

Problem ID	Model 1 Exact		Model 2 Exact		Model 2 NGQ™			Model 4 Gurobi Exact		Model 4 Q-Card			ub*
	Solution	Time to best	Solution	Time to best	Best Solution	Avg Solution (std)	Average Time to best	Solution	Time to best	Best Solution	Avg Solution (std)	Average Time to best	
myciel3	21	0	21	0	21	21(0)	0.0002	21	0	21	21(0)	0.001	21
myciel4	45	0	45	228	45	45(0)	0.007	45	5	45	45(0)	0.0176	45
myciel5	93	0	104	0	93	93(0)	0.1278	93	6524	93	93(0)	0.1764	93
myciel6	189	27	215	0	189	190.8(1.5491)	2.5114	215	188	189	189(0)	16.3272	189
myciel7	381	176	438	3	381	386.8(8.9084)	6.9332	418	5137	382	382.4(0.5163)	110.699	381
anna	276	0	282	5023	276	276(0)	4.976	276	17	276	276(0)	88.4444	276
david	237	0	252	4950	237	237(0)	6.6194	237	7	237	237(0)	31.4688	237
games120	443	0	449	323	443	446.4(3.3730)	169.511	446	195	443	443(0)	100.081	443
huck	243	0	243	4180	243	243(0)	0.137	243	14	243	243(0)	0.0008	243
Jean	217	0	218	2054	217	217(0)	1.5828	217	4	217	217.4(0.5163)	6.8466	217
miles250	325	0	329	1277	326	326.8(3.0594)	573.5232	327	20	325	326.6(0.8432)	568.1484	325
miles500	705	1	708	8	711	712.4(16.4600)	1750	745	7077	712	715.2(2.8596)	126.6716	705
queen5.5	75	0	75	0	75	75(0)	0.0132	75	0	75	75(0)	0.0002	75
queen6.6	138	0	138	802	138	138(0)	1.3796	148	5176	138	138(0)	0.1282	138
queen7.7	196	0	229	15	196	196(0)	26.4266	220	5585	196	196(0)	0.018	196
queen8.8	291	64	325	84	291	291(0)	879.5624	325	4453	291	291(0)	91.712	291
DSJC125.1	326	6439	356	7007	331	333.6(3.3065)	847.4676	340	105	326	326.2(0.4216)	290.9694	326
DSJC125.5	1219	4112	1277	6424	1032	1038.6(9.1796)	5030.024	1248	2530	1022	1030.8(1.5491)	2257.731	1012
DSJC125.9	2665	6830	2969	4638	2673	2792.0(57.1625)	3709.4281	3101	6968	2510	2524.6(2.0655)	3911.9098	2503
DSJC250.1	1141	6022	-	-	1030	1047.8(12.7958)	1480.23	1139	7200	985	995.6(3.1692)	3657.6842	970
DSJC250.5	-	-	-	-	3447	3812.6(746.5221)	4076.9	8250	7061	3320	3343.4(16.5274)	2909.0968	3210
DSJC250.9	-	-	-	-	11606	11618.0(88.8869)	1394.6504	-	-	8419	8519.0(16.0000)	3837.1284	8277
DSJC500.1	3766	1887	-	-	3184	3187.8(42.8298)	4944.042	9224	7146	2976	2998.6(12.6947)	5392.181	2836
DSJC500.5(20h)	-	-	-	-	17129	17350	11383.9901	-	-	11590	11890	18433.9189	10886
DSJC1000.1(20h)	12646	39788	-	-	10588	10600	57930.7301	-	-	10073	10073	17707.6386	8991
flat1000_50(20h)	-	-	-	-	-	-	-	-	-	25500	25500	14633.5842	25500
flat1000_60(20h)	-	-	-	-	-	-	-	-	-	20289	30289	69555.539	30100
flat1000_76(20h)	-	-	-	-	-	-	-	-	-	37167	37167	47122.8484	37164

Table 3: Comparing Exact and Metaheuristic Solvers