

Table 1: Sizes and times (seconds) produced by APTS, DPTS and SPTS for 2-way CAG

Name	DPTS		SPTS		APTS	
	min(avg)_size	avg_time	min(avg)_size	avg_time	min(avg)_size	avg_time
SPIN-S	19(19)	12.9	19(19)	0.1	19(19)	0.0
SPIN-V	38(43)	0.0	31(31)	0.5	31(31)	0.7
GCC	16(19.8)	0.2	16(16)	3.1	16(16)	15.2
Apache	30(30)	0.3	30(30)	0.2	30(30)	0.3
Bugzilla	16(16)	0.0	16(16)	0.0	16(16)	0.0
Syn_1	36(36)	2.3	36(36)	3.1	36(36)	2.3
Syn_2	30(30)	0.0	30(30)	0.0	30(30)	0.1
Syn_3	18(18)	0.0	18(18)	0.0	18(18)	0.0
Syn_4	20(20)	0.0	20(20)	0.0	20(20)	0.0
Syn_5	43(43.7)	13.4	42(42)	389.4	40 (40.9)	576.5
Syn_6	24(24)	0.0	24(24)	0.0	24(24)	0.0
Syn_7	9(9)	0.0	9(9)	0.0	9(9)	0.0
Syn_8	36(36.3)	243.4	36(36)	49.0	36(36)	7.3
Syn_9	20(20)	0.0	20(20)	0.0	20(20)	0.0
Syn_10	39(40.6)	14.9	38(38.5)	428.0	37 (37.8)	414.6
Syn_11	37(37.9)	334.8	37(37.4)	545.4	37(37.7)	60.2
Syn_12	36(36)	2.1	36(36)	0.6	36(36)	1.1
Syn_13	36(36)	0.0	36(36)	0.0	36(36)	0.1
Syn_14	36(36)	0.1	36(36)	0.1	36(36)	0.1
Syn_15	30(30)	0.0	30(30)	0.0	30(30)	0.0
Syn_16	24(24)	0.0	24(24)	0.0	24(24)	0.0
Syn_17	36(36)	0.6	36(36)	0.5	36(36)	0.8
Syn_18	38(38)	255.4	38(38)	30.4	36 (36.9)	120.6
Syn_19	42(43.2)	466.8	42(42)	375.3	39 (39.5)	1477.2
Syn_20	49(49.2)	22.1	48(48.4)	697.6	47 (47.4)	1000.9
Syn_21	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_22	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_23	12(12)	0.0	12(12)	0.0	12(12)	0.0
Syn_24	39(39.4)	8.6	38(38)	664.3	38(38)	61.7
Syn_25	44(45.7)	173.3	41 (43.4)	930.7	42(42.9)	552.0
Syn_26	27(27.4)	237.4	26(26.6)	206.9	26(26)	155.3
Syn_27	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_28	46(46.5)	133.4	45(45.9)	117.4	43 (43.9)	1500.0
Syn_29	25(25)	1.6	25(25)	0.8	25(25)	0.7
Syn_30	16(16)	4.3	16(16)	1.6	16(16)	1.1

Table 2: Sizes and times (seconds) produced by APTS, DPTS and SPTS for 3-way CAG

Name	DPTS		SPTS		APTS	
	min(avg)_size	avg_time	min(avg)_size	avg_time	min(avg)_size	avg_time
SPIN-S	80(80)	30.3	80(80)	101.9	80(80)	13.3
SPIN-V	244(266.2)	15.9	192(192.9)	1656.3	192(193)	932.8
GCC	78(81)	1180.2	77(78)	3314.8	77(78.4)	4117.0
Apache	136(137.9)	7096.2	135(138)	6969.0	134 (137.3)	5165.9
Bugzilla	48(48)	176.6	48(48)	632.1	48(48)	373.9
Syn_1	244(246.7)	1659.7	242(245.5)	3818.5	239 (241.2)	7320.6
Syn_2	135(136.3)	4043.1	123(127.2)	5258.0	122 (125.8)	5732.4
Syn_3	51(51)	259.2	51(51)	1007.9	51(51)	699.1
Syn_4	80(80)	84.7	80(80)	105.8	80(80)	82.5
Syn_5	329(333.8)	2220.3	325(330.3)	5021.3	325(328.2)	7820.2
Syn_6	96(96)	135.9	96(96)	268.9	96(96)	108.4
Syn_7	25(25)	6.6	25(25)	27.2	25(25)	64.6
Syn_8	256(258)	5279.8	249(255.2)	5207.0	249(250.6)	7934.7
Syn_9	60(60)	55.1	60(60)	78.8	60(60)	56.1
Syn_10	282(283.9)	2633.0	277(279.7)	5645.2	274 (276.8)	7337.4
Syn_11	271(273.7)	3554.7	266(270.7)	5559.8	266(267.7)	7344.9
Syn_12	216(216.4)	2961.8	216(216)	1211.3	216(216)	1360.5
Syn_13	180(180)	519.2	180(180)	175.5	180(180)	70.3
Syn_14	216(216)	51.2	216(216)	53.0	216(216)	33.6
Syn_15	150(150.2)	202.9	150(150)	64.5	150(150)	70.7
Syn_16	96(96)	207.8	96(96)	496.7	96(96)	381.6
Syn_17	216(216.4)	5113.1	216(216)	1347.1	216(216)	907.5
Syn_18	279(280.9)	5610.5	273(278.7)	5287.1	271 (273.7)	8023.8
Syn_19	316(319.4)	4773.4	313(317)	4069.7	310 (314.2)	7494.7
Syn_20	411(412.1)	4461.1	407(409.5)	6164.0	406 (407.7)	8202.2
Syn_21	216(216)	7.2	216(216)	12.4	216(216)	17.1
Syn_22	144(144)	62.9	144(144)	46.9	144(144)	37.6
Syn_23	36(36)	19.1	36(36)	8.4	36(36)	25.9
Syn_24	285(287.8)	1641.5	278(284.9)	3043.6	277 (278.8)	8153.8
Syn_25	352(354.7)	3085.6	344(347.2)	7544.5	343 (345.1)	8107.3
Syn_26	163(165)	688.3	157(160.1)	5504.0	155 (158)	6402.4
Syn_27	180(180)	24.7	180(180)	15.8	180(180)	17.3
Syn_28	371(372.1)	2428.7	365(368)	5166.8	362 (365.1)	8816.4
Syn_29	125(125)	653.4	125(125)	103.2	125(125)	260.0
Syn_30	66(67.6)	3381.4	65(65.4)	4455.0	64 (65.6)	2883.0

Table 3: Statistical test results of comparison between APTS and DPTS, SPTS on size

Name	2-way				3-way			
	APTS vs DPTS		APTS vs SPTS		APTS vs DPTS		APTS vs SPTS	
	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>
SPIN-S	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
SPIN-V	0.000	0.000	1.000	0.500	0.002	0.090	0.737	0.540
GCC	0.000	0.050	1.000	0.500	0.038	0.240	0.167	0.670
Apache	1.000	0.500	1.000	0.500	0.817	0.470	0.445	0.400
Bugzilla	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_1	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.040
Syn_2	1.000	0.500	1.000	0.500	0.000	0.000	0.300	0.365
Syn_3	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_4	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_5	0.000	0.000	0.000	0.000	0.000	0.035	0.017	0.190
Syn_6	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_7	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_8	0.147	0.400	1.000	0.500	0.000	0.000	0.020	0.090
Syn_9	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_10	0.000	0.000	0.007	0.200	0.000	0.000	0.001	0.090
Syn_11	0.276	0.400	0.189	0.650	0.000	0.000	0.002	0.100
Syn_12	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_13	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_14	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_15	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_16	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_17	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_18	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.085
Syn_19	0.000	0.000	0.000	0.000	0.001	0.065	0.039	0.230
Syn_20	0.000	0.000	0.002	0.120	0.000	0.000	0.029	0.220
Syn_21	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_22	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_23	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_24	0.000	0.000	1.000	0.500	0.000	0.000	0.001	0.080
Syn_25	0.000	0.000	0.021	0.235	0.000	0.000	0.026	0.210
Syn_26	0.000	0.000	0.004	0.200	0.000	0.000	0.020	0.195
Syn_27	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_28	0.000	0.050	0.000	0.000	0.000	0.000	0.003	0.120
Syn_29	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_30	1.000	0.500	1.000	0.500	0.001	0.065	0.188	0.660

Table 4: Comparisons among APTS, DPTS and SPTS in terms of time (second) for 2-way CAG

Name	size	DPTS avg_time	SPTS avg_time	APTS avg_time	Name	size	DPTS avg_time	SPTS avg_time	APTS avg_time
SPIN-S	19	12.9	0.1	0.0	Syn_13	36	0.0	0.0	0.1
Apache	30	0.3	0.2	0.3	Syn_14	36	0.1	0.1	0.1
Bugzilla	16	0.0	0.0	0.0	Syn_15	30	0.0	0.0	0.0
Syn_1	36	2.3	3.1	2.3	Syn_16	24	0.0	0.0	0.0
Syn_2	30	0.0	0.0	0.1	Syn_17	36	0.6	0.5	0.8
Syn_3	18	0.0	0.0	0.0	Syn_21	36	0.0	0.0	0.0
Syn_4	20	0.0	0.0	0.0	Syn_22	36	0.0	0.0	0.0
Syn_6	24	0.0	0.0	0.0	Syn_23	12	0.0	0.0	0.0
Syn_7	9	0.0	0.0	0.0	Syn_27	36	0.0	0.0	0.0
Syn_9	20	0.0	0.0	0.0	Syn_29	25	1.6	0.8	0.7
Syn_12	36	2.1	0.6	1.1	Syn_30	16	4.3	1.6	1.1

Table 5: Comparisons among APTS, DPTS and SPTS in terms of time (second) for 3-way CAG

Name	size	DPTS avg_time	SPTS avg_time	APTS avg_time	Name	size	DPTS avg_time	SPTS avg_time	APTS avg_time
SPIN-S	80	30.3	101.9	13.3	Syn_14	216	51.2	53.0	33.6
Bugzilla	48	176.6	632.1	373.9	Syn_15	150	202.9	64.5	70.7
Syn_3	51	259.2	1007.9	699.1	Syn_16	96	207.8	496.7	381.6
Syn_4	80	84.7	105.8	82.5	Syn_17	216	5113.1	1347.1	907.5
Syn_6	96	135.9	268.9	108.4	Syn_21	216	7.2	12.4	17.1
Syn_7	25	6.6	27.2	276.3	Syn_22	144	62.9	46.9	37.6
Syn_9	60	55.1	78.8	56.1	Syn_23	36	19.1	8.4	25.9
Syn_12	216	2961.8	1211.3	1360.5	Syn_27	180	24.7	15.8	17.3
Syn_13	180	519.2	175.5	70.3	Syn_29	125	653.4	103.2	260.0

Table 6: Statistical test results of comparison between APTS and DPTS,SPTS on time

Name	2-way				3-way			
	APTS vs DPTS		APTS vs SPTS		APTS vs DPTS		APTS vs SPTS	
	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>
SPIN-S	0.448	0.400	0.075	0.300	0.940	0.490	0.037	0.225
Apache	0.288	0.640	0.330	0.620	-	-	-	-
Bugzilla	1.000	0.500	1.000	0.500	0.019	0.810	0.545	0.420
Syn_1	0.293	0.365	0.293	0.365	-	-	-	-
Syn_2	0.121	0.700	0.056	0.720	-	-	-	-
Syn_3	1.000	0.500	1.000	0.500	0.096	0.720	0.273	0.355
Syn_4	0.141	0.600	0.146	0.600	0.880	0.480	0.198	0.330
Syn_6	1.000	0.500	1.000	0.500	0.406	0.610	0.114	0.290
Syn_7	1.000	0.500	1.000	0.500	0.003	0.890	0.384	0.615
Syn_9	1.000	0.500	1.000	0.500	0.762	0.540	0.344	0.375
Syn_12	0.051	0.735	0.051	0.740	0.019	0.190	0.241	0.655
Syn_13	0.684	0.560	0.075	0.700	0.000	0.010	0.187	0.325
Syn_14	0.172	0.680	0.058	0.720	0.344	0.375	0.405	0.390
Syn_15	0.146	0.400	0.146	0.400	0.273	0.355	0.520	0.585
Syn_16	1.000	0.500	1.000	0.500	0.151	0.690	0.571	0.425
Syn_17	1.000	0.500	0.140	0.680	0.000	0.020	0.273	0.355
Syn_21	0.146	0.400	0.146	0.400	0.820	0.530	0.970	0.505
Syn_22	1.000	0.500	1.000	0.500	0.850	0.475	0.272	0.355
Syn_23	1.000	0.500	1.000	0.500	0.384	0.380	0.084	0.525
Syn_27	1.000	0.500	0.146	0.600	0.384	0.385	0.649	0.560
Syn_29	1.000	0.500	0.939	0.490	0.028	0.210	0.064	0.745
Syn_30	0.759	0.460	0.434	0.400	-	-	-	-

Table 7: Sizes and times (seconds) produced by APTS and existing algorithms for 2-way CAG

Name	CATS	Calot	HHSA-H	CASA		FastCA		WCA		APTS	
	min _size	min _size	min _size	min(avg) _size	avg _time	min(avg) _size	avg _time	min(avg) _size	avg _time	min(avg) _size	avg _time
SPIN-S	19	19	19	19(20.8)	3.6	19(19)	0.2	19(19)	0.1	19(19)	0.0
SPIN-V	31	31	31	36(40.1)	56.0	31(31)	61.8	31(31)	1.5	31(31)	0.7
GCC	16	15	18	19(21.1)	483.0	16(16)	127.6	15(15)	27.3	16(16)	15.2
Apache	30	30	30	30(33.2)	63.6	30(30)	0.0	30(30)	0.0	30(30)	0.3
Bugzilla	16	16	16	16(16.3)	3.2	16(16)	0.0	16(16)	0.0	16(16)	0.0
Syn_1	36	37	36	38(39.1)	183.7	36(36)	0.5	36(36)	0.2	36(36)	2.3
Syn_2	30	30	30	30(32.3)	20.9	30(30)	0.0	30(30)	1.4	30(30)	0.1
Syn_3	18	18	18	18(18.2)	0.5	18(18)	0.0	18(18)	0.0	18(18)	0.0
Syn_4	20	20	20	20(22.3)	5.0	20(20)	0.0	20(20)	0.0	20(20)	0.0
Syn_5	41	45	44	46(51.9)	351.1	42(42)	3895.4	42(42)	451.7	40(40.9)	576.5
Syn_6	24	24	24	24(24.4)	12.2	24(24)	0.0	24(24)	0.0	24(24)	0.0
Syn_7	9	9	9	9(9)	0.2	9(9)	0.0	9(9)	0.0	9(9)	0.0
Syn_8	36	36	37	39(40.3)	468.1	36(36)	1.9	36(36)	26.6	36(36)	7.3
Syn_9	20	20	20	20(20)	6.7	20(20)	0.0	20(20)	0.0	20(20)	0.0
Syn_10	37	39	40	43(44.2)	789.0	38(38)	477.9	37(37)	339.9	37(37.8)	414.6
Syn_11	37	39	38	41(43)	281.8	37(37)	1943.5	37(37)	49.6	37(37.7)	60.2
Syn_12	36	36	36	38(41.6)	322.5	36(36)	1.0	36(36)	0.1	36(36)	1.1
Syn_13	36	36	36	36(38)	27.7	36(36)	0.0	36(36)	0.0	36(36)	0.1
Syn_14	36	36	36	36(37.9)	60.6	36(36)	0.0	36(36)	0.0	36(36)	0.1
Syn_15	30	30	30	30(33.1)	13.0	30(30)	0.0	30(30)	0.0	30(30)	0.0
Syn_16	24	24	24	24(24.2)	19.8	24(24)	0.0	24(24)	0.0	24(24)	0.0
Syn_17	36	36	36	39(40.5)	93.4	36(36)	0.4	36(36)	0.0	36(36)	0.8
Syn_18	37	40	39	41(42.4)	595.9	38(38)	50.9	37(37)	3297.9	36(36.9)	120.6
Syn_19	40	42	44	45(50.2)	832.6	41(41)	1380.6	39(39)	773.4	39(39.5)	1477.2
Syn_20	47	54	50	52(54.2)	1291.3	48(48)	4129.6	48(48)	3177.6	47(47.4)	1000.9
Syn_21	36	36	36	36(36.6)	43.3	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_22	36	36	36	36(36.1)	7.6	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_23	12	12	12	12(12.8)	2.3	12(12)	0.0	12(12)	0.0	12(12)	0.0
Syn_24	38	41	40	42(43.2)	348.0	38(38)	258.6	38(38)	757.8	38(38)	61.7
Syn_25	42	48	46	47(48.6)	1168.9	44(44)	56.3	43(43)	2630.6	42(42.9)	552.0
Syn_26	26	26	27	30(31.9)	85.3	27(27)	8.5	26(26)	8.9	26(26)	155.3
Syn_27	36	36	36	36(36.4)	11.4	36(36)	0.0	36(36)	0.0	36(36)	0.0
Syn_28	44	49	48	49(51.5)	1704.6	45(45)	1890.8	45(45)	10.6	43(43.9)	1500.0
Syn_29	25	25	26	29(30.5)	49.0	25(25)	0.2	25(25)	0.0	25(25)	0.7
Syn_30	16	16	16	19(19.9)	12.0	16(16)	1.3	16(16)	0.0	16(16)	1.1

Table 8: Sizes and times (seconds) produced by APTS and existing algorithms for 2-way CAG

Name	CASA		FastCA		WCA		APTS	
	min(avg) _size	avg _time	min(avg) _size	avg _time	min(avg) _size	avg _time	min(avg) _size	avg _time
SPIN-S	92(96.9)	317.84	80(80)	0.07	80(80)	0.07	80(80)	13.30
SPIN-V	220(227.8)	3948.37	195(195)	1554.19	195(195)	39.31	192 (193)	932.80
GCC	109(124.7)	4431.31	76(76)	172.74	69 (69)	3136.82	77(78.4)	4117.00
Apache	244(245.8)	4302.25	133 (133.4)	5960.79	135(135)	140.23	134(137.3)	5165.90
Bugzilla	60(62.5)	200.08	48(48)	1.12	48(48)	0.34	48(48)	373.90
Syn_1	335(349.7)	4549.16	244(244)	4070.11	249(249)	283.19	239 (241.2)	7320.60
Syn_2	165(172.7)	3850.92	133(133)	5036.03	132(132)	8192.48	122 (125.8)	5732.40
Syn_3	54(60.6)	134.90	50(50)	1675.27	50(50)	0.09	51(51)	699.10
Syn_4	97(100.9)	692.82	80(80)	2.79	80(80)	0.76	80(80)	82.50
Syn_5	1058(1060.8)	4942.98	329(329)	5770.65	325(325)	8110.93	325(328.2)	7820.20
Syn_6	118(122.6)	2130.28	96(96)	1.06	96(96)	0.87	96(96)	108.40
Syn_7	26(27)	107.94	25(25)	22.02	26(26)	0.05	25(25)	64.60
Syn_8	380(391.1)	4422.20	253(253)	1816.22	257(257)	505.01	249 (250.6)	7934.70
Syn_9	68(74.1)	2102.16	60(60)	0.54	60(60)	0.39	60(60)	56.10
Syn_10	599(735.1)	4761.10	279(279)	1962.32	275(275)	2485.73	274 (276.8)	7337.40
Syn_11	385(397.4)	4564.90	270(270)	147.55	276(276)	3794.20	266 (267.7)	7344.90
Syn_12	354(373.2)	4505.80	216(216)	214.29	216(216)	35.28	216(216)	1360.50
Syn_13	265(274.7)	4581.87	180(180)	23.20	180(180)	5.33	180(180)	70.30
Syn_14	247(254.1)	4327.47	216(216)	3.59	216(216)	1.79	216(216)	33.60
Syn_15	164(170.4)	1511.65	150(150)	3.01	150(150)	0.48	150(150)	70.70
Syn_16	113(118.7)	2975.95	96(96)	16.41	96(96)	1.17	96(96)	381.60
Syn_17	331(340.4)	4541.66	216(216)	221.72	216(216)	61.32	216(216)	907.50
Syn_18	437(445.4)	4445.65	276(276)	6563.50	274(274)	1532.57	271 (273.7)	8023.80
Syn_19	-	0.00	314(314)	992.60	300 (300)	6613.39	310(314.2)	7494.70
Syn_20	1005(1041)	4665.92	410(410)	3790.07	406(406)	5560.91	406(407.7)	8202.20
Syn_21	226(233.6)	4564.80	216(216)	1.07	216(216)	1.15	216(216)	17.10
Syn_22	153(167.9)	1893.63	144(144)	0.56	144(144)	0.68	144(144)	37.60
Syn_23	38(41)	37.81	36(36)	1.78	36(36)	0.36	36(36)	25.90
Syn_24	436(442.7)	4593.48	281(281)	5885.80	291(291)	836.06	277 (278.8)	8153.80
Syn_25	553(562)	4779.01	350(350)	6189.68	350(350)	579.93	343 (345.1)	8107.30
Syn_26	199(202.1)	4210.04	161(161)	3001.51	165(165)	332.54	155 (158)	6402.40
Syn_27	193(196)	2931.84	180(180)	0.48	180(180)	0.58	180(180)	17.30
Syn_28	1048(1053)	4824.63	367(367)	542.65	363(363)	6725.35	362 (365.1)	8816.40
Syn_29	177(179.7)	4501.64	125(125)	19.11	125(125)	6.41	125(125)	260.00
Syn_30	84(90.5)	1233.05	66(66)	3716.22	64(64)	3705.61	64(65.6)	2883.00

Table 9: Statistical test results of CA size comparison between APTS and CASA, FastCA and WCA

Name	2-way						3-way					
	APTS vs CASA		APTS vs FastCA		APTS vs WCA		APTS vs CASA		APTS vs FastCA		APTS vs WCA	
	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>
SPIN-S	0.001	0.100	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
SPIN-V	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
GCC	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.000	1.000	0.000	1.000
Apache	0.000	0.050	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.980	0.001	0.900
Bugzilla	0.317	0.450	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_1	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
Syn_2	0.000	0.050	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
Syn_3	0.146	0.400	1.000	0.500	1.000	0.500	0.000	0.000	0.000	1.000	0.000	1.000
Syn_4	0.000	0.050	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.086	0.300	0.000	0.950
Syn_6	0.147	0.400	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_7	1.000	0.500	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	0.000	0.000
Syn_8	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.050	0.000	0.000
Syn_9	1.000	0.500	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_10	0.000	0.000	0.146	0.400	0.000	0.900	0.000	0.000	0.001	0.100	0.001	0.900
Syn_11	0.000	0.000	0.001	0.850	0.001	0.850	0.000	0.000	0.000	0.050	0.000	0.000
Syn_12	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_13	0.001	0.100	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_14	0.000	0.050	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_15	0.000	0.050	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_16	0.146	0.400	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_17	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_18	0.000	0.000	0.000	0.000	0.317	0.450	0.000	0.000	0.001	0.100	0.619	0.450
Syn_19	0.000	0.000	0.000	0.000	0.012	0.750	0.000	0.000	0.212	0.650	0.000	1.000
Syn_20	0.000	0.000	0.004	0.200	0.004	0.200	0.000	0.000	0.000	0.050	0.000	0.950
Syn_21	0.012	0.250	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_22	0.317	0.450	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_23	0.013	0.250	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_24	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.000	0.050	0.000	0.000
Syn_25	0.000	0.000	0.000	0.000	0.317	0.450	0.000	0.000	0.000	0.000	0.000	0.000
Syn_26	0.000	0.000	0.000	0.000	1.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
Syn_27	0.147	0.400	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.001	0.900
Syn_29	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	1.000	0.500	1.000	0.500
Syn_30	0.000	0.000	1.000	0.500	1.000	0.500	0.000	0.000	0.619	0.450	0.000	0.950

Table 10: Comparisons among APTS, FastCA and WCA in terms of time (second) for 2-way CAG

Name	avg_size	FastCA avg_time	WCA avg_time	APTS avg_time	Name	avg_size	FastCA avg_time	WCA avg_time	APTS avg_time
SPIN-S	19	0.2	0.1	0.0	Syn_12	36	1.0	0.1	1.1
SPIN-V	31	61.8	1.5	0.7	Syn_13	36	0.0	0.0	0.1
GCC	16	127.6	27.3	15.2	Syn_14	36	0.0	0.0	0.1
Apache	30	0.0	0.0	0.3	Syn_15	30	0.0	0.0	0.0
Bugzilla	16	0.0	0.0	0.0	Syn_16	24	0.0	0.0	0.0
Syn_1	36	0.5	0.2	2.3	Syn_17	36	0.4	0.0	0.8
Syn_2	30	0.0	1.4	0.1	Syn_21	36	0.0	0.0	0.0
Syn_3	18	0.0	0.0	0.0	Syn_22	36	0.0	0.0	0.0
Syn_4	20	0.0	0.0	0.0	Syn_23	12	0.0	0.0	0.0
Syn_6	24	0.0	0.0	0.0	Syn_24	38	258.6	757.8	61.7
Syn_7	9	0.0	0.0	0.0	Syn_27	36	0.0	0.0	0.0
Syn_8	36	1.9	26.6	7.3	Syn_29	25	0.2	0.0	0.7
Syn_9	20	0.0	0.0	0.0	Syn_30	16	1.3	0.0	1.1

Table 11: Comparisons among APTS, FastCA and WCA in terms of time (second) for 3-way CAG

Name	avg_size	FastCA avg_time	WCA avg_time	APTS avg_time	Name	avg_size	FastCA avg_time	WCA avg_time	APTS avg_time
SPIN-S	80	0.1	0.1	13.3	Syn_15	150	3.0	0.5	70.7
Bugzilla	48	1.1	0.3	373.9	Syn_16	96	16.4	1.2	381.6
Syn_4	80	2.8	0.8	82.5	Syn_17	216	221.7	61.3	907.5
Syn_6	96	1.1	0.9	108.4	Syn_21	216	1.1	1.1	17.1
Syn_9	60	0.5	0.4	56.1	Syn_22	144	0.6	0.7	37.6
Syn_12	216	214.3	35.3	1360.5	Syn_23	36	1.8	0.4	25.9
Syn_13	180	23.2	5.3	70.3	Syn_27	180	0.5	0.6	17.3
Syn_14	216	3.6	1.8	33.6	Syn_29	125	19.1	6.4	260.0

Table 12: Statistical test results of comparison between APTS and DPTS (SPTS) on time

Name	2-way				3-way			
	APTS vs FastCA		APTS vs WCA		APTS vs FastCA		APTS vs WCA	
	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>	<i>p-value</i>	<i>effect size</i>
SPIN-S	0.000	0.000	0.000	0.100	0.000	1.000	0.000	1.000
SPIN-V	0.000	0.000	0.000	0.000	-	-	-	-
GCC	0.000	0.000	0.021	0.200	-	-	-	-
Apache	0.000	1.000	0.000	1.000	-	-	-	-
Bugzilla	1.000	0.500	1.000	0.500	0.000	1.000	0.000	1.000
Syn_1	0.005	0.800	0.000	1.000	-	-	-	-
Syn_2	0.005	0.800	0.000	0.000	-	-	-	-
Syn_3	1.000	0.500	1.000	0.500	-	-	-	-
Syn_4	0.146	0.600	0.146	0.600	0.000	1.000	0.000	1.000
Syn_6	1.000	0.500	1.000	0.500	0.000	1.000	0.000	1.000
Syn_7	1.000	0.500	1.000	0.500	-	-	-	-
Syn_8	0.000	1.000	0.000	0.000	-	-	-	-
Syn_9	1.000	0.500	1.000	0.500	0.000	1.000	0.000	1.000
Syn_12	0.543	0.550	0.001	0.925	0.000	1.000	0.000	1.000
Syn_13	0.004	0.800	0.004	0.800	0.002	0.900	0.000	1.000
Syn_14	0.001	0.900	0.001	0.900	0.000	1.000	0.000	1.000
Syn_15	1.000	0.500	1.000	0.500	0.000	1.000	0.000	1.000
Syn_16	1.000	0.500	1.000	0.500	0.002	0.900	0.000	1.000
Syn_17	0.012	0.800	0.001	0.890	0.000	1.000	0.000	1.000
Syn_21	1.000	0.500	1.000	0.500	0.023	0.800	0.023	0.800
Syn_22	1.000	0.500	1.000	0.500	0.000	1.000	0.000	1.000
Syn_23	1.000	0.500	1.000	0.500	1.000	0.500	1.000	0.500
Syn_24	0.000	0.000	0.000	0.000	-	-	-	-
Syn_27	0.146	0.600	0.146	0.600	0.000	1.000	0.000	0.500
Syn_29	0.087	0.700	0.000	1.000	0.000	1.000	0.000	1.000
Syn_30	0.015	0.200	0.000	1.000	-	-	-	-