Appendix for Towards Tackling MaxSAT by Combining Nested Monte Carlo with Local Search

Hui Wang[1], Abdallah Saffidine[2], and Tristan Cazenave[1]

[1] LAMSADE, University Paris Dauphine - PSL
[2] The University of New South Wales

Appendix

Table 1: Results of Mastering Max2Sat (300 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
1200	1	1191.2	1190.7	1190.7	1190.7	1189.7	1190.8	1194
	2	1191.0	1190.8	1190.4	1189.9	1190.6	1189.8	1195
	3	1191.0	1190.9	1190.4	1189.5	1189.2	1190.0	1194
	4	1190.6	1190.4	1189.6	1189.7	1189.5	1188.8	1193
	5	1190.7	1191.1	1190.5	1189.9	1190.4	1189.5	1194
	6	1190.8	1191.3	1191.0	1190.0	1190.4	1189.6	1194
	7	1191.6	1191.9	1190.9	1191.1	1190.9	1190.1	1195
	8	1189.9	1190.4	1189.8	1189.6	1189.5	1188.8	1193
	9	1190.4	1190.7	1189.9	1189.2	1189.7	1188.4	1193
	10	1190.8	1190.7	1189.7	1190.1	1189.8	1189.6	1193
	11	1191.1	1191.9	1190.5	1189.7	1190.6	1190.1	1194
	12	1190.7	1190.8	1190.0	1189.9	1189.9	1189.4	1193
	13	1191.4	1191.6	1190.8	1190.2	1190.3	1190.8	1194
	14	1191.0	1190.6	1190.9	1189.7	1189.8	1189.3	1194
	15	1190.4	1191.1	1189.8	1189.2	1189.6	1188.7	1193
	16	1190.0	1190.8	1190.1	1189.5	1189.9	1189.8	1194
	17	1190.6	1190.4	1190.4	1189.5	1188.8	1189.7	1193
	18	1191.3	1190.9	1190.0	1190.2	1189.7	1189.9	1193
	19	1190.4	1190.3	1189.5	1189.5	1189.8	1188.9	1194
	20	1190.1	1189.9	1189.3	1189.5	1189.1	1189.3	1194
	21	1190.0	1190.7	1189.4	1189.3	1189.2	1188.8	1195
	22	1191.2	1191.2	1190.4	1189.7	1189.9	1189.9	1194
	23	1190.3	1191.3	1190.5	1190.0	1190.9	1189.2	1193
	24	1191.4	1190.9	1190.3	1189.7	1190.3	1189.8	1193
Aggregate		1190.7	1190.9	1190.2	1189.8	1189.9	1189.5	1193.7

Table 2: Results of Mastering Max3Sat (70 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
800	1	769.0	769.0	769.0	769.0	769.0	769.0	769
	2	766.0	766.0	765.9	766.0	766.0	765.8	766
	3	770.0	769.9	770.0	770.0	770.0	770.0	770
	4	772.0	772.0	772.0	772.0	772.0	772.0	772
	5	768.1	768.8	768.9	769.0	768.9	768.7	769
	6	770.0	770.0	770.0	770.0	770.0	770.0	770
	7	768.9	768.9	769.0	768.9	768.9	768.9	769
	8	765.9	766.0	766.0	766.0	766.0	766.0	766
	9	767.7	767.8	768.0	768.0	767.9	767.3	768
	10	769.7	770.0	769.9	769.9	770.0	769.4	770
900	1	861.0	861.0	861.0	861.0	861.0	860.7	861
	2	861.4	861.6	862.0	862.0	862.0	861.8	862
	3	860.8	860.3	861.0	861.0	861.0	860.9	861
	4	860.4	860.4	861.0	861.0	861.0	860.8	861
	5	859.8	859.8	859.9	860.0	860.0	859.9	860
	6	859.0	859.0	859.0	859.0	859.0	858.9	859
	7	859.6	859.0	860.0	860.0	860.0	859.9	860
	8	858.0	858.0	858.0	858.0	858.0	858.0	858
	9	865.0	865.0	865.0	865.0	865.0	865.0	865
	10	861.0	861.0	861.0	861.0	861.0	860.8	861
1000	1	953.0	953.0	953.0	953.0	953.0	953.0	953
	2	956.8	957.0	957.0	957.0	957.0	957.0	957
	3	955.0	955.0	955.0	955.0	955.0	955.0	955
	4	952.3	951.5	953.0	953.0	953.0	952.6	953
	5	958.0	958.0	958.0	958.0	958.0	958.0	958
	6	949.8	949.5	949.1	949.1	949.3	949.0	950
	7	950.8	951.0	951.0	951.0	951.0	950.8	951
	8	951.7	951.9	952.0	952.0	952.0	951.9	952
	9	949.8	949.6	950.7	950.5	950.5	950.4	951
	10	955.0	954.9	955.0	955.0	955.0	955.0	955
1100	1	1043.9	1044.0	1044.0	1044.0	1044.0	1044.0	1044
	2	1044.0	1043.4	1044.9	1044.9	1044.9	1044.8	1045
	3	1045.6	1046.0	1046.3	1046.8	1046.3	1046.2	1047
	4	1047.8	1047.7	1047.9	1048.0	1048.0	1047.9	1048
	5	1046.2	1046.2	1046.7	1047.0	1046.9	1046.6	1047
	6	1046.9	1046.1	1046.4	1047.0	1047.0	1046.6	1047
	7	1046.2	1046.3	1046.9	1046.9	1047.0	1046.8	1047
	8	1048.9	1048.9	1049.0	1049.0	1049.0	1048.9	1049
	9	1052.0	1052.0	1052.0	1052.0	1052.0	1052.0	1052
	10	1041.9	1041.9	1041.9	1042.0	1042.0	1041.9	1042
1200	1	1133.1	1132.9	1133.7	1133.9	1134.0	1133.8	1134
	2	1135.5	1135.5	1136.9	1136.6	1136.3	1135.5	1137
	3	1134.0	1134.6	1134.7	1135.0	1135.0	1134.8	1135
	4	1131.9	1131.7	1132.6	1132.9	1132.8	1132.8	1133
	5	1134.5	1134.4	1134.3	1134.6	1134.5	1134.3	1135
	6	1133.0	1133.0	1133.8	1134.0	1133.9	1133.8	1134
	7	1137.2	1137.9	1138.0	1137.9	1138.0	1137.9	1138
	8	1135.1	1133.8	1136.6	1136.7	1137.0	1136.9	1137
	9	1138.8	1139.0	1139.0	1139.0	1139.0	1138.8	1139
	10	1136.1	1136.7	1137.0	1136.8	1137.0	1136.7	1137
Aggregate		952.8	952.7	953.1	953.1	953.1	953.0	953.18

Table 3: Results of Mastering Max2Sat (120 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
1200	1	1026.0	1025.8	1032.3	1032.0	1032.0	1032.1	1039
	2	1026.6	1027.5	1033.9	1034.2	1033.5	1032.7	1041
	3	1024.1	1024.4	1031.0	1033.8	1034.0	1033.0	1040
	4	1029.8	1029.9	1031.0	1037.2	1036.6	1036.6	1043
	5	1046.9	1045.8	1051.8	1051.4	1050.5	1051.9	1057
	6	1019.4	1020.3	1024.5	1025.0	1024.1	1024.8	1033
	7	1022.8	1023.7	1029.9	1030.6	1030.7	1027.6	1038
	8	1019.6	1020.6	1027.8	1029.0	1027.8	1028.6	1035
	9	1041.1	1042.3	1047.7	1047.4	1049.2	1047.0	1052
	10	1034.0	1034.2	1040.4	1041.3	1041.3	1040.8	1046
1300	1	1105.7	1106.3	1111.0	1113.4	1113.4	1112.1	1120
	2	1115.6	1115.0	1119.6	1121.7	1121.0	1120.7	1128
	3	1112.2	1112.4	1118.6	1120.4	1117.4	1119.6	1127
	4	1109.6	1109.6	1113.8	1116.0	1118.1	1115.9	1124
	5	1118.6	1118.9	1124.0	1125.1	1125.4	1123.8	1132
	6	1106.9	1106.6	1111.3	1111.8	1113.9	1113.1	1120
	7	1114.9	1114.6	1124.0	1124.6	1124.3	1121.5	1131
	8	1109.3	1109.7	1115.5	1118.1	1117.0	1116.3	1126
	9	1099.8	1099.8	1105.3	1108.2	1107.5	1106.3	1114
	10	1108.9	1107.6	1112.2	1113.6	1114.6	1112.0	1120
1400	1	1187.2	1187.2	1192.4	1196.1	1196.0	1192.7	1203
	2	1195.2	1193.7	1198.1	1200.8	1201.3	1199.0	1209
	3	1195.7	1195.9	1197.4	1202.4	1201.6	1200.6	1211
	4	1181.7	1181.8	1185.6	1189.5	1189.7	1186.6	1200
	5	1185.0	1184.3	1191.0	1194.3	1192.8	1189.8	1201
	6	1186.8	1188.8	1191.6	1196.4	1196.6	1195.8	1204
	7	1176.2	1175.8	1180.4	1185.1	1184.0	1182.1	1194
	8	1192.3	1192.6	1196.0	1198.2	1197.2	1196.4	1206
	9	1185.9	1186.5	1189.9	1194.5	1193.8	1191.2	1202
	10	1171.5	1171.5	1172.6	1177.2	1177.5	1176.6	1189
1500	1	1274.3	1274.2	1279.6	1282.6	1282.5	1281.8	1289
	2	1269.8	1270.8	1273.4	1278.8	1277.7	1276.4	1287
	3	1275.9	1277.1	1279.4	1283.6	1284.3	1280.6	1293
	4	1271.5	1271.7	1274.6	1277.1	1278.9	1278.8	1288
	5	1248.5	1248.8	1251.1	1256.9	1257.6	1253.9	1267
	6	1273.6	1272.2	1277.4	1281.6	1282.5	1279.1	1291
	7	1269.0	1269.0	1272.2	1277.3	1275.1	1274.4	1284
	8	1271.7	1270.4	1275.3	1279.4	1280.1	1277.9	1288
	9	1262.0	1261.7	1263.9	1269.4	1267.4	1268.9	1277
	10	1269.0	1269.2	1270.7	1275.3	1276.3	1276.8	1287
1600	1	1274.3	1274.2	1279.6	1282.6	1282.5	1281.8	1367
	2	1269.8	1270.8	1273.4	1278.8	1277.7	1276.4	1361
	3	1275.9	1277.1	1279.4	1283.6	1284.3	1280.6	1367
	4	1271.5	1271.7	1274.6	1277.1	1278.9	1278.8	1381
	5	1248.5	1248.8	1251.1	1256.9	1257.6	1253.9	1353
	6	1273.6	1272.2	1277.4	1281.6	1282.5	1279.1	1365
	7	1269.0	1269.0	1272.2	1277.3	1275.1	1274.4	1375
	8	1271.7	1270.4	1275.3	1279.4	1280.1	1277.9	1363
	9	1262.0	1261.7	1263.9	1269.4	1267.4	1268.9	1360
	10	1269.0	1269.2	1270.7	1275.3	1276.3	1276.8	1367
Aggregate		1172.4	1172.5	1176.7	1179.9	1179.8	1178.5	1203.9

Table 4: Results of Mastering Max2Sat (140 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
1200	1	1040.2	1041.0	1043.7	1046.0	1048.2	1046.6	1056
	2	1030.6	1030.4	1032.1	1035.8	1035.8	1036.3	1045
	3	1029.6	1029.3	1032.7	1035.6	1034.3	1036.0	1045
	4	1038.0	1038.5	1040.6	1042.2	1044.1	1040.7	1052
	5	1044.1	1044.5	1047.2	1050.0	1050.0	1049.3	1057
	6	1037.9	1037.6	1040.3	1044.6	1044.0	1042.6	1052
	7	1036.2	1036.1	1037.8	1043.7	1043.6	1040.8	1052
	8	1032.1	1033.7	1036.3	1040.0	1039.5	1037.0	1048
	9	1034.9	1035.4	1037.1	1041.4	1041.0	1041.5	1049
	10	1046.1	1046.2	1047.5	1050.9	1052.0	1051.5	1060
	1	1120.9	1121.0	1124.8	1128.2	1128.6	1128.2	1138
	2	1112.8	1113.8	1116.5	1120.6	1119.9	1118.4	1129
	3	1115.9	1116.4	1118.5	1123.6	1123.6	1122.4	1132
	4	1118.1	1118.5	1123.3	1126.8	1125.3	1126.3	1136
	5	1113.5	1114.9	1115.8	1122.3	1120.7	1120.6	1131
	6	1115.8	1116.2	1118.5	1123.2	1124.3	1123.0	1132
	7	1125.9	1125.7	1127.7	1132.5	1132.1	1132.0	1140
	8	1128.8	1129.1	1130.2	1136.7	1136.4	1134.6	1143
	9	1123.1	1122.4	1124.8	1129.7	1129.0	1127.8	1138
	10	1111.6	1111.9	1113.4	1119.9	1118.6	1117.4	1130
	1	1200.4	1200.2	1203.0	1207.5	1207.2	1208.7	1218
	2	1202.5	1201.7	1204.6	1210.8	1213.1	1208.0	1222
	3	1187.9	1187.3	1191.2	1198.0	1196.6	1194.8	1207
	4	1197.4	1198.0	1200.5	1207.6	1207.6	1206.5	1216
	5	1195.2	1194.5	1196.9	1202.1	1203.5	1202.7	1213
	6	1195.5	1195.9	1198.4	1200.8	1202.3	1202.1	1212
	7	1192.4	1192.3	1195.1	1200.4	1202.0	1198.9	1213
	8	1198.5	1200.8	1202.7	1206.4	1207.4	1205.8	1219
	9	1197.4	1198.9	1202.3	1206.3	1206.1	1202.8	1215
	10	1190.5	1191.6	1192.6	1199.3	1200.0	1199.7	1212
	1	1276.9	1277.1	1280.3	1285.1	1283.4	1284.5	1295
	2	1284.4	1282.9	1283.5	1289.8	1293.1	1290.2	1301
	3	1266.9	1267.8	1270.1	1275.2	1276.5	1273.8	1288
	4	1281.1	1281.3	1283.7	1291.2	1292.0	1289.6	1303
	5	1274.0	1274.6	1277.4	1283.2	1282.6	1281.9	1295
	6	1281.4	1283.2	1285.5	1290.0	1290.0	1289.5	1302
	7	1278.9	1279.1	1281.4	1285.8	1286.2	1285.1	1298
	8	1279.7	1281.8	1284.2	1289.8	1290.3	1289.9	1301
	9	1282.0	1282.1	1284.7	1288.6	1288.0	1288.0	1301
	10	1278.4	1278.6	1281.4	1287.8	1286.9	1286.3	1298
	1	1357.9	1359.4	1362.6	1368.7	1368.0	1366.4	1379
	2	1358.5	1359.4	1362.0	1367.3	1364.7	1362.3	1379
	3	1350.7	1351.3	1352.8	1358.9	1360.0	1357.9	1374
	4	1357.7	1358.3	1361.8	1366.9	1361.8	1365.4	1380
	5	1350.1	1351.5	1353.2	1359.2	1358.7	1357.0	1372
	6	1357.9	1356.3	1360.4	1362.9	1367.8	1366.1	1380
	7	1361.4	1362.3	1364.1	1368.8	1369.9	1366.8	1382
	8	1351.1	1352.0	1352.3	1359.5	1360.7	1359.6	1373
	9	1351.4	1350.1	1352.1	1358.9	1356.6	1357.2	1372
	10	1353.0	1354.6	1357.2	1363.0	1361.2	1361.8	1374
statistic	1196.9	1197.4	1199.7	1204.7	1204.7	1203.6	1215.18	
Aggregate		1196.9	1197.4	1199.7	1204.7	1204.7	1203.6	1215.18

Table 5: Results of Mastering Max2Sat (200 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
	1	1065.9	1065.9	1067.5	1070.3	1069.8	1070.3	1082
	2	1055.3	1055.3	1058.3	1062.0	1060.4	1060.9	1073
	3	1058.3	1059.1	1059.9	1063.2	1063.7	1063.4	1075
1200	4	1069.0	1068.9	1071.4	1075.6	1077.9	1077.5	1085
	5	1066.1	1066.6	1067.7	1072.0	1073.7	1072.5	1083
	6	1054.0	1053.9	1056.4	1060.4	1059.0	1058.7	1073
	7	1072.5	1073.3	1075.2	1080.3	1079.3	1079.8	1088
	1	1136.6	1135.8	1136.2	1141.0	1139.8	1140.4	1156
	2	1135.1	1136.9	1137.7	1143.0	1142.5	1141.7	1157
	3	1161.6	1162.1	1163.8	1167.4	1167.5	1166.6	1179
	4	1141.2	1141.3	1142.9	1146.6	1147.8	1145.0	1161
	5	1136.9	1137.9	1138.9	1142.8	1142.6	1142.5	1158
	6	1147.4	1146.4	1148.3	1152.7	1153.1	1152.7	1166
	7	1156.3	1156.8	1158.5	1162.1	1161.5	1160.6	1172
	1	1222.5	1221.6	1224.0	1231.4	1230.3	1229.7	1244
	2	1233.7	1235.2	1235.8	1240.9	1239.6	1237.1	1253
	3	1227.8	1227.4	1229.3	1233.3	1234.3	1235.0	1250
	4	1213.7	1213.4	1214.8	1221.1	1220.5	1218.9	1236
	5	1225.7	1225.6	1227.1	1232.1	1230.9	1231.4	1247
	6	1237.0	1236.9	1239.4	1244.0	1241.9	1244.6	1255
	7	1240.4	1240.1	1241.6	1245.2	1244.9	1243.9	1258
	1	1313.5	1313.8	1313.8	1319.0	1317.7	1320.1	1335
	2	1313.3	1311.9	1315.1	1319.1	1317.5	1319.6	1335
	3	1311.8	1312.3	1315.1	1320.0	1318.3	1320.0	1335
	4	1297.6	1298.9	1300.5	1305.2	1305.5	1302.7	1322
	5	1302.5	1303.0	1303.8	1307.8	1308.0	1307.0	1326
	6	1297.7	1295.7	1298.7	1302.7	1302.7	1304.4	1320
	7	1294.5	1295.7	1296.0	1299.6	1302.5	1301.6	1321
	1	1375.7	1376.9	1379.0	1381.9	1382.9	1381.4	1405
	2	1398.8	1399.1	1401.8	1406.6	1405.7	1404.0	1422
	3	1387.1	1387.8	1389.7	1394.4	1395.3	1394.5	1414
	4	1376.9	1377.4	1380.3	1384.1	1386.7	1384.5	1405
	5	1377.6	1379.2	1380.1	1386.2	1384.0	1385.2	1406
	6	1398.0	1399.9	1401.1	1406.1	1405.8	1403.3	1421
	7	1380.7	1382.4	1384.5	1387.4	1388.6	1381.4	1408
	1	1479.3	1480.1	1483.0	1488.3	1488.0	1490.6	1507
	2	1465.8	1465.5	1466.5	1475.3	1470.9	1473.7	1493
	3	1458.5	1459.4	1460.3	1466.2	1464.1	1467.1	1487
	4	1460.2	1461.0	1463.3	1469.0	1468.1	1468.0	1488
	5	1456.2	1455.3	1459.3	1463.1	1462.9	1461.5	1483
	6	1462.3	1463.9	1465.0	1471.7	1472.0	1470.0	1491
	7	1470.7	1471.2	1474.9	1479.4	1477.7	1479.9	1499
	1	1565.0	1564.5	1568.3	1572.1	1566.1	1564.9	1594
	2	1546.8	1547.9	1549.5	1552.7	1555.4	1555.8	1577
	3	1542.1	1541.3	1542.5	1549.1	1548.0	1546.6	1571
	4	1547.4	1547.9	1550.7	1554.0	1555.8	1553.7	1579
	5	1545.8	1546.4	1547.6	1557.0	1558.1	1555.4	1580
	6	1539.5	1542.9	1544.5	1550.2	1547.8	1547.8	1572
	7	1544.6	1543.1	1544.9	1551.7	1550.6	1551.7	1574
Aggregate		1305.4	1305.8	1307.6	1312.4	1312.0	1311.6	1329.0

Table 6: Results of Mastering Max2Sat (250 variables) on different Instances Using SingleUCT SLS, MultiUCT SLS and NMC SLS respectively, 10 repetitions each.

Clauses	Ins	$UCTMax$	$NMCTSMax$	$NMCSZMax$		$NMCSMax$		Optimal Solution
			m=100	rounds=5 level 1	rounds=1 level 2	rounds=5 level 1	rounds=1 level 2	
1000	1	992.7	992.1	992.2	991.6	991.5	991.0	995
	2	992.9	992.8	992.0	991.7	992.6	992.3	995
	3	992.2	992.2	992.4	991.3	991.6	991.4	995
	4	991.8	992.6	992.7	991.4	991.0	991.5	994
	5	992.4	991.8	991.1	991.1	990.8	990.5	994
	6	992.3	992.6	991.6	991.0	991.2	991.6	994
	7	992.4	992.1	991.2	990.7	991.5	990.9	994
	8	992.7	992.5	992.0	991.4	991.9	991.4	995
	9	991.5	991.9	991.3	990.8	991.0	991.0	994
	10	992.2	992.4	992.2	991.7	992.4	991.5	994
	11	992.4	992.5	991.8	992.0	991.6	991.2	994
	12	991.5	991.7	991.7	991.0	991.1	991.3	994
	13	993.0	992.6	991.5	991.3	990.8	991.9	995
	14	992.4	992.7	991.7	991.7	991.9	991.3	995
	15	992.7	993.5	991.8	993.0	992.1	992.0	995
	16	992.2	991.8	991.4	991.0	990.9	991.0	995
	17	991.7	991.9	990.9	990.5	991.1	990.6	994
	18	991.8	991.7	991.4	990.4	990.5	991.0	994
	19	993.5	993.4	992.7	991.5	991.9	991.8	995
	20	991.5	991.1	991.4	990.9	991.1	990.5	993
	21	992.4	992.1	991.6	990.7	991.2	991.1	996
	22	992.0	992.3	991.9	991.4	991.7	991.3	995
	23	992.7	992.6	992.0	992.1	991.6	991.8	994
	24	993.4	992.9	992.2	993.1	992.8	991.9	995
Aggregate		992.3	992.3	991.8	991.4	991.5	991.3	994.5