

Appendix of the paper “An effective branch-and-bound algorithm for the maximum s -bundle problem”

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Appendix

This appendix contains detailed computational results of three compared algorithms (RDS, BB and MSB). The tables show the following information.

- (1) Column “name” indicates the name of tested graph.
- (2) Column “#vtx” indicates the number of vertices in the tested graph.
- (3) Column “#edge” indicates the number of edges in the tested graph.
- (4) Column “ $|S^*|$ ” indicates the size of the largest s -bundle found by the respective algorithm. According to our experimental settings, if the runtime is not larger than 3600 seconds, the value in this column is the optimal value to the instance, otherwise it is a lower bound.
- (5) Column “#branches” indicates the number of branches generated by the respective algorithm. Note that RDS runs multiple rounds of branch-and-bound, we present the sum of the numbers of branches.

Tables 1-4 show the computational results on 80 DIMACS2 graphs with $s = 2, 3, 4$ and 5 , respectively. Tables 5-8 show the computational results on 43 DIMACS10 and SNAP graphs with $s = 2, 3, 4$ and 5 , respectively.

Table 1
Results of the three algorithms on DIAMCS2 graphs with $s = 2$.

graph			RDS			BB			MSB		
name	#vtx	#edge	S *	time(s)	#branches	S *	time(s)	#branches	S *	time(s)	#branches
brock200_1.clq	200	14834	20	3600.01	97803101	22	3600.01	813912153	25	3600.01	293383465
brock200_2.clq	200	9876	13	140.09	23204771	13	701.61	279680379	13	258	40950215
brock200_3.clq	200	12048	16	3600.01	231480303	17	3600.01	1269609039	17	3600.01	496573861
brock200_4.clq	200	13089	19	3600.01	134999412	19	3600.01	1309103898	19	3600.01	372923319
brock400_1.clq	400	59723	20	3600.01	99397090	27	3600.01	304841916	27	3600.01	115811979
brock400_2.clq	400	59786	21	3600.01	85450612	29	3600.01	355001852	29	3600.01	105946005
brock400_3.clq	400	59681	20	3600.01	99219659	31	3600.01	337500706	31	3600.01	127340268
brock400_4.clq	400	59765	20	3600.01	90906807	33	3600.01	364355893	33	3600.01	124903646
brock800_1.clq	800	207505	17	3600.01	162919724	23	3600.01	167976155	23	3600.01	61477523
brock800_2.clq	800	208166	17	3600.01	146088941	24	3600.01	163388120	24	3600.01	71793629
brock800_3.clq	800	207333	17	3600.01	183703886	25	3600.01	190556271	25	3600.01	67493662
brock800_4.clq	800	207643	18	3600.01	171568869	26	3600.01	182529607	26	3600.01	66166410
C1000.9.clq	1000	450079	31	3600.01	25301813	68	3600.01	35766617	68	3600.01	17159926
C125.9.clq	125	6963	31	3600.01	18282578	39	3600.01	580780482	41	3600.01	339887004
C2000.5.clq	2000	999836	14	3600.01	317543539	17	3600.01	30515180	16	3600.01	17831057
C2000.9.clq	2000	1799532	30	3600.01	22940688	80	3600.01	18720542	80	3600.01	5213508
C250.9.clq	250	27984	29	3600.01	24003727	44	3600.01	231860895	48	3600.01	113604988
C4000.5.clq	4000	4000268	14	3600.01	363823747	18	3600.01	35998601	18	3600.01	13203313
C500.9.clq	500	112332	28	3600.01	30883966	57	3600.01	117831075	60	3600.01	49863360
c-fat200-1.clq	200	1534	12	0	3757	12	0	8070	12	0	345
c-fat200-2.clq	200	3235	24	0	2221	24	0	4539	24	0	402
c-fat200-5.clq	200	8473	58	0.02	2565	58	0.02	8990	58	0.01	1825
c-fat500-1.clq	500	4459	14	0.07	19844	14	0.06	35815	14	0	723
c-fat500-10.clq	500	46627	126	0.3	10372	126	0.3	46696	126	0.12	7383
c-fat500-2.clq	500	9139	26	0.05	10462	26	0.09	33859	26	0.01	1023
c-fat500-5.clq	500	23191	64	0.05	6381	64	0.11	31151	64	0.03	2260
DSJC1000.5.clq	1000	249826	14	3600.01	98973830	15	3600.01	34252376	16	3600.01	23562819
DSJC500.5.clq	500	62624	15	3600.01	94660470	15	3600.01	161164817	15	3600.01	173836002
gen200_p0.9.44.clq	200	17910	35	3600.01	18298975	44	3600.01	212960304	49	3600.01	96137339
gen200_p0.9.55.clq	200	17910	30	3600.01	26934738	55	3600.01	458398748	55	3600.01	149925082
gen400_p0.9.55.clq	400	71820	30	3600.01	31510238	55	3600.01	90346261	56	3600.01	14471558
gen400_p0.9.65.clq	400	71820	35	3600.01	21023548	65	3600.01	190559668	66	3600.01	9841289
gen400_p0.9.75.clq	400	71820	31	3600.01	23083899	75	3600.01	137973465	75	3600.01	10047483
hamming10-2.clq	1024	518656	228	3600.22	91716	512	3600.01	5409986	512	3600.01	7228180
hamming10-4.clq	1024	434176	22	3600.01	44073767	40	3600.01	44442872	40	3600.01	29346184
hamming6-2.clq	64	1824	32	0.03	1182	32	705.25	310576331	32	10.55	2963698
hamming6-4.clq	64	704	6	0	4569	6	0.04	58258	6	0.04	23197
hamming8-2.clq	256	31616	128	73.48	23389	128	3600.01	119378085	128	3600.01	133759989
hamming8-4.clq	256	20864	16	187.86	8101239	16	3600.01	753853474	16	3600.01	347806429
johnson16-2-4.clq	120	5460	10	3600.01	523877307	10	3600.01	1343069266	10	3600.01	647707464
johnson32-2-4.clq	496	107880	10	3600.01	552853078	21	3600.01	190229062	20	3600.01	104126660
johnson8-2-4.clq	28	210	5	0	1465	5	0.01	11857	5	0	6916
johnson8-4-4.clq	70	1855	14	0.43	43441	14	122.54	108627984	14	54.3	17124673
keller4.clq	171	9435	15	3442.72	156769519	15	3600.01	1460375865	15	3600.01	367595746
keller5.clq	776	225990	15	3600.01	157505582	27	3600.01	112835609	30	3600.01	31287816
keller6.clq	3361	4619898	15	3600.01	45923904	59	3600.01	2491462	61	3600.01	280950
MANN_a27.clq	378	70551	46	3600.01	30359896	236	3600.01	7711735	235	3600.01	4349075
MANN_a45.clq	1035	533115	64	3600.01	41472777	661	3600.01	427174	661	3600.02	255055
MANN_a81.clq	3321	5506380	100	3600.01	29776704	2162	3600.21	18192	2161	3600.09	16985
MANN_a9.clq	45	918	26	13.55	331829	26	256.99	74773734	26	1.01	179429
p.hat1000-1.clq	1000	122253	13	3600.01	470084017	12	3600.01	458939372	13	3600.01	100566543
p.hat1000-2.clq	1000	244799	26	3600.01	61763704	46	3600.01	59720812	53	3600.01	29332672
p.hat1000-3.clq	1000	371746	25	3600.01	56284702	68	3600.01	24565653	77	3600.01	17502133
p.hat1500-1.clq	1500	284923	12	3600.01	496225352	13	3600.01	237355778	13	3600.01	66114057
p.hat1500-2.clq	1500	568960	28	3600.01	50743586	65	3600.01	53367469	70	3600.01	14241020
p.hat1500-3.clq	1500	847244	29	3600.01	38425814	94	3600.01	14123273	109	3600.01	1774452
p.hat300-1.clq	300	10933	10	5.51	1428704	10	44.85	29476779	10	22.79	3447325
p.hat300-2.clq	300	21928	24	3600.01	94881184	27	3600.01	757505632	30	3600.01	205751043
p.hat300-3.clq	300	33390	25	3600.01	55119139	37	3600.01	338101504	43	3600.01	113269919
p.hat500-1.clq	500	31569	12	143.48	26425229	12	1785.94	541199388	12	750.25	54381068
p.hat500-2.clq	500	62946	25	3600.01	57967577	36	3600.01	192353195	41	3600.01	78805399
p.hat500-3.clq	500	93800	27	3600.01	31996124	50	3600.01	144450076	60	3600.01	48860587
p.hat700-1.clq	700	60999	13	926.55	134143326	12	3600.01	725683758	13	3600.01	148853164
p.hat700-2.clq	700	121728	28	3600.01	43552749	44	3600.01	173217054	49	3600.01	44797556
p.hat700-3.clq	700	183010	25	3600.01	48748567	62	3600.01	116644524	70	3600.01	32196254
san1000.clq	1000	250500	14	3600.01	127933809	16	3600.01	262565192	17	3600.01	14114298
san200_0.7.1.clq	200	13930	29	3600.01	15802340	30	3600.01	203676777	31	3600.01	196361626
san200_0.7.2.clq	200	13930	12	3600.01	207445921	24	3600.01	289211556	25	3600.01	91797577
san200_0.9.1.clq	200	17910	61	3600.01	2109267	75	3600.01	32289591	90	3600.01	187970212
san200_0.9.2.clq	200	17910	60	3600.01	2581204	60	3600.01	524417209	70	3600.01	152814891
san200_0.9.3.clq	200	17910	33	3600.01	20417527	44	3600.01	266099981	51	3600.01	191558207
san400_0.5.1.clq	400	39900	12	3600.01	262651436	15	3600.01	672938347	15	3600.01	97110676
san400_0.7.1.clq	400	55860	33	3600.01	6888434	40	3600.01	169281399	41	3600.01	19731948
san400_0.7.2.clq	400	55860	25	3600.01	17523720	30	3600.01	77176486	31	3600.01	136194625
san400_0.7.3.clq	400	55860	22	3600.01	33399111	22	3600.01	70621149	26	3600.01	37029158
san400_0.9.1.clq	400	71820	53	3600.01	13715651	100	3600.01	262370551	101	3600.01	7737562
sanr200_0.7.clq	200	13868	20	3600.01	128132484	21	3600.01	1207355626	22	3600.01	359917059
sanr200_0.9.clq	200	17863	28	3600.01	30738739	43	3600.01	317769548	48	3600.01	174854169
sanr400_0.5.clq	400	39984	14	3600.01	386105072	14	3600.01	685450418	15	3600.01	193147250
sanr400_0.7.clq	400	55869	20	3600.01	112166915	22	3600.01	371552486	23	3600.01	130537592
#SOLVED			19			15			15		
#AVE-TIME			2806.687625			2970.23325			2938.723125		

Table 2
Results of the three algorithms on DIAMCS2 graphs with $s = 3$.

graph			RDS			BB			MSB		
name	#vtx	#edge	S *	time(s)	#branches	S *	time(s)	#branches	S *	time(s)	#branches
brock200_1.clq	200	14834	22	3600.01	43774739	25	3600.01	645061880	29	3600.01	312168176
brock200_2.clq	200	9876	15	3600.01	189316069	15	3600.01	1682056011	15	3600.01	422787110
brock200_3.clq	200	12048	17	3600.01	74186377	18	3600.01	1072477634	19	3600.01	356065252
brock200_4.clq	200	13089	20	3600.01	54100770	20	3600.01	809646654	22	3600.01	302877639
brock400_1.clq	400	59723	21	3600.01	41497220	27	3600.01	162050379	32	3600.01	116026992
brock400_2.clq	400	59786	22	3600.01	39584480	29	3600.01	171043094	33	3600.01	86768170
brock400_3.clq	400	59681	21	3600.01	41459589	31	3600.01	235338532	33	3600.01	123421852
brock400_4.clq	400	59765	21	3600.01	43166638	33	3600.01	281928861	33	3600.01	110958991
brock800_1.clq	800	207505	17	3600.01	93163468	23	3600.01	111896206	25	3600.01	67455508
brock800_2.clq	800	208166	17	3600.01	72171161	24	3600.01	98673974	25	3600.01	72987083
brock800_3.clq	800	207333	19	3600.01	81306340	25	3600.01	97585291	25	3600.01	68041985
brock800_4.clq	800	207643	18	3600.01	64932398	26	3600.01	117342210	26	3600.01	45767068
C1000.9.clq	1000	450079	31	3600.01	7954616	68	3600.01	14538323	79	3600.01	24821649
C125.9.clq	125	6963	34	3600.01	5234547	44	3600.01	156386948	48	3600.01	255653782
C2000.5.clq	2000	999836	15	3600.01	188228527	17	3600.01	38104668	18	3600.01	34530952
C2000.9.clq	2000	1799532	31	3600.01	6858131	80	3600.01	3458005	88	3600.01	8182712
C250.9.clq	250	27984	30	3600.01	7714424	47	3600.01	76044564	58	3600.01	105911292
C4000.5.clq	4000	4000268	14	3600.01	161338113	18	3600.01	5282747	20	3600.01	12209363
C500.9.clq	500	112332	31	3600.01	10983843	57	3600.01	51283169	69	3600.01	47401059
c-fat200-1.clq	200	1534	12	0.12	90123	12	0.02	16283	12	0	841
c-fat200-2.clq	200	3235	24	0.04	17829	24	0.01	7845	24	0	490
c-fat200-5.clq	200	8473	58	0.06	6010	58	0.07	44287	58	0.02	2606
c-fat500-1.clq	500	4459	14	2.63	1003177	14	0.09	50296	14	0.01	1396
c-fat500-10.clq	500	46627	126	0.51	19549	126	1	249791	126	0.16	9578
c-fat500-2.clq	500	9139	26	0.63	192141	26	0.19	89770	26	0.02	1935
c-fat500-5.clq	500	23191	64	0.23	31711	64	0.29	86616	64	0.05	2522
DSJC1000.5.clq	1000	249826	14	3600.01	58376681	17	3600.01	24454394	18	3600.01	20691308
DSJC500.5.clq	500	62624	15	3600.01	52119598	15	3600.01	120156052	17	3600.01	115853143
gen200_p0.9.44.clq	200	17910	32	3600.01	11441122	48	3600.01	97153707	62	3600.01	136631622
gen200_p0.9.55.clq	200	17910	30	3600.01	15022129	55	3600.01	141768164	62	3600.01	119306858
gen400_p0.9.55.clq	400	71820	29	3600.01	13984817	55	3600.01	79095383	82	3600.01	74745726
gen400_p0.9.65.clq	400	71820	30	3600.01	11862194	65	3600.01	106570704	97	3600.01	9465359
gen400_p0.9.75.clq	400	71820	34	3600.01	10319427	75	3600.01	94344375	111	3600.01	8407619
hamming10-2.clq	1024	518656	42	3600.01	6574146	512	3600.01	4949155	512	3600.01	7069614
hamming10-4.clq	1024	434176	14	3600.01	145203943	47	3600.01	35039971	48	3600.01	6808865
hamming6-2.clq	64	1824	32	18.45	253714	32	3600.01	929298635	32	3600.01	598357118
hamming6-4.clq	64	704	8	0.11	31337	8	0.54	718935	8	0.68	319781
hamming8-2.clq	256	31616	42	3600.01	6301042	128	3600.01	58660566	128	3600.01	167056483
hamming8-4.clq	256	20864	14	3600.01	148277366	18	3600.01	863032809	20	3600.01	279924510
johnson16-2-4.clq	120	5460	12	3600.01	159853250	15	3600.01	792792828	16	3600.01	587752518
johnson32-2-4.clq	496	107880	12	3600.01	174251295	31	3600.01	86093552	32	3600.01	100630013
johnson8-2-4.clq	28	210	8	0.07	11209	8	0.05	47967	8	0.02	27630
johnson8-4-4.clq	70	1855	18	891.25	13720679	18	3600.01	2404085611	18	3600.01	762776066
keller4.clq	171	9435	20	3600.01	52772351	19	3600.01	1213315061	20	3600.01	329619108
keller5.clq	776	225990	20	3600.01	56632086	30	3600.01	98654273	37	3600.01	48574437
keller6.clq	3361	4619898	20	3600.01	26155497	67	3600.01	1212827	81	3600.01	1042782
MANN_a27.clq	378	70551	67	3600.01	3680316	351	3600.01	207146187	351	3600.01	97086728
MANN_a45.clq	1035	533115	145	3600.01	6091428	990	3600.01	39871081	990	3600.01	7430298
MANN_a81.clq	3321	5506380	121	3600.01	3629757	3240	3600.01	1352	3240	3600.01	83
MANN_a9.clq	45	918	36	3.69	27632	36	2.22	610143	36	0.02	13031
p_hat1000-1.clq	1000	122253	13	3600.01	292325954	14	3600.01	422196366	14	3600.01	99641432
p_hat1000-2.clq	1000	244799	19	3600.01	98392336	46	3600.01	33004677	63	3600.01	25820862
p_hat1000-3.clq	1000	371746	23	3600.01	33071817	68	3600.01	27730314	94	3600.01	11215861
p_hat1500-1.clq	1500	284923	12	3600.01	316293865	13	3600.01	175650372	15	3600.01	52616186
p_hat1500-2.clq	1500	568960	24	3600.01	113993029	65	3600.01	9201591	88	3600.01	3822684
p_hat1500-3.clq	1500	847244	23	3600.01	31878054	94	3600.01	6023051	121	3600.01	13210805
p_hat300-1.clq	300	10933	12	622.36	81407111	12	3600.01	1819070399	12	2654.45	291775936
p_hat300-2.clq	300	21928	23	3600.01	35539216	27	3600.01	491766442	36	3600.01	172168868
p_hat300-3.clq	300	33390	24	3600.01	21992386	39	3600.01	174281290	51	3600.01	103270404
p_hat500-1.clq	500	31569	13	3600.01	282742306	13	3600.01	840655967	14	3600.01	263462636
p_hat500-2.clq	500	62946	21	3600.01	38854650	39	3600.01	112604500	48	3600.01	72369003
p_hat500-3.clq	500	93800	24	3600.01	26330577	50	3600.01	47627528	70	3600.01	47445477
p_hat700-1.clq	700	60999	13	3600.01	267252404	13	3600.01	515228513	14	3600.01	148365050
p_hat700-2.clq	700	121728	20	3600.01	55338814	44	3600.01	127993434	59	3600.01	41514934
p_hat700-3.clq	700	183010	24	3600.01	23325768	62	3600.01	66380151	86	3600.01	25473839
san1000.clq	1000	250500	21	3600.01	17527300	24	3600.01	243979055	25	3600.01	24470789
san200_0.7.1.clq	200	13930	38	3600.01	3663541	38	3600.01	472402998	46	3600.01	57231879
san200_0.7.2.clq	200	13930	18	3600.01	25926490	36	3600.01	320006443	37	3600.01	61860976
san200_0.9.1.clq	200	17910	30	3600.01	71975498	70	3600.01	86091863	125	3600.01	167667451
san200_0.9.2.clq	200	17910	37	3600.01	8527204	60	3600.01	164360137	103	3600.01	109442611
san200_0.9.3.clq	200	17910	32	3600.01	7397748	47	3600.01	172553324	72	3600.01	133257891
san400_0.5.1.clq	400	39900	18	3600.01	31264766	21	3600.01	179220638	22	3600.01	70008415
san400_0.7.1.clq	400	55860	46	3600.01	1485025	46	3600.01	34363190	61	3600.01	17122096
san400_0.7.2.clq	400	55860	33	3600.01	4034760	30	3600.01	114211537	46	3600.01	58554698
san400_0.7.3.clq	400	55860	29	3600.01	6480302	26	3600.01	115995557	38	3600.01	29634749
san400_0.9.1.clq	400	71820	33	3600.01	10299972	100	3600.01	167684227	150	3600.01	10430098
sanr200_0.7.clq	200	13868	19	3600.01	50903174	24	3600.01	649586246	25	3600.01	266296580
sanr200_0.9.clq	200	17863	29	3600.01	10658265	46	3600.01	151582935	58	3600.01	159404482
sanr400_0.5.clq	400	39984	15	3600.01	160055817	17	3600.01	598245969	17	3600.01	161836525
sanr400_0.7.clq	400	55869	21	3600.01	42603733	23	3600.01	265913165	28	3600.01	102465002
#SOLVED				13			10			11	
#AVE-TIME				3034.26025			3150.06475			3138.2015	

Table 3
Results of the three algorithms on DIAMCS2 graphs with $s = 4$.

graph			RDS			BB			MSB		
name	#vtx	#edge	S *	time(s)	#branches	S *	time(s)	#branches	S *	time(s)	#branches
brock200_1.clq	200	14834	23	3600.01	25809250	29	3600.01	452631273	33	3600.01	215516116
brock200_2.clq	200	9876	16	3600.01	78038819	17	3600.01	1318455458	18	3600.01	444866753
brock200_3.clq	200	12048	17	3600.01	55893733	20	3600.01	817223661	22	3600.01	380414879
brock200_4.clq	200	13089	19	3600.01	29801750	23	3600.01	571129949	25	3600.01	320977631
brock400_1.clq	400	59723	21	3600.01	28629479	30	3600.01	133846633	36	3600.01	104861034
brock400_2.clq	400	59786	22	3600.01	21213425	30	3600.01	111773785	37	3600.01	96234245
brock400_3.clq	400	59681	22	3600.01	27627559	31	3600.01	108534296	38	3600.01	121192035
brock400_4.clq	400	59765	22	3600.01	21705878	33	3600.01	203719610	37	3600.01	91435400
brock800_1.clq	800	207505	18	3600.01	43970521	23	3600.01	51680014	28	3600.01	60130668
brock800_2.clq	800	208166	18	3600.01	43282901	24	3600.01	56762699	29	3600.01	71024324
brock800_3.clq	800	207333	19	3600.01	36972192	25	3600.01	64098463	28	3600.01	67877902
brock800_4.clq	800	207643	20	3600.01	35526051	26	3600.01	83749292	28	3600.01	58318531
C1000.9.clq	1000	450079	35	3600.01	4695130	68	3600.01	14792122	95	3600.01	20858431
C125.9.clq	125	6963	34	3600.01	4820431	50	3600.01	100173049	57	3600.01	180509105
C2000.5.clq	2000	999836	15	3600.01	103812922	18	3600.01	28402020	20	3600.01	31110292
C2000.9.clq	2000	1799532	33	3600.01	3767698	80	3600.01	1218875	102	3600.01	4502740
C250.9.clq	250	27984	32	3600.01	5803240	55	3600.01	36216901	69	3600.01	126051439
C4000.5.clq	4000	4000268	14	3600.01	108125550	20	3600.02	8476486	22	3600.01	6348052
C500.9.clq	500	112332	34	3600.01	5999717	58	3600.01	25778171	79	3600.01	46568992
c-fat200-1.clq	200	1534	12	6.49	5074105	12	0.08	36864	12	0.01	3324
c-fat200-2.clq	200	3235	24	0.79	385727	24	0.02	24555	24	0	1034
c-fat200-5.clq	200	8473	58	0.54	31892	58	0.54	297958	58	0.05	4320
c-fat500-1.clq	500	4459	14	202.6	124087559	14	0.28	99517	14	0.03	5201
c-fat500-10.clq	500	46627	126	2.99	88184	126	5.85	1586216	126	0.27	11322
c-fat500-2.clq	500	9139	26	27.31	10443398	26	0.55	333375	26	0.08	5539
c-fat500-5.clq	500	23191	64	2.27	486119	64	1.07	435989	64	0.08	3755
DSJC1000.5.clq	1000	249826	15	3600	42009629	18	3600	14843311	20	3600.01	19623441
DSJC500.5.clq	500	62624	15	3600	36634129	16	3600	87154217	19	3600.01	114242355
gen200_p0.9.44.clq	200	17910	37	3600.01	5347275	57	3600.01	60689951	73	3600.01	124346207
gen200_p0.9.55.clq	200	17910	32	3600.01	6831012	55	3600.01	44618272	70	3600.01	132586882
gen400_p0.9.55.clq	400	71820	31	3600.01	6549012	60	3600.01	30799157	106	3600.01	43158460
gen400_p0.9.65.clq	400	71820	30	3600.01	7837708	65	3600.01	42996757	124	3600.01	21732998
gen400_p0.9.75.clq	400	71820	32	3600.01	5388136	75	3600.01	40964496	134	3600.01	32682945
hamming10-2.clq	1024	518656	32	3600.01	7532259	512	3600.01	1582263	512	3600.01	11938818
hamming10-4.clq	1024	434176	13	3600.01	112868775	64	3600.01	98984540	64	3600.01	24263323
hamming6-2.clq	64	1824	32	3600.01	6517269	37	3600.01	442260370	35	3600.01	373957279
hamming6-4.clq	64	704	10	2.29	374894	10	2.91	5103105	10	5.67	2488713
hamming8-2.clq	256	31616	32	3600.01	7034980	128	3600.01	13960346	128	3600.01	202017323
hamming8-4.clq	256	20864	13	3600.01	110395427	18	3600.01	725158589	24	3600.01	246927747
johnson16-2-4.clq	120	5460	13	3600.01	107594269	17	3600.01	555243153	19	3600.01	473276908
johnson32-2-4.clq	496	107880	13	3600.01	92136534	35	3600.01	44782954	36	3600.01	111977631
johnson8-2-4.clq	28	210	9	1.92	163360	9	0.63	346597	9	0.47	183688
johnson8-4-4.clq	70	1855	19	3600.01	31461200	22	3600.01	1545298580	22	3600.01	622303721
keller4.clq	171	9435	17	3600.01	79492242	21	3600.01	907018180	22	3600.01	343280144
keller5.clq	776	225990	17	3600.01	81099315	39	3600.01	86043378	45	3600.01	48255044
keller6.clq	3361	4619898	14	3600	35609032	65	3600.03	797570	88	3600.01	1550343
MANN_a27.clq	378	70551	54	3600.01	2665936	351	3600.01	118535236	351	3600.01	123282934
MANN_a45.clq	1035	533115	77	3600.01	1775410	990	3600.02	22840239	990	3600.01	22422311
MANN_a81.clq	3321	5506380	108	3600.01	2620914	3240	8968.23	1762	3240	9390.22	83
MANN_a9.clq	45	918	36	3600.01	2765586	36	1214.03	55729412	36	4.57	878911
p.hat1000-1.clq	1000	122253	12	3600.01	725955735	15	3600.01	349942961	17	3600.01	102718667
p.hat1000-2.clq	1000	244799	11	3600.01	545724723	50	3600.01	23721429	73	3600.01	28070835
p.hat1000-3.clq	1000	371746	23	3600.01	17053003	68	3600.01	12352464	107	3600.01	23975372
p.hat1500-1.clq	1500	284923	11	3600.01	779214838	14	3600.01	136179278	18	3600.01	47849459
p.hat1500-2.clq	1500	568960	10	3600.01	742020012	65	3600.01	10123883	102	3600.01	20390374
p.hat1500-3.clq	1500	847244	20	3600.01	25194727	94	3600.01	8849607	142	3600.01	1949184
p.hat300-1.clq	300	10933	12	3600.01	286494805	14	3600.01	1429111222	14	3600.01	466801482
p.hat300-2.clq	300	21928	22	3600.01	27653027	31	3600.01	361482639	40	3600.01	130266129
p.hat300-3.clq	300	33390	22	3600.01	23126877	46	3600.01	90630294	58	3600.01	102545211
p.hat500-1.clq	500	31569	12	3600.01	316424435	15	3600.01	943109333	15	3600.01	212979002
p.hat500-2.clq	500	62946	17	3600.01	96359105	39	3600.01	54718512	56	3600.01	70225798
p.hat500-3.clq	500	93800	22	3600.01	24281923	55	3600.01	30979329	77	3600.01	43261591
p.hat700-1.clq	700	60999	12	3600.01	436262299	14	3600.01	506499665	16	3600.01	161723933
p.hat700-2.clq	700	121728	15	3600.01	350621357	44	3600.01	73148103	69	3600.01	53456398
p.hat700-3.clq	700	183010	24	3600.01	12994506	62	3600.01	33866783	97	3600.01	34036572
san1000.clq	1000	250500	28	3600.01	6772812	32	3600.01	239768023	33	3600.01	18302664
san200_0.7.1.clq	200	13930	51	3600.01	1300927	30	3600.01	674339741	60	3600.01	197883690
san200_0.7.2.clq	200	13930	24	3600.01	6786160	48	3600.01	189847649	48	3600.01	194564174
san200_0.9.1.clq	200	17910	32	3600.01	3860985	70	3600.01	95687541	125	3600.01	129595478
san200_0.9.2.clq	200	17910	32	3600.01	8897166	60	3600.01	115566467	103	3600.01	89141389
san200_0.9.3.clq	200	17910	34	3600.01	4077379	49	3600.01	94313396	93	3600.01	86205767
san400_0.5.1.clq	400	39900	24	3600.01	7934387	28	3600.01	273868615	29	3600.01	49985739
san400_0.7.1.clq	400	55860	62	3600.01	678589	40	3600.01	207410139	80	3600.01	57195544
san400_0.7.2.clq	400	55860	43	3600.01	3364481	30	3600.01	149500763	61	3600.01	19493521
san400_0.7.3.clq	400	55860	37	3600.01	3875848	24	3600.01	112908650	49	3600.01	23390778
san400_0.9.1.clq	400	71820	33	3600.01	5480058	100	3600.01	108895801	193	3600.01	27215432
sanr200_0.7.clq	200	13868	20	3600.01	30218474	26	3600.01	545424858	28	3600.01	215084995
sanr200_0.9.clq	200	17863	31	3600.01	7612382	56	3600.01	72312856	66	3600.01	115223469
sanr400_0.5.clq	400	39984	15	3600.01	107825222	18	3600.01	472349602	20	3600.01	185284956
sanr400_0.7.clq	400	55869	20	3600.01	34227174	27	3600.01	182531764	32	3600.01	101395410
#SOLVED				9			10			10	
#AVE-TIME				3198.0985			3232.43625			3222.52675	

Table 4
Results of the three algorithms on DIAMCS2 graphs with $s = 5$.

graph			RDS			BB			MSB		
name	#vtx	#edge	S *	time(s)	#branches	S *	time(s)	#branches	S *	time(s)	#branches
brock200_1.clq	200	14834	23	3600.01	17782360	30	3600.01	231612300	37	3600.01	205416002
brock200_2.clq	200	9876	16	3600.01	65248065	18	3600.01	694182987	19	3600.01	399156838
brock200_3.clq	200	12048	17	3600.01	44646772	20	3600.01	449484651	25	3600.01	243851771
brock200_4.clq	200	13089	20	3600.01	24534528	24	3600.01	320839507	28	3600.01	221010425
brock400_1.clq	400	59723	22	3600.01	15103075	32	3600.01	118387846	41	3600.01	94610273
brock400_2.clq	400	59786	22	3600.01	16330444	30	3600.01	61352872	41	3600.01	87893720
brock400_3.clq	400	59681	23	3600.01	16111966	33	3600.01	79485831	41	3600.01	94796662
brock400_4.clq	400	59765	22	3600.01	18479154	33	3600.01	105454460	42	3600.01	93711871
brock800_1.clq	800	207505	20	3600.01	29368312	26	3600.01	52507568	31	3600.01	66971919
brock800_2.clq	800	208166	18	3600.01	32038346	24	3600.01	45139974	32	3600.01	50251770
brock800_3.clq	800	207333	20	3600.01	27463807	29	3600.01	63182769	32	3600.01	63517655
brock800_4.clq	800	207643	20	3600.01	25523079	26	3600.01	41552008	32	3600.01	58194825
C1000.9.clq	1000	450079	38	3600.01	2369134	68	3600.01	9479881	108	3600.01	25354595
C125.9.clq	125	6963	41	3600.01	2570191	50	3600.01	80765830	63	3600.01	180239061
C2000.5.clq	2000	999836	16	3600.01	76888740	18	3600.01	16677528	23	3600.01	28211594
C2000.9.clq	2000	1799532	37	3600.01	2008806	80	3600.01	1695275	112	3600.01	3179760
C250.9.clq	250	27984	36	3600.01	3061895	62	3600.01	23000667	82	3600.01	95226021
C4000.5.clq	4000	4000268	16	3600.01	80998890	18	3600.01	2887548	25	3600.01	4067981
C500.9.clq	500	112332	36	3600.01	3122024	62	3600.01	14111828	91	3600.01	46933166
c-fat200-1.clq	200	1534	12	230.07	332799550	12	0.62	90247	12	0.11	20830
c-fat200-2.clq	200	3235	24	11.37	9697151	24	0.17	129575	24	0.03	3778
c-fat200-5.clq	200	8473	58	5.04	300289	58	3.64	2040620	58	0.24	9079
c-fat500-1.clq	500	4459	8	3600.01	3451363703	14	1.01	276611	14	0.44	42861
c-fat500-10.clq	500	46627	126	30.39	657809	126	33.41	11354380	126	0.99	15756
c-fat500-2.clq	500	9139	26	1201.87	604112363	26	3.7	1757377	26	0.39	29615
c-fat500-5.clq	500	23191	64	31.67	7823971	64	6.85	2922154	64	0.28	9338
DSJC1000.5.clq	1000	249826	16	3600.01	32774118	21	3600	15694913	23	3600.01	19442044
DSJC500.5.clq	500	62624	16	3600.01	31123800	17	3600	70486648	21	3600.01	108806419
gen200_p0.9.44.clq	200	17910	42	3600.01	2507514	61	3600.01	24969912	79	3600.01	134479160
gen200_p0.9.55.clq	200	17910	35	3600.01	3119675	57	3600.01	20926712	78	3600.01	147018849
gen400_p0.9.55.clq	400	71820	35	3600.01	3517386	68	3600.01	26193463	118	3600.01	38845768
gen400_p0.9.65.clq	400	71820	33	3600.01	3920407	65	3600.01	29204856	133	3600.01	39732781
gen400_p0.9.75.clq	400	71820	36	3600.01	3138394	75	3600.01	24485740	134	3600.01	35073989
hamming10-2.clq	1024	518656	40	3600.01	2653105	512	3600.03	96128	512	3600.01	15425836
hamming10-4.clq	1024	434176	15	3600.01	96269067	47	3600.01	48509681	66	3600.01	28731244
hamming6-2.clq	64	1824	40	3600.01	2512174	44	3600.01	185070959	48	3600.01	453834699
hamming6-4.clq	64	704	12	48.14	3659296	12	20.35	22304439	12	36.67	13885967
hamming8-2.clq	256	31616	40	3600.01	2497980	128	3600.01	3842871	128	3600.01	157809866
hamming8-4.clq	256	20864	15	3600.01	85721924	21	3600.01	647846483	32	3600.01	285413061
johnson16-2-4.clq	120	5460	15	3600.01	53663933	22	3600.01	454618360	24	3600.01	392782304
johnson32-2-4.clq	496	107880	15	3600.01	52162127	45	3600.01	35579078	48	3600.01	146544221
johnson8-2-4.clq	28	210	12	9.06	266073	12	0.39	252089	12	0.3	154757
johnson8-4-4.clq	70	1855	20	3600.01	22109650	25	3600.01	918345300	25	3600.01	477763068
keller4.clq	171	9435	16	3600.01	56433379	25	3600.01	808102505	27	3600.01	288910340
keller5.clq	776	225990	16	3600.01	49959048	43	3600.01	25776005	55	3600.01	34769330
keller6.clq	3361	4619898	16	3600.01	19645203	78	3600.04	797870	100	3600.01	1701496
MANN_a27.clq	378	70551	135	3600.29	33015	351	3600.01	54128977	351	3600.01	136476187
MANN_a45.clq	1035	533115	94	3600.01	603946	990	3600.01	28046598	990	3600.01	29607009
MANN_a81.clq	3321	5506380	177	3601.42	15886	3240	6318.49	1765	3240	4692.34	83
MANN_a9.clq	45	918	45	0.79	1020	45	0	1	45	0	2
p_hat1000-1.clq	1000	122253	9	3600.01	2936639616	16	3600.01	294501706	18	3600.01	106026204
p_hat1000-2.clq	1000	244799	10	3600.01	1297458721	49	3600.01	15320170	83	3600.01	31631240
p_hat1000-3.clq	1000	371746	21	3600.01	18222674	68	3600.01	6233803	117	3600.01	18558870
p_hat1500-1.clq	1500	284923	8	3600.01	3352727861	14	3600.01	54655879	20	3600.01	50876707
p_hat1500-2.clq	1500	568960	10	3600.01	1874319777	65	3600.01	4687123	114	3600.01	22945734
p_hat1500-3.clq	1500	847244	20	3600.01	28500543	94	3600.01	5711824	155	3600.01	2926253
p_hat300-1.clq	300	10933	13	3600.01	309992832	15	3600.01	1582515278	16	3600.01	413488909
p_hat300-2.clq	300	21928	18	3600.01	64796448	30	3600.01	173512561	45	3600.01	141635688
p_hat300-3.clq	300	33390	21	3600.01	22058547	43	3600.01	55182691	64	3600.01	99331202
p_hat500-1.clq	500	31569	12	3600.01	802201339	15	3600.01	848685873	17	3600.01	200004749
p_hat500-2.clq	500	62946	11	3600.01	547694530	41	3600.01	51410709	60	3600.01	62386986
p_hat500-3.clq	500	93800	23	3600.01	16742847	58	3600.01	25149415	85	3600.01	56741924
p_hat700-1.clq	700	60999	9	3600.01	1896588120	15	3600.01	473097914	18	3600.01	145346137
p_hat700-2.clq	700	121728	11	3600.01	781371758	44	3600.01	64546989	75	3600.01	46893043
p_hat700-3.clq	700	183010	23	3600.01	10833985	62	3600.01	26612109	107	3600.01	28771421
san1000.clq	1000	250500	32	3600.01	3364699	40	3600.01	161127392	41	3600.01	16360830
san200_0.7.1.clq	200	13930	67	3600.03	7850683	30	3600.01	444644669	75	3600.01	209062547
san200_0.7.2.clq	200	13930	30	3600.01	2631659	60	3600.01	56246131	60	3600.01	35735615
san200_0.9.1.clq	200	17910	36	3600.01	2275766	70	3600.01	63719671	125	3600.01	74820409
san200_0.9.2.clq	200	17910	33	3600.01	5594922	60	3600.01	33599565	103	3600.01	83139421
san200_0.9.3.clq	200	17910	34	3600.01	2978947	55	3600.01	42782218	95	3600.01	99292225
san400_0.5.1.clq	400	39900	28	3600.01	3218785	35	3600.01	407487783	35	3600.01	36669316
san400_0.7.1.clq	400	55860	75	3600.01	6232200	40	3600.01	171160879	100	3600.01	12042988
san400_0.7.2.clq	400	55860	46	3600.01	10295256	30	3600.01	157177435	76	3600.01	19119378
san400_0.7.3.clq	400	55860	44	3600.01	9784930	25	3600.01	74836537	61	3600.01	20399504
san400_0.9.1.clq	400	71820	36	3600.01	2813997	100	3600.01	48303810	193	3600.01	22802899
sanr200_0.7.clq	200	13868	20	3600.05	26117596	27	3600.01	298983055	31	3600.01	235058096
sanr200_0.9.clq	200	17863	32	3600.01	4074399	58	3600.01	40188474	73	3600.01	129293255
sanr400_0.5.clq	400	39984	17	3600.01	77511692	18	3600.01	329047792	22	3600.01	147913387
sanr400_0.7.clq	400	55869	21	3600.01	18293867	28	3600.01	96312162	35	3600.01	87568946
#SOLVED	9					10					
#AVE-TIME	3214.63525					3184.866875					
						3164.156					

Table 5
Results of the three algorithms on DIMACS10 and SNAP graphs with $s = 2$.

graph	RDS			BB			MSB		
	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches
adjnoun.graph	6	0	1905	6	0	4284	6	0	1395
as-22july06.graph	19	0.17	14631	19	0.11	111543	19	0.15	22145
astro-ph.graph	57	0	0	57	0.01	0	57	0.01	0
caidaRouterLevel.graph	20	110.54	12335666	20	11.8	1368045	20	13.78	211935
celegans_metabolic.graph	10	0	1423	10	0	2656	10	0	471
celegansneural.graph	10	0.11	12372	10	0.1	39344	10	0.06	4141
chesapeake.graph	7	0	737	7	0	342	7	0	130
cit-HepPh.txt	24	966.22	35280937	24	489.62	18999638	24	188.18	1067121
cit-HepTh.txt	28	457.67	20292248	28	936.86	56982397	28	780.24	2719809
cnr-2000.graph	85	0.54	3654	85	0.1	25	85	0.11	5
coAuthorsCiteseer.graph	87	0.03	0	87	0.04	0	87	0.04	0
coAuthorsDBLP.graph	115	0.05	0	115	0.07	0	115	0.07	0
cond-mat.graph	18	0	0	18	0	0	18	0	0
cond-mat-2003.graph	25	0	0	25	0.01	0	25	0	0
cond-mat-2005.graph	30	0.01	0	30	0.01	0	30	0	0
dolphins.graph	6	0	211	6	0	241	6	0	69
email.graph	12	0	0	12	0	0	12	0	0
email-EuAll.txt	19	16.12	2029493	19	154.81	29430847	19	428.95	3215472
football.graph	10	0	1850	10	0	1637	10	0	194
hep-th.graph	24	0	0	24	0	0	24	0	0
jazz.graph	30	0	0	30	0	0	30	0	0
karate.graph	6	0	31	6	0	25	6	0	20
lesmis.graph	10	0	66	10	0	28	10	0	6
memplus.graph	97	0	0	97	0	0	97	0	0
netscience.graph	20	0	0	20	0	0	20	0	0
p2p-Gnutella04.txt	5	460.98	13275808	5	164.24	7469445	5	34.55	346505
p2p-Gnutella24.txt	5	1022.96	22869070	5	949.74	23359873	5	75.46	386703
p2p-Gnutella25.txt	5	587.93	20959691	5	495.52	17090942	5	50.6	257497
PGPgiantcompo.graph	29	3.18	76355	29	0.02	19279	29	0.01	586
polblogs.graph	23	16.22	1523729	23	13.13	8116178	23	5.8	207570
polbooks.graph	7	0	1563	7	0	1267	7	0	394
power.graph	6	0	47	6	0	51	6	0	15
rgg_n.2.17_s0.graph	16	0.03	357	16	0.04	228	16	0.03	31
rgg_n.2.19_s0.graph	19	0.11	187	19	0.13	1	19	0.17	2
rgg_n.2.20_s0.graph	18	0.4	14788	18	0.35	9998	18	0.43	466
Slashdot0811.txt	31	315.93	9228474	31	3608.22	429349324	31	3600.01	8198605
Slashdot0902.txt	32	285.99	10049555	32	3600.01	320983898	32	3600.01	7442901
soc-Epinions1.txt	28	899.92	40381147	28	3600.01	236500796	28	3601.18	18340657
web-BerkStan.txt	202	25.46	34299	202	0.94	56207	202	0.73	385
web-Google.txt	46	1.11	4849	46	1.02	1343	46	1.03	101
web-NotreDame.txt	155	4.72	729314	155	15.3	3985497	155	0.18	4611
web-Stanford.txt	63	3600.01	82894034	64	0.57	31051	64	12.19	82836
wiki-Vote.txt	21	95.87	8547750	21	1375.82	236064013	21	3002.35	16054034
#SOLVED	42			40			40		
#AVE-TIME	206.332093			358.572093			358.0539535		

Table 6
Results of the three algorithms on DIMACS10 and SNAP graphs with $s = 3$.

graph	RDS			BB			MSB		
	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches
adjnoun.graph	8	0.03	21912	8	0	5926	8	0	986
as-22july06.graph	21	10.71	267033	21	2.33	1855978	21	2.83	268096
astro-ph.graph	57	0.13	34210	57	0.01	1545	57	0.01	62
caidaRouterLevel.graph	15	3600.01	598892906	23	63.13	7622809	23	25.99	521690
celegans_metabolic.graph	11	0.14	58370	11	0	9391	11	0	981
celegansneural.graph	11	4.3	327398	11	0.47	174210	11	0.11	10019
chesapeake.graph	8	0	3254	8	0	1258	8	0	236
cit-HepPh.txt	15	3600.01	366433471	27	1080.15	37248436	27	200.04	864930
cit-HepTh.txt	16	3600.01	583163763	31	3605.36	286124706	31	858.68	4935089
cnr-2000.graph	86	0.74	3735	86	0.09	1	86	0.13	2
coAuthorsCiteseer.graph	87	0.04	0	87	0.04	0	87	0.03	0
coAuthorsDBLP.graph	115	0.06	0	115	0.06	0	115	0.07	0
cond-mat.graph	18	0	0	18	0	0	18	0	0
cond-mat-2003.graph	25	0.1	1064	25	0.01	89	25	0	78
cond-mat-2005.graph	30	0	0	30	0	0	30	0	0
dolphins.graph	7	0	3110	7	0	1048	7	0	218
email.graph	12	0.27	171329	12	0	3081	12	0	121
email-EuAll.txt	22	2890.41	156121754	22	3600.37	812282746	22	3600.04	76410373
football.graph	11	0.03	20563	11	0	3536	11	0	320
hep-th.graph	24	0	0	24	0	0	24	0	0
jazz.graph	30	0	0	30	0	0	30	0	0
karate.graph	6	0	724	6	0	193	6	0	66
lesmis.graph	11	0	347	11	0	139	11	0	29
memplus.graph	97	0	0	97	0	0	97	0	0
netscience.graph	20	0	0	20	0	0	20	0	0
p2p-Gnutella04.txt	4	3600.01	914621813	7	280.02	14392762	7	54.06	324412
p2p-Gnutella24.txt	4	3600.01	903755309	6	1813.67	42925144	6	229.83	419613
p2p-Gnutella25.txt	4	3600.01	1096277454	6	1190.43	31306994	6	150.53	284788
PGPgiantcompo.graph	31	48.21	408884	31	0.04	23560	31	0	746
polblogs.graph	27	1598.07	44737364	27	112.64	72268293	27	50.42	1944699
polbooks.graph	9	0.04	31497	9	0	2804	9	0	478
power.graph	6	0	4465	6	0	652	6	0	238
rgg_n.2.17_s0.graph	16	0.26	185049	16	0.05	5370	16	0.03	366
rgg_n.2.19_s0.graph	19	0.12	6921	19	0.13	709	19	0.14	66
rgg_n.2.20_s0.graph	19	10.36	7908493	19	0.38	71667	19	0.41	1393
Slashdot0811.txt	6	3600.01	506287443	33	3600.01	364712666	34	3600.01	28941337
Slashdot0902.txt	6	3600.01	594182780	35	3600.01	375157120	35	3600.02	31536254
soc-Epinions1.txt	20	3600.01	517968508	23	3600.01	213065396	32	3600.01	35641346
web-BerkStan.txt	202	32.34	760147	202	1.44	233496	202	0.72	590
web-Google.txt	40	3600.01	35464762	47	1.07	2756	47	1.06	768
web-NotreDame.txt	155	1381.62	286591656	155	142.44	37369397	155	0.68	23644
web-Stanford.txt	64	3600.01	39412793	64	7.87	2043869	64	294.77	2381162
wiki-Vote.txt	20	3600.01	295377912	19	3600.04	736210629	24	3600.01	84873260
#SOLVED	31			37			38		
#AVE-TIME	1143.676744			611.6806977			462.1076744		

Table 7
Results of the three algorithms on DIMACS10 and SNAP graphs with $s = 4$.

graph	RDS			BB			MSB		
	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches
adjnoun.graph	8	1.22	767369	8	0.03	61306	8	0.04	17883
as-22july06.graph	22	584.83	9960220	22	31.18	16584070	22	33.3	2734183
astro-ph.graph	57	1.71	490927	57	0.02	1441	57	0.01	68
caidaRouterLevel.graph	12	3600.01	1056478098	24	932.68	171253088	24	1098.67	35374237
celegans_metabolic.graph	12	5.02	2087066	12	0.02	24611	12	0.01	2188
celegansneural.graph	12	141.75	10650745	12	2.06	719682	12	0.2	18390
chesapeake.graph	9	0.05	34460	9	0	3143	9	0	369
cit-HepPh.txt	15	3600.01	1357982344	30	1556.34	37998033	30	239.41	511246
cit-HepTh.txt	17	3600.01	873446953	34	3600.01	283558818	34	208.32	1628827
cnr-2000.graph	86	5.14	4167	86	0.1	509	86	0.11	13
coAuthorsCiteseer.graph	87	0.05	0	87	0.05	0	87	0.04	0
coAuthorsDBLP.graph	115	0.04	0	115	0.06	0	115	0.08	0
cond-mat.graph	18	0.06	26417	18	0	735	18	0	226
cond-mat-2003.graph	26	0.06	18556	26	0.01	327	26	0.01	55
cond-mat-2005.graph	30	0	0	30	0.01	0	30	0	0
dolphins.graph	7	0.06	70280	7	0	2785	7	0	493
email.graph	12	121.53	93840054	12	0.01	15896	12	0.01	4257
email-EuAll.txt	9	3600.01	1591318350	24	3600.01	742299566	25	3600.01	96945775
football.graph	12	0.79	522491	12	0	7591	12	0	531
hep-th.graph	24	0	0	24	0	0	24	0	0
jazz.graph	30	0	0	30	0	0	30	0	0
karate.graph	8	0	13714	8	0	713	8	0	174
lesmis.graph	12	0.04	2763	12	0	352	12	0	54
memplus.graph	97	0	0	97	0	0	97	0	0
netscience.graph	20	0	0	20	0	0	20	0	0
p2p-Gnutella04.txt	4	3600.01	3117019876	9	2846.5	98201066	9	93.5	260125
p2p-Gnutella24.txt	4	3600.01	3040655665	5	3600.01	70755505	8	773	395071
p2p-Gnutella25.txt	4	3600.01	3864501719	8	3600.01	75987296	8	383.18	287287
PGPgiantcompo.graph	33	315.25	1976138	33	0.03	17653	33	0	727
polblogs.graph	18	3600.01	128661444	29	810.04	481859800	29	348.53	15465547
polbooks.graph	10	0.4	429748	10	0	4235	10	0	699
power.graph	8	41.31	79494155	8	0.01	14354	8	0	1034
rgg_n.2.17_s0.graph	16	3600.01	2736602833	17	0.26	137745	17	0.05	2176
rgg_n.2.19_s0.graph	20	61.38	47273529	20	0.13	15837	20	0.14	545
rgg_n.2.20_s0.graph	18	3600.01	2307369025	20	5.3	1399802	20	0.65	7078
Slashdot0811.txt	6	3600.01	2903583297	35	3600.01	226323655	38	3600.01	56919226
Slashdot0902.txt	6	3600.01	2760777278	38	3600.01	211013553	40	3600.01	53344941
soc-Epinions1.txt	19	3600.01	909588409	23	3600.01	279470177	37	3600.01	34804839
web-BerkStan.txt	202	364.44	30564805	202	4.44	1289354	202	0.77	923
web-Google.txt	13	3600.01	498968162	48	1.01	3070	48	1.03	986
web-NotreDame.txt	154	3600.01	567620651	155	1546.95	394704249	155	4.53	201458
web-Stanford.txt	62	3600.01	2965419492	65	707.23	183750812	65	3600.01	28071785
wiki-Vote.txt	7	3600.01	2255767223	24	3600.01	635237833	27	3600.01	88071741
#SOLVED	26			35			37		
#AVE-TIME	1461.518605			866.1523256			576.4104651		

Table 8
Results of the three algorithms on DIMACS10 and SNAP graphs with $s = 5$.

graph	RDS			BB			MSB		
	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches	$ S^* $	time(s)	#branches
adjnoun.graph	10	9.88	11684377	10	0.01	27261	10	0	2926
as-22july06.graph	22	3600.01	193448602	24	109.82	45073210	24	188.5	12570684
astro-ph.graph	57	367.89	22119592	57	0.08	84685	57	0.01	286
caidaRouterLevel.graph	9	3600.01	3345111749	26	1339.59	144482544	17	3600.01	40289995
celegans_metabolic.graph	14	1245.46	1647223802	14	0.05	65965	14	0	2029
celegansneural.graph	11	3600.01	365095125	13	4.27	1374876	13	0.35	31717
chesapeake.graph	11	0.56	261302	11	0	5060	11	0	208
cit-HepPh.txt	7	3600.01	7124417586	19	3602.06	202448148	32	238.64	409078
cit-HepTh.txt	9	3600.01	2962960598	37	823.09	42572891	37	107.42	516893
cnr-2000.graph	85	3600.01	41990967	86	0.11	4076	86	0.12	106
coAuthorsCiteseer.graph	87	0.03	0	87	0.05	0	87	0.04	0
coAuthorsDBLP.graph	115	0.03	0	115	0.08	0	115	0.09	0
cond-mat.graph	18	7.92	11112484	18	0.02	3426	18	0.01	917
cond-mat-2003.graph	27	6.08	1274596	27	0.01	1588	27	0.01	78
cond-mat-2005.graph	30	0.64	206310	30	0	308	30	0	34
dolphins.graph	9	0.46	904567	9	0.01	21829	9	0	448
email.graph	12	3600.01	2248495675	13	0.06	69730	13	0.04	7573
email-EuAll.txt	7	3600.01	5017530359	25	3600.01	515000626	27	3600.01	90809308
football.graph	12	7.71	8437060	12	0.01	15225	12	0	831
hep-th.graph	24	0	0	24	0	0	24	0	0
jazz.graph	30	0	0	30	0	0	30	0	0
karate.graph	9	0.02	64235	9	0	1166	9	0	197
lesmis.graph	12	0.53	33848	12	0	839	12	0	107
memplus.graph	97	0	0	97	0	0	97	0	0
netscience.graph	20	0	0	20	0	0	20	0	0
p2p-Gnutella04.txt	5	3600.01	6893637390	6	3600.73	122154021	10	91.77	276221
p2p-Gnutella24.txt	5	3600.01	7823384284	5	3600.01	34786759	9	715.71	450854
p2p-Gnutella25.txt	5	3600.01	7309543519	5	3600.01	61945751	10	391.09	282175
PGPgiantcompo.graph	29	3600.01	34486216	35	0.06	48460	35	0.01	1757
polblogs.graph	10	3600.01	3884094179	32	1409.8	725799291	32	687.37	32327667
polbooks.graph	11	8.03	8330823	11	0	11705	11	0	993
power.graph	7	3600.01	5438048671	9	23.31	3841378	9	1.14	26217
rgg_n.2.17_s0.graph	16	3600.01	4810748430	18	6.43	1478634	18	0.25	10939
rgg_n.2.19_s0.graph	19	3600.01	5315889057	21	0.21	100579	21	0.18	2075
rgg_n.2.20_s0.graph	18	3600.01	5579984034	20	166	14280742	20	3.67	32022
Slashdot0811.txt	6	3600.01	6291847096	37	3600.01	219129529	40	3600.01	55409867
Slashdot0902.txt	6	3600.01	6136075983	31	3600.01	203964507	42	3600.01	54972232
soc-Epinions1.txt	22	3600.01	4129558744	23	3600.01	139677662	39	3600.01	37955143
web-BerkStan.txt	202	3600.01	348125133	202	21.22	7348112	202	0.97	2242
web-Google.txt	16	3600.01	210426755	48	0.88	3343	48	1.05	1169
web-NotreDame.txt	154	3600.01	289689096	155	3600.01	903620956	155	28.16	1996870
web-Stanford.txt	25	3600.01	27271224	64	3600.01	1233379460	61	3600.01	78510008
wiki-Vote.txt	6	3600.01	6611975269	20	3600.01	537567821	28	3600.01	81350646
#SOLVED	18			32			36		
#AVE-TIME	2131.523023			1011.815116			643.1783721		