777.5	114.1	36	37	69	3588.3
$P - n50 - k10_1$	868.0	6.5	32	31	3	8.0
$P - n51 - k10_1$	839.0	11.3	30	19	11	29.6
$P - n55 - k7_1$	688.0	29.5	10	7	5	50.3
$P - n55 - k8_1$	758.0	138.3	38	31	63	2744.4
$P - n55 - k10_1$	792.0	3.9	18	3	1	3.9
$P - n55 - k15_1$	1155.0	12.3	47	43	9	24.0
$P - n60 - k10_1$	873.5	11.5	16	19	6	19.4
$P - n60 - k15_1$	1129.5	3.7	52	27	5	5.4
$P - n65 - k10_1$	970.0	19.1	16	19	43	135.2
$P - n70 - k10_1$	944.5	123.8	41	31	75	1191.3

Table EC. 27: Detailed results for the instances of class P with $\theta = 0.10$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$P - n16 - k8_2$	595.0	0.4	2	1	1	0.4
$P - n19 - k2_2$	325.0	54.1	2	9	1	54.1
$P - n20 - k2_2$	300.0	58.5	3	5	1	58.5
$P - n21 - k2_2$	292.5	9.3	0	1	1	9.3
$P - n22 - k2_2$	286.0	25.3	0	1	1	25.3
$P - n22 - k8_2$	758.0	0.5	10	9	3	0.6
$P - n23 - k8_2$	706.0	0.5	0	1	1	0.5
$P - n40 - k5_2$	598.0	21.7	4	13	1	21.7
$P - n45 - k5_2$	572.0	127.9	10	13	1	127.9
$P - n50 - k7_2$	656.5	12.9	24	7	8	24.8
$P - n50 - k10_2$	852.0	6.5	31	27	1	6.5
$P - n51 - k10_2$	850.0	11.7	24	31	7	24.6
$P - n55 - k7_2$	699.0	58.1	14	31	5	102.9
$P - n55 - k10_2$	807.0	4.5	28	9	1	4.5
$P - n55 - k15_2$	1177.5	12.6	42	43	9	23.5
$P - n60 - k10_2$	902.0	14.2	18	31	17	53.1
$P - n60 - k15_2$	1136.0	5.0	42	43	12	11.2
$P - n65 - k10_2$	977.5	14.1	21	13	8	28.1
$P - n70 - k10_2$	964.0	164.1	48	37	25	734.2

Table EC. 28: Detailed results for the instances of class P with $\theta = 0.15$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$P - n16 - k8_3$	602.0	0.5	3	1	1	0.5
$P - n19 - k2_3$	327.5	28.4	4	3	1	28.4
$P - n20 - k2_3$	303.0	14.9	1	1	1	14.9
$P - n21 - k2_3$	275.5	12.6	0	1	1	12.6
$P - n22 - k2_3$	302.0	31.9	0	1	1	31.9
$P - n22 - k8_3$	772.0	0.7	16	11	3	0.8
$P - n23 - k8_3$	708.5	0.5	0	1	1	0.5
$P - n40 - k5_3$	597.5	25.5	2	11	1	25.5
$P - n45 - k5_3$	593.0	424.9	9	19	1	424.9
$P - n50 - k7_3$	662.0	18.8	18	19	3	25.9
$P - n50 - k10_3$	904.5	6.6	29	25	5	11.0
$P - n51 - k10_3$	855.0	20.8	48	50	9	47.0
$P - n55 - k7_3$	706.0	75.9	16	23	1	75.9
$P - n55 - k10_3$	837.5	4.5	22	9	1	4.5
$P - n55 - k15_3$	1198.0	15.2	50	49	3	19.0
$P - n60 - k10_3$	868.0	12.3	23	7	1	12.3
$P - n60 - k15_3$	1165.0	4.4	50	19	5	6.2
$P - n65 - k10_3$	987.5	49.7	31	37	3	65.8

Table EC. 29: Detailed results for the instances of class P with $\theta = 0.20$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$P - n16 - k8_4$	607.0	0.4	4	1	1	0.4
$P - n19 - k2_4$	332.0	11.6	2	3	1	11.6
$P - n20 - k2_4$	305.0	20.9	0	1	1	20.9
$P - n21 - k2_4$	307.5	21.3	0	1	1	21.3
$P - n22 - k2_4$	329.0	23.0	0	1	1	23.0
$P - n22 - k8_4$	781.5	0.5	11	5	3	0.6
$P - n23 - k8_4$	698.0	0.5	0	1	1	0.5
$P - n40 - k5_4$	613.5	27.9	3	9	1	27.9
$P - n45 - k5_4$	589.0	86.5	5	7	4	128.8
$P - n50 - k7_4$	656.0	22.3	16	25	4	31.4
$P - n50 - k10_4$	902.0	5.4	26	31	5	8.4
$P - n51 - k10_4$	893.0	16.6	21	31	36	114.4
$P - n55 - k7_4$	721.0	69.0	18	19	1	69.0
$P - n55 - k10_4$	832.5	3.1	17	7	10	7.7
$P - n55 - k15_4$	1192.0	12.3	42	37	47	97.8
$P - n60 - k10_4$	876.5	3.2	0	1	1	3.2
$P - n60 - k15_4$	1172.5	3.4	37	25	9	6.8
$P - n65 - k10_4$	1043.0	39.8	14	37	33	252.9
$P - n70 - k10_4$	1008.0	192.8	26	31	109	2610.3

Table EC. 30: Detailed results for the instances of class P with $\theta = 0.25$

Instances	f^I_{opt}	$t_{root}(s)$	#CC	#SR	#Nodes	$t_T(s)$
$P - n16 - k8_5$	616.5	0.5	4	1	1	0.5
$P - n19 - k2_5$	357.5	19.4	1	1	1	19.4
$P - n20 - k2_5$	314.0	62.0	1	7	1	62.0
$P - n21 - k2_5$	319.5	14.4	0	1	1	14.4
$P - n22 - k2_5$	312.5	17.7	0	1	1	17.7
$P - n22 - k8_5$	790.0	0.5	12	4	1	0.5
$P - n23 - k8_5$	719.0	0.5	0	1	1	0.5
$P - n40 - k5_5$	614.5	36.2	5	19	1	36.2
$P - n50 - k7_5$	678.5	38.5	20	19	1	38.5
$P - n50 - k10_5$	922.5	6.3	25	25	35	44.3
$P - n51 - k10_5$	922.0	9.5	19	19	59	142.6
$P - n55 - k7_5$	759.0	55.1	10	13	24	329.2
$P - n55 - k10_5$	848.5	5.4	17	7	1	5.4
$P - n55 - k15_5$	1218.5	9.0	35	25	27	46.8
$P - n60 - k10_5$	934.5	21.7	19	31	37	151.4
$P - n60 - k15_5$	1159.0	2.7	34	11	1	2.7
$P - n65 - k10_5$	1040.5	45.8	28	43	1	45.8
$P - n70 - k10_5$	1030.5	214.5	29	37	93	2192.9