Table 1: Detailed results from the mathematical model (with and without valid inequalities) and matheuristic

Instance	Mathematical model with IS					Mathematical model with IS and VIs					Matheuristic			
	IS	Best	Bound	Gap	Time (s)	IS	Best	Bound	Gap	Time (s)	Phase 1	Phase 2	Phase 3	Time(s)
L_10_3_01	202.49	197.84	197.84	0.00	8773	202.49	197.84	197.84	0.00	1997	202.49	199.70	197.84	4
L_10_3_02	302.79	251.50	251.50	0.00	399	302.79	251.50	251.50	0.00	250	281.61	255.58	251.50	3
L_10_3_03	314.08	204.66	204.66	0.00	93	314.08	204.66	204.66	0.00	31	289.82	204.66	204.66	2
L_10_3_04	232.59	199.03	199.03	0.00	255	232.59	199.03	199.03	0.00	362	203.14	203.14	200.71	2
L_10_3_05	269.20	234.51	234.51	0.00	5256	269.20	234.51	234.51	0.00	1277	245.05	235.77	234.51	4
L_10_5_01	223.79	179.14	179.14	0.00	270	223.79	179.14	179.14	0.00	128	211.40	180.58	179.35	3
L_10_5_02	154.90	143.52	143.52	0.00	38	154.90	143.52	143.52	0.00	24	143.64	143.64	143.52	2
L_10_5_03	235.44	191.50	191.50	0.00	37	235.44	191.50	191.50	0.00	11	197.23	197.23	191.50	2
L_10_5_04	291.40	229.03	229.03	0.00	954	291.40	229.03	229.03	0.00	1113	231.79	231.79	229.03	2
L_10_5_05	294.80	246.85	246.85	0.00	3017	294.80	246.85	246.85	0.00	930	264.54	249.07	246.85	2
M_10_3_01	269.35	196.10	196.10	0.00	518	269.35	196.10	196.10	0.00	372	222.50	196.79	196.79	2
M_10_3_02	324.88	258.16	258.16	0.00	1199	324.88	258.16	258.16	0.00	861	258.49	258.49	258.16	2
M_10_3_03	290.44	204.73	204.73	0.00	384	290.44	204.73	204.73	0.00	20	289.10	207.82	204.73	2
M_10_3_04	249.21	195.88	195.88	0.00	134	249.21	195.88	195.88	0.00	59	203.20	202.22	200.05	2
M_10_3_05	280.78	234.64	234.64	0.00	656	280.78	234.64	234.64	0.00	314	248.50	234.64	234.64	2
M_10_5_01	237.84	189.90	189.90	0.00	2014	237.84	189.90	189.90	0.00	314	200.47	191.01	189.90	2
M_10_5_02	143.46	142.74	142.74	0.00	15	143.46	142.74	142.74	0.00	6	142.80	142.80	142.80	2
M_10_5_03	271.06	223.97	223.97	0.00	6044	271.06	223.97	223.97	0.00	2471	230.27	226.31	226.25	3
M_10_5_04	327.17	262.04	246.96	5.75	10800	327.17	262.04	251.60	3.98	10800	263.57	263.57	263.03	2
M_10_5_05	255.29	238.91	238.91	0.00	321	255.29	238.91	238.91	0.00	65	243.05	240.71	238.91	4
S_10_3_01	217.92	201.23	201.23	0.00	1652	217.92	201.23	201.23	0.00	1215	217.92	202.70	201.23	4
S_10_3_02	268.95	250.39	250.39	0.00	172	268.95	250.39	250.39	0.00	84	268.95	250.75	250.39	2
S_10_3_03	276.72	205.72	205.72	0.00	30	276.72	205.72	205.72	0.00	9	276.72	207.97	205.72	1
S_10_3_04	201.17	196.73	196.73	0.00	13	201.17	196.73	196.73	0.00	7	201.17	201.17	201.17	2
S_10_3_05	244.03	225.89	225.89	0.00	201	244.03	225.89	225.89	0.00	225	233.16	226.13	225.89	2
S_10_5_01	221.75	188.76	188.76	0.00	45	221.75	188.76	188.76	0.00	12	214.97	191.85	191.34	2
S_10_5_02	142.68	140.88	140.88	0.00	10	142.68	140.88	140.88	0.00	4	142.68	141.57	140.88	4
S_10_5_03	242.67	221.52	211.70	4.43	10800	242.67	221.52	221.52	0.00	10651	227.94	221.55	221.52	2
S_10_5_04	298.27	234.76	234.76	0.00	132	298.27	234.76	234.76	0.00	26	235.51	235.51	235.51	1
S_10_5_05	259.43	238.58	238.58	0.00	28	259.43	238.58	238.58	0.00	9	241.10	238.58	238.58	1

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Instance	Mathematical model with IS					Mathematical model with IS and VIs					Matheuristic			
	IS	Best	Bound	Gap	Time (s)	IS	Best	Bound	Gap	Time (s)	Phase 1	Phase 2	Phase 3	Time(s)
L_20_3_01	522.32	387.57	285.15	26.43	10800	522.32	350.65	302.23	13.81	10800	392.36	353.96	350.65	289
L_20_3_02	480.96	379.01	325.98	13.99	10800	480.96	368.28	335.35	8.94	10800	394.42	370.99	366.54	182
L_20_3_03	575.61	527.01	324.88	38.35	10800	575.61	431.83	340.25	21.21	10800	434.44	430.37	430.13	196
L_20_3_04	466.56	358.68	309.32	13.76	10800	466.56	352.80	325.63	7.70	10800	366.34	349.58	349.06	175
L_20_3_05	477.76	461.67	348.60	24.49	10800	477.76	441.70	354.29	19.79	10800	406.93	393.82	393.10	847
L_20_5_01	526.27	407.83	330.98	18.84	10800	526.27	384.04	346.06	9.89	10800	397.57	386.47	382.36	207
L_20_5_02	464.81	338.09	311.00	8.01	10800	464.81	339.03	312.92	7.70	10800	360.21	336.96	336.03	20
L_20_5_03	374.15	323.44	283.80	12.26	10800	374.15	312.83	289.63	7.42	10800	328.41	310.55	310.52	118
L_20_5_04	404.29	350.56	300.38	14.31	10800	404.29	343.24	314.23	8.45	10800	367.36	338.81	336.24	56
L_20_5_05	359.43	306.21	201.09	34.33	10800	359.43	292.07	233.57	20.03	10800	277.63	256.13	252.65	124
M_20_3_01	503.44	327.71	287.22	12.36	10800	503.44	326.87	298.10	8.80	10800	375.11	328.07	326.87	91
M_20_3_02	473.66	355.09	323.46	8.91	10800	473.66	362.23	334.91	7.54	10800	393.02	358.67	353.65	208
M_20_3_03	584.63	515.74	346.35	32.84	10800	584.63	450.26	360.10	20.02	10800	467.00	434.88	432.87	746
M_20_3_04	451.03	350.56	295.52	15.70	10800	451.03	348.70	317.96	8.82	10800	348.46	342.02	341.00	116
M_20_3_05	453.43	407.44	365.90	10.20	10800	453.43	420.52	368.11	12.46	10800	411.16	402.22	402.22	252
M_20_5_01	494.28	391.29	342.32	12.52	10800	494.28	393.99	355.10	9.87	10800	431.87	388.68	385.98	75
M_20_5_02	450.65	341.77	314.42	8.00	10800	450.65	366.28	308.87	15.67	10800	368.71	334.55	333.50	75
M_20_5_03	396.92	323.42	298.92	7.58	10800	396.92	314.72	299.93	4.70	10800	332.48	314.43	314.43	111
M_20_5_04	445.81	328.11	315.09	3.97	10800	445.81	328.11	328.09	0.01	4584	369.27	333.95	333.95	47
M_20_5_05	389.86	265.21	227.15	14.35	10800	389.86	265.21	252.72	4.71	10800	283.20	266.21	264.41	24
S_20_3_01	494.19	323.58	292.29	9.67	10800	494.19	325.87	300.85	7.68	10800	333.42	326.49	323.58	26
S_20_3_02	464.96	357.44	316.46	11.46	10800	464.96	359.13	331.74	7.63	10800	384.32	354.46	349.72	127
S_20_3_03	519.49	442.04	347.60	21.36	10800	519.49	436.09	363.20	16.71	10800	463.97	432.32	431.30	97
S_20_3_04	419.01	348.75	309.43	11.27	10800	419.01	343.50	324.59	5.51	10800	374.52	349.80	347.44	142
S_20_3_05	495.03	372.21	352.61	5.27	10800	495.03	372.21	361.47	2.89	10800	412.29	375.78	372.21	201
S_20_5_01	496.23	366.72	355.21	3.14	10800	496.23	366.72	346.48	5.52	10800	406.80	375.18	366.72	13
S_20_5_02	428.50	328.81	308.22	6.26	10800	428.50	328.81	310.01	5.72	10800	347.29	331.04	328.81	102
S_20_5_03	387.13	318.38	298.67	6.19	10800	387.13	317.04	306.40	3.36	10800	334.18	316.85	315.38	74
S_20_5_04	412.39	338.82	292.41	13.70	10800	412.39	336.60	317.50	5.67	10800	365.80	337.32	337.32	98
S_20_5_05	383.14	267.75	251.86	5.93	10800	383.14	267.75	256.11	4.35	10800	292.91	271.14	270.27	54

Continued on the nex page

	Mathematical model with IS					Mathematical model with IS and VIs					Matheuristic			
Instance	IS	Best	Bound	Gap	Time (s)	IS	Best	Bound	Gap	Time (s)	Phase 1	Phase 2	Phase 3	Time(s)
L_50_3_01	1025.94	765.24	493.94	35.45	10800	1025.94	794.17	516.97	34.90	10800	655.32	627.65	621.06	1352
L_50_3_02	941.21	852.64	556.65	34.71	10800	941.21	859.26	577.68	32.77	10800	711.01	698.66	694.39	868
L_50_3_03	971.24	781.52	511.95	34.49	10800	971.24	792.14	513.89	35.13	10800	653.71	638.31	634.64	1031
L_50_3_04	865.22	809.68	494.77	38.89	10800	865.22	821.20	499.89	39.13	10800	725.57	662.02	656.02	1160
L_50_3_05	990.98	804.11	485.64	39.61	10800	990.98	809.70	496.23	38.71	10800	639.03	603.12	601.59	2061
L_50_5_01	1059.52	805.26	455.24	43.47	10800	1059.52	930.39	498.76	46.39	10800	660.77	603.80	600.35	958
L_50_5_02	1000.28	678.48	477.33	29.65	10800	1000.28	708.94	504.70	28.81	10800	612.58	596.95	589.77	614
L_50_5_03	837.46	676.06	503.49	25.53	10810	837.46	656.01	507.53	22.63	10800	600.69	577.61	574.53	621
L_50_5_04	991.27	808.48	448.12	44.57	10800	991.27	847.37	470.67	44.46	10800	611.15	550.90	541.25	594
L_50_5_05	903.08	688.90	492.43	28.52	10801	903.08	748.01	534.89	28.49	10800	674.72	636.71	630.75	720
M_50_3_01	989.38	667.60	513.53	23.08	10800	989.38	732.77	529.58	27.73	10800	665.90	619.57	613.50	444
M_50_3_02	949.92	830.28	552.64	33.44	10800	949.92	695.64	574.02	17.48	10800	702.61	673.83	667.95	937
M_50_3_03	845.07	795.42	527.73	33.65	10800	845.07	712.46	525.48	26.24	10800	642.39	631.78	626.69	852
M_50_3_04	939.06	900.32	496.03	44.91	10800	939.06	758.80	510.77	32.69	10800	713.40	639.74	632.74	1532
M_50_3_05	1109.55	675.15	501.61	25.70	10800	1109.55	706.57	505.98	28.39	10800	660.68	636.10	630.99	1216
M_50_5_01	935.98	685.35	490.25	28.47	10800	935.98	727.74	516.15	29.07	10800	659.61	607.94	601.39	1114
M_50_5_02	980.03	647.53	496.76	23.28	10800	980.03	631.47	521.66	17.39	10800	609.69	603.74	590.14	385
M_50_5_03	863.40	632.95	516.29	18.43	10800	863.40	610.63	517.50	15.25	10800	601.39	572.85	564.98	545
M_50_5_04	942.94	580.34	446.60	23.05	10800	942.94	561.94	479.34	14.70	10800	590.57	526.98	521.86	430
M_50_5_05	947.12	824.52	516.80	37.32	10800	947.12	753.51	532.20	29.37	10800	678.50	631.13	626.08	630
S_50_3_01	951.29	601.70	494.25	17.86	10800	951.29	688.25	515.25	25.14	10800	646.35	599.87	595.99	533
S_50_3_02	971.19	774.20	570.91	26.26	10800	971.19	761.99	578.68	24.06	10800	754.87	744.05	741.60	630
S_50_3_03	917.67	631.06	520.54	17.51	10800	917.67	676.41	531.32	21.45	10800	646.62	627.28	621.29	544
S_50_3_04	981.47	739.08	506.65	31.45	10800	981.47	680.25	526.47	22.61	10800	737.72	645.86	642.87	972
S_50_3_05	1006.62	647.09	481.55	25.58	10800	1006.62	663.30	498.16	24.90	10800	661.00	627.99	624.80	1568
S_50_5_01	1027.81	803.23	481.06	40.11	10800	1027.81	666.12	524.24	21.30	10800	702.27	632.49	632.01	777
S_50_5_02	983.54	613.38	499.86	18.51	10800	983.54	612.25	512.10	16.36	10800	608.75	597.60	594.46	339
S_50_5_03	874.76	588.91	508.08	13.73	10800	874.76	603.22	515.19	14.59	10800	611.82	580.69	573.95	612
S_50_5_04	888.75	574.32	434.00	24.43	10800	888.75	555.65	473.80	14.73	10800	610.25	556.79	548.67	500
S_50_5_05	991.72	673.84	483.88	28.19	10800	991.72	633.76	537.05	15.26	10800	676.80	635.28	628.24	698

Continued on the nex page

	Mathematical model with IS					Mathematical model with IS and VIs					Matheuristic			
Instance	IS	Best	Bound	Gap	Time (s)	IS	Best	Bound	Gap	Time (s)	Phase 1	Phase 2	Phase 3	Time(s)
L_80_3_01	1466.54	1360.86	544.64	59.98	10800	1466.54	1281.17	601.42	53.06	10800	807.13	802.97	797.41	997
L_80_3_02	1182.06	1142.90	587.52	48.59	10800	1182.06	1140.82	623.17	45.38	10800	839.43	827.74	822.55	1876
L_80_3_03	1201.49	1006.39	589.21	41.45	10800	1201.49	1059.39	630.00	40.53	10805	864.72	831.18	820.91	2194
L_80_3_04	1551.94	1499.37	575.94	61.59	10800	1551.94	1489.55	648.27	56.48	10800	1010.94	973.12	959.88	1667
L_80_3_05	1409.32	1333.16	637.88	52.15	10800	1409.32	1396.37	701.58	49.76	10800	1082.12	1028.92	1011.72	1987
L_80_5_01	1246.33	1200.40	624.57	47.97	10800	1246.33	1196.46	672.29	43.81	10800	905.34	870.31	862.62	1434
L_80_5_02	1166.14	1076.80	538.61	49.98	10800	1166.14	1124.29	601.52	46.50	10800	807.02	770.73	762.22	1787
L_80_5_03	1260.89	1211.53	595.91	50.81	10800	1260.89	1174.11	654.53	44.25	10800	972.95	919.30	908.82	2039
L_80_5_04	1417.09	1357.19	577.40	57.46	10800	1417.09	1294.96	621.50	52.01	10800	945.20	884.71	878.03	2243
L_80_5_05	1415.46	1139.92	553.57	51.44	10800	1415.46	1282.29	584.75	54.40	10800	866.27	813.52	807.40	1770
M_80_3_01	1277.77	1215.89	569.62	53.15	10800	1277.77	1143.34	620.57	45.72	10800	867.92	851.31	844.34	634
M_80_3_02	1355.80	1248.31	634.10	49.20	10800	1355.80	1107.49	650.09	41.30	10800	862.09	845.57	840.30	932
M_80_3_03	1543.57	1204.20	620.01	48.51	10807	1543.57	1303.71	646.39	50.42	10800	1020.64	938.40	931.68	2822
M_80_3_04	1362.72	1266.93	649.01	48.77	10800	1362.72	1285.20	682.70	46.88	10800	1056.29	1012.59	1007.63	2601
M_80_3_05	1485.58	1391.58	672.03	51.71	10800	1485.58	1384.55	719.50	48.03	10800	1097.96	1058.92	1052.17	1960
M_80_5_01	1208.97	1179.22	637.30	45.96	10800	1208.97	1182.12	663.15	43.90	10800	919.16	889.69	879.14	1359
M_80_5_02	1241.72	1109.28	599.91	45.92	10803	1241.72	1028.64	619.61	39.76	10800	839.06	798.62	789.65	1398
M_80_5_03	1364.26	1169.66	613.75	47.53	10822	1364.26	1239.10	653.16	47.29	10803	931.80	876.17	870.44	1119
M_80_5_04	1342.68	1238.62	641.13	48.24	10800	1342.68	1204.48	653.24	45.77	10800	914.76	872.89	864.57	1381
M_80_5_05	1080.12	842.46	564.86	32.95	10800	1080.12	943.52	593.29	37.12	10800	797.87	772.40	763.33	1789
S_80_3_01	1435.63	1425.18	581.14	59.22	10800	1435.63	1357.98	619.83	54.36	10800	891.85	832.86	828.70	1896
S_80_3_02	1308.72	1269.83	614.76	51.59	10800	1308.72	1209.70	644.57	46.72	10800	843.29	823.15	814.45	1381
S_80_3_03	1191.96	1011.55	592.24	41.45	10800	1191.96	975.63	624.76	35.96	10800	898.81	835.14	826.95	1523
S_80_3_04	1393.56	1281.87	627.12	51.08	10800	1393.56	1332.45	671.95	49.57	10800	1005.19	987.53	967.49	2156
S_80_3_05	1524.00	1436.23	675.60	52.96	10800	1524.00	1363.61	716.55	47.45	10800	1106.45	1019.54	1011.98	3344
S_80_5_01	1157.14	1126.64	659.24	41.49	10800	1157.14	1135.78	672.31	40.81	10800	894.39	874.53	866.46	1507
S_80_5_02	1158.57	1092.90	570.78	47.77	10801	1158.57	1038.98	598.57	42.39	10800	805.87	769.93	762.72	1024
S_80_5_03	1295.94	1197.20	638.63	46.66	10800	1295.94	1159.07	665.68	42.57	10800	969.39	911.21	905.71	1445
S_80_5_04	1412.68	1353.37	602.72	55.47	10800	1412.68	1264.99	656.49	48.10	10800	911.40	883.77	876.86	1044
S_80_5_05	1381.54	1044.21	527.38	49.49	10800	1381.54	1038.93	578.40	44.33	10800	839.99	783.94	777.83	2135

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	Mathematical model with IS					Mathematical model with IS and VIs					Matheuristic			
Instance	IS	Best	Bound	Gap	Time (s)	IS	Best	Bound	Gap	Time (s)	Phase 1	Phase 2	Phase 3	Time(s)
L_100_3_01	1352.03	1228.96	588.77	52.09	10800	1352.03	1266.43	680.75	46.25	10805	1352.03	930.20	919.44	4277
L_100_3_02	1343.08	1249.86	647.98	48.16	10800	1343.08	1268.04	712.12	43.84	10802	1343.08	971.12	958.55	1882
L_100_3_03	1586.42	1502.46	760.42	49.39	10800	1586.42	1504.89	832.67	44.67	10800	1586.42	1104.30	1096.75	3703
L_100_3_04	1607.77	1399.34	661.66	52.72	10800	1607.77	1419.26	742.77	47.67	10800	1607.77	1004.26	993.40	2485
L_100_3_05	1868.58	1745.82	761.89	56.36	10800	1868.58	1813.22	826.25	54.43	10800	1868.58	1277.37	1265.03	2349
L_100_5_01	1668.82	1304.25	636.40	51.21	10800	1668.82	1552.09	712.53	54.09	10800	1668.82	971.93	960.23	2037
L_100_5_02	792.06	751.29	349.05	53.54	10800	792.06	708.99	385.22	45.67	10800	792.06	520.32	515.58	3142
L_100_5_03	1293.13	1275.67	597.07	53.20	10800	1293.13	1281.89	655.56	48.86	10800	1293.13	903.01	893.84	2669
L_100_5_04	1342.81	1317.96	606.16	54.01	10801	1342.81	1323.63	679.03	48.70	10800	1342.81	902.43	886.38	5779
L_100_5_05	1560.69	1448.55	656.95	54.65	10800	1560.69	1373.37	747.58	45.57	10800	1560.69	1006.56	993.34	2658
M_100_3_01	1730.85	1545.99	607.86	60.68	10800	1730.85	1546.92	682.76	55.86	10800	1730.85	961.54	953.41	2515
M_100_3_02	1508.22	1201.05	683.09	43.13	10800	1508.22	1349.33	731.10	45.82	10800	1508.22	1019.61	1006.45	2673
M_100_3_03	1470.14	1460.62	777.04	46.80	10800	1470.14	1420.71	824.66	41.95	10800	1470.14	1084.78	1074.40	2811
M_100_3_04	1407.65	1335.90	683.75	48.82	10800	1407.65	1339.19	760.72	43.20	10833	1407.65	993.23	981.61	2963
M_100_3_05	2067.97	2012.64	792.01	60.65	10800	2067.97	1842.46	855.26	53.58	10800	2067.97	1233.00	1219.85	3388
M_100_5_01	1440.30	1374.51	659.87	51.99	10800	1440.30	1368.97	723.27	47.17	10800	1440.30	988.14	975.06	2212
M_100_5_02	836.22	710.72	355.45	49.99	10800	836.22	787.47	391.71	50.26	10800	836.22	532.01	522.39	3140
M_100_5_03	1446.63	1381.26	619.94	55.12	10800	1446.63	1328.06	679.12	48.86	10836	1446.63	893.10	884.01	2021
M_100_5_04	1355.99	1217.79	616.07	49.41	10800	1355.99	1249.62	672.78	46.16	10800	1355.99	899.68	889.55	2689
M_100_5_05	1810.43	1554.96	670.22	56.90	10800	1810.43	1582.89	758.14	52.10	10814	1810.43	988.70	974.07	2268
S_100_3_01	1372.82	1189.93	667.47	43.91	10804	1372.82	1356.18	700.30	48.36	10800	1372.82	948.31	940.47	6426
S_100_3_02	1318.28	1243.55	717.26	42.32	10801	1318.28	1296.70	760.62	41.34	10801	1318.28	1016.57	1007.04	3180
S_100_3_03	1700.20	1593.36	806.06	49.41	10800	1700.20	1439.97	857.95	40.42	10800	1700.20	1121.01	1113.45	3307
S_100_3_04	1404.17	1320.90	744.90	43.61	10801	1404.17	1342.79	773.07	42.43	10800	1404.17	1042.17	1027.86	5864
S_100_3_05	2050.71	1815.02	830.92	54.22	10800	2050.71	1831.37	865.59	52.74	10800	2050.71	1256.79	1246.70	2540
S_100_5_01	1848.90	1088.08	716.26	34.17	10801	1848.90	1066.83	759.94	28.77	10800	1864.91	968.31	957.62	3184
S_100_5_02	805.01	669.62	362.17	45.91	10802	805.01	728.77	401.26	44.94	10800	805.01	515.13	508.45	1401
S_100_5_03	1276.40	1177.16	666.17	43.41	10800	1276.40	1180.35	694.98	41.12	10802	1276.40	921.67	914.81	1804
S_100_5_04	1251.37	1209.33	661.88	45.27	10800	1251.37	1155.88	711.17	38.47	10800	1251.37	912.02	900.24	2568
S_100_5_05	1659.19	1418.00	715.45	49.55	10803	1659.19	1516.47	770.53	49.19	10800	1659.19	1046.80	1035.42	2591

Table 2: Detailed best bound from linear relaxation of the mathematical model

Instance	Valid inequalities used			
	Without	New	Existing	All
L_10_3_01	142.92	142.92	152.31	152.31
L_10_3_02	166.93	169.94	197.24	201.03
L_10_3_03	132.12	135.57	168.00	170.26
L_10_3_04	143.77	144.22	160.24	160.24
L_10_3_05	156.85	159.00	169.90	171.54
M_10_3_01	144.46	144.46	155.05	155.05
M_10_3_02	168.82	169.34	197.50	199.73
M_10_3_03	128.05	129.51	166.25	166.90
M_10_3_04	146.38	148.55	160.91	161.99
M_10_3_05	160.62	162.51	172.50	173.90
S_10_3_01	142.95	142.96	155.37	155.37
S_10_3_02	169.57	172.66	198.82	202.42
S_10_3_03	130.93	135.11	168.92	170.86
S_10_3_04	141.79	142.99	159.69	159.85
S_10_3_05	160.51	161.27	172.38	173.26
L_10_5_01	137.55	137.55	156.85	156.85
L_10_5_02	117.15	117.15	126.26	126.26
L_10_5_03	153.94	157.14	173.76	174.70
L_10_5_04	154.57	154.57	184.11	184.11
L_10_5_05	182.28	183.46	206.49	207.32
M_10_5_01	138.11	139.22	157.67	159.10
M_10_5_02	118.28	118.28	125.52	126.05
M_10_5_03	154.39	156.97	174.02	174.80
M_10_5_04	155.13	155.97	187.96	189.39
M_10_5_05	180.68	180.76	205.92	205.92
S_10_5_01	136.25	136.33	157.72	158.02
S_10_5_02	118.63	118.63	126.44	126.44
S_10_5_03	153.72	155.07	173.76	173.84
S_10_5_04	157.08	158.02	188.09	189.99
S_10_5_05	183.41	184.44	208.16	209.06

Continued on the nex page

Instance	Valid inequalities used			
	Without	New	Existing	All
L_20_3_01	226.13	226.13	246.89	246.89
L_20_3_02	255.46	259.31	281.68	285.84
L_20_3_03	251.41	256.05	286.51	294.99
L_20_3_04	233.14	234.37	279.41	281.63
L_20_3_05	292.43	299.09	313.15	317.40
M_20_3_01	227.80	227.80	247.65	247.66
M_20_3_02	249.64	251.17	278.96	281.30
M_20_3_03	272.77	280.06	302.83	310.22
M_20_3_04	232.13	233.51	279.51	281.72
M_20_3_05	292.27	299.81	313.64	318.17
S_20_3_01	232.04	233.90	249.30	251.16
S_20_3_02	248.84	251.27	280.60	283.38
S_20_3_03	253.33	258.74	288.12	297.93
S_20_3_04	235.07	238.89	281.01	284.87
S_20_3_05	298.87	304.49	318.84	322.89
L_20_5_01	268.44	275.86	293.35	300.58
L_20_5_02	228.01	228.01	262.93	262.93
L_20_5_03	231.77	233.04	250.24	251.61
L_20_5_04	234.81	237.64	275.63	277.39
L_20_5_05	169.95	174.26	213.12	214.24
M_20_5_01	267.03	273.60	291.83	298.64
M_20_5_02	215.04	216.09	254.49	255.13
M_20_5_03	234.72	238.02	252.58	255.71
M_20_5_04	238.78	242.86	278.21	281.80
M_20_5_05	175.35	178.83	215.81	216.63
S_20_5_01	269.49	277.04	294.05	301.43
S_20_5_02	217.94	218.26	257.82	258.12
S_20_5_03	237.61	240.98	254.01	257.38
S_20_5_04	238.94	240.60	278.30	279.57
S_20_5_05	171.17	175.49	214.18	215.35

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Instance	Valid inequalities used			
	Without	New	Existing	All
L_50_3_01	410.56	419.83	458.01	466.79
L_50_3_02	472.98	480.53	514.28	521.89
L_50_3_03	435.46	442.20	463.39	470.13
L_50_3_04	396.03	400.36	441.32	447.52
L_50_3_05	406.76	412.44	447.15	454.92
M_50_3_01	406.58	415.18	455.39	463.20
M_50_3_02	475.49	482.91	515.84	523.69
M_50_3_03	435.17	442.19	462.92	470.09
M_50_3_04	399.94	408.10	445.22	453.45
M_50_3_05	401.21	406.03	443.28	450.23
S_50_3_01	416.59	423.69	462.88	469.95
S_50_3_02	475.26	479.10	514.54	520.58
S_50_3_03	436.36	443.66	465.66	472.56
S_50_3_04	418.24	425.22	460.66	468.35
S_50_3_05	401.26	407.65	443.71	452.03
L_50_5_01	387.22	392.83	451.03	454.15
L_50_5_02	396.87	398.73	453.01	455.47
L_50_5_03	429.79	432.48	457.77	460.87
L_50_5_04	385.29	392.27	420.75	427.47
L_50_5_05	393.05	397.33	468.59	475.63
M_50_5_01	391.50	401.02	453.89	458.97
M_50_5_02	407.16	411.70	463.88	468.64
M_50_5_03	422.95	425.13	453.76	456.02
M_50_5_04	384.42	389.98	418.60	424.86
M_50_5_05	396.78	399.06	471.63	476.88
S_50_5_01	392.44	402.32	455.43	460.42
S_50_5_02	397.67	398.86	456.10	458.04
S_50_5_03	430.50	433.99	460.89	464.31
S_50_5_04	387.40	393.18	422.62	429.18
S_50_5_05	402.34	404.87	473.35	478.50

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Instance	Valid inequalities used			
	Without	New	Existing	All
L_80_3_01	500.58	506.59	560.65	567.09
L_80_3_02	530.09	537.68	582.19	591.38
L_80_3_03	538.66	544.18	585.32	590.99
L_80_3_04	526.95	551.96	580.08	608.08
L_80_3_05	596.74	616.49	638.81	664.04
M_80_3_01	495.01	503.01	556.52	564.62
M_80_3_02	529.03	537.15	581.71	591.80
M_80_3_03	541.29	548.68	585.49	593.50
M_80_3_04	552.68	569.68	601.03	621.43
M_80_3_05	596.17	616.72	639.69	665.23
S_80_3_01	510.08	515.12	567.91	573.39
S_80_3_02	543.27	551.71	594.39	603.92
S_80_3_03	527.40	531.78	576.60	581.91
S_80_3_04	538.52	557.76	591.61	615.94
S_80_3_05	609.66	627.70	647.81	670.84
L_80_5_01	587.42	594.10	634.56	641.42
L_80_5_02	505.40	507.62	567.32	570.34
L_80_5_03	565.41	572.02	614.27	621.16
L_80_5_04	537.01	544.62	583.67	591.00
L_80_5_05	488.28	494.65	538.11	544.74
M_80_5_01	566.33	571.52	617.42	622.79
M_80_5_02	517.64	520.25	578.73	581.42
M_80_5_03	539.09	547.23	594.38	604.12
M_80_5_04	565.62	573.28	607.34	614.93
M_80_5_05	488.79	494.87	540.22	546.40
S_80_5_01	595.80	600.95	641.96	647.20
S_80_5_02	506.70	508.09	568.73	571.08
S_80_5_03	549.23	557.90	604.61	613.94
S_80_5_04	545.62	553.28	590.62	597.69
S_80_5_05	484.80	492.09	534.41	541.99

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Instance	Valid inequalities used			
	Without	New	Existing	All
L_100_3_01	555.90	562.59	637.50	644.40
L_100_3_02	611.70	619.00	665.58	672.89
L_100_3_03	720.52	733.30	775.06	788.11
L_100_3_04	635.75	645.11	698.56	707.96
L_100_3_05	719.32	730.58	773.73	781.54
M_100_3_01	555.16	563.30	637.97	645.94
M_100_3_02	612.70	625.22	665.86	678.38
M_100_3_03	720.80	731.88	772.66	783.17
M_100_3_04	649.45	663.43	709.77	725.22
M_100_3_05	753.64	775.24	801.75	820.34
S_100_3_01	559.09	565.90	639.73	646.60
S_100_3_02	634.46	653.52	685.51	703.98
S_100_3_03	720.06	733.26	774.90	787.80
S_100_3_04	636.56	647.41	704.98	715.85
S_100_3_05	734.77	749.12	785.57	796.45
L_100_5_01	603.64	611.11	667.78	675.42
L_100_5_02	331.79	337.38	361.77	367.52
L_100_5_03	570.48	574.48	627.63	631.88
L_100_5_04	576.50	583.64	635.72	642.94
L_100_5_05	623.87	637.11	699.36	711.57
M_100_5_01	622.94	631.53	683.58	692.29
M_100_5_02	336.87	343.55	365.78	372.67
M_100_5_03	587.56	592.83	642.14	647.82
M_100_5_04	577.04	583.43	637.06	643.49
M_100_5_05	634.13	647.83	708.66	721.15
S_100_5_01	626.80	638.14	687.56	698.39
S_100_5_02	336.42	341.10	364.40	369.26
S_100_5_03	577.19	580.93	635.23	639.34
S_100_5_04	579.24	586.69	639.11	646.51
S_100_5_05	620.39	630.24	698.48	707.39

Table 3: Detailed results of the routing costs with constant travel times over routing costs considering time-dependent travel time

Instance	Routing costs	
	Constant	Time-dependent
L_10_3_01	183.92	211.37
L_10_3_02	227.05	267.85
L_10_3_03	192.69	204.93
L_10_3_04	179.89	224.08
L_10_3_05	214.44	256.83
L_10_5_01	166.81	198.70
L_10_5_02	137.04	147.84
L_10_5_03	177.91	200.77
L_10_5_04	212.41	249.25
L_10_5_05	222.43	265.93
M_10_3_01	184.22	203.57
M_10_3_02	226.84	263.86
M_10_3_03	191.29	209.92
M_10_3_04	178.00	214.45
M_10_3_05	213.04	254.50
M_10_5_01	171.33	195.57
M_10_5_02	137.04	155.31
M_10_5_03	204.29	251.39
M_10_5_04	248.30	278.81
M_10_5_05	220.88	251.75
S_10_3_01	184.22	207.23
S_10_3_02	226.84	258.67
S_10_3_03	191.29	208.18
S_10_3_04	178.00	210.43
S_10_3_05	199.82	226.13
S_10_5_01	171.33	199.95
S_10_5_02	137.04	144.15
S_10_5_03	204.29	222.41
S_10_5_04	212.41	235.63
S_10_5_05	220.88	238.58