Table 1 The array sizes produced by DPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	40
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	43	43	43	43	43	43	42	43	43	43
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	39	38	38	39	38	38	38	40	41	38
Syn_11	38	37	38	37	38	37	38	38	38	37
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	37	37	38	38	38	38	38	38
Syn_19	42	42	43	42	42	41	42	42	42	42
Syn_20	49	49	51	49	49	49	49	49	49	49
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	39	39	39	40	39	40	39	40	39	39
Syn_25	47	44	44	44	44	44	45	44	45	44
Syn_26	27	28	27	26	27	28	27	27	27	27
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	46	46	46	46	46	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	41	44	38	45	43	40	42	42	44	36
GCC	16	21	19	21	22	19	20	22	23	19
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	18	18	17	18	18	16	18	18	17	17
concurrency	6	6	6	6	5	6	6	5	6	6
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	21	21	21	21	21	21	21	21	21	21
processorcomm2	25	25	25	25	31	25	25	25	27	25
service	103	103	104	101	106	103	103	102	106	102
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	215	215	215	215	215	215	215	215	215	215
systemmgmt	16	16	17	15	15	15	15	15	17	15
telecom	30	30	30	30	30	30	30	30	30	30

Table 2 The construction time consumed by DPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	1.57	1.21	0.85	3.89	0.92	1.81	1.50	2.21	1.03	0.37
Syn_2	0.31	0.26	0.38	0.27	0.31	0.26	0.31	0.28	0.29	0.28
Syn_3	0.20	0.21	0.22	0.19	0.22	0.18	0.21	0.19	0.20	0.20
Syn_4	0.24	0.23	0.24	0.23	0.26	0.22	0.22	0.22	0.24	0.26
Syn_5	8.37	6.62	1.38	1.12	3.00	2.63	812.09	3.12	5.35	2.91
Syn_6	0.27	0.29	0.29	0.27	0.29	0.29	0.30	0.27	0.29	0.28
Syn_7	0.19	0.19	0.20	0.21	0.20	0.21	0.19	0.18	0.19	0.20
Syn_8	81.37	43.31	13.90	27.80	19.95	39.87	4.88	50.70	31.20	8.52
Syn_9	0.26	0.26	0.27	0.25	0.25	0.27	0.25	0.25	0.27	0.28
Syn_10	5.07	928.24	734.55	95.48	565.61	394.51	119.04	1.19	0.77	506.55
Syn_11	34.68	435.81	128.53	706.85	9.81	808.49	97.48	23.00	41.56	119.48
Syn_12	0.76	2.51	0.66	0.62	1.13	0.98	0.60	0.98	0.76	1.10
Syn_13	0.32	0.33	0.34	0.33	0.34	0.36	0.34	0.32	0.34	0.37
Syn_14	0.29	0.29	0.29	0.27	0.28	0.27	0.25	0.26	0.32	0.29
Syn_15	0.25	0.23	0.24	0.25	0.25	0.26	0.25	0.24	0.26	0.24
Syn_16	0.28	0.24	0.30	0.26	0.28	0.27	0.26	0.25	0.26	0.26
Syn_17	0.54	0.45	0.71	0.67	0.99	0.53	0.56	0.39	0.51	0.76
Syn_18	101.61	38.42	174.24	947.91	11.45	9.93	9.32	8.12	47.83	32.45
Syn_19	17.93	1.07	1.74	7.20	55.82	188.18	15.44	79.10	7.81	2.84
Syn_20	76.79	295.18	0.78	26.15	5.59	3.90	10.82	3.76	2.08	11.34
Syn_21	0.28	0.31	0.28	0.30	0.28	0.33	0.29	0.29	0.29	0.34
Syn_22	0.26	0.26	0.25	0.28	0.27	0.26	0.26	0.25	0.26	0.27
Syn_23	0.19	0.19	0.19	0.21	0.20	0.22	0.18	0.19	0.20	0.20
Syn_24	5.94	3.41	5.11	1.89	1.78	1.64	4.96	1.43	44.92	6.70
Syn_25	0.45	56.22	25.17	10.96	458.59	38.96	4.12	12.33	6.27	378.72
Syn_26	1.16	0.79	1.14	80.77	0.53	0.62	9.05	0.82	3.95	1.79
Syn_27	0.25	0.26	0.26	0.26	0.26	0.28	0.25	0.25	0.25	0.27
Syn_28	509.31	12.56	180.57	24.39	47.82	586.15	13.75	51.22	34.46	647.85
Syn_29	0.54	1.10	0.59	0.59	0.44	0.55	0.92	0.38	0.52	0.74
Syn_30	0.96	1.44	2.20	0.93	1.48	1.10	1.38	1.73	2.85	1.82
SPIN-S	0.57	0.58	0.19	1.67	0.77	0.20	0.22	2.15	0.19	0.29
SPIN-V	0.30	0.29	0.73	0.00	0.27	0.69	0.48	0.56	0.27	1.28
GCC	0.45	0.43	0.42	0.43	0.41	0.44	0.45	0.48	0.00	0.49
Apache	0.85	0.34	0.36	0.38	0.49	0.36	0.40	0.37	0.33	0.36
Bugzilla	0.22	0.22	0.21	0.21	0.22	0.20	0.21	0.22	0.21	0.22
banking1_yue	0.24	0.24	0.25	0.24	0.26	0.24	0.24	0.26	0.24	0.27
banking2_yue	0.18	0.17	0.17	0.19	0.18	0.18	0.19	0.17	0.16	0.19
commprotocol	0.32	0.32	0.30	0.29	0.31	0.47	0.36	0.45	0.46	0.42
concurrency	0.33	0.14	0.15	0.14	0.14	0.14	0.14	0.15	0.15	0.15
healthcare1	0.17	0.17	0.17	0.16	0.17	0.17	0.16	0.17	0.17	0.17
healthcare2	0.23	0.21	0.23	0.24	0.26	0.22	0.21	0.21	0.27	0.20
healthcare3	0.28	0.36	0.24	0.84	0.23	0.38	0.47	0.21	0.47	0.43
healthcare4	0.21	0.21	0.47	0.23	0.23	0.84	0.35	0.22	0.22	0.23
Insurance	0.19	0.18	0.19	0.20	0.18	0.18	0.19	0.18	0.18	0.18
networkMgmt	0.20	0.20	0.19	0.22	0.21	0.22	0.20	0.19	0.20	0.22
processorcomm1	21.63	192.34	0.81	159.79	59.98	47.71	96.26	59.51	177.08	198.57
processorcomm2	0.32	0.34	0.38	0.73	0.30	0.95	0.96	0.32	0.43	0.77
service	0.42	0.41	0.39	5.65	0.00	1.11	0.91	1.02	0.00	9.34
storage1	0.19	0.18	0.20	0.18	0.17	0.17	0.17	0.18	0.18	0.18
storage2	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.14
storage3	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.21
storage4	0.24	0.21	0.22	0.23	0.23	0.24	0.23	0.21	0.25	0.24
storage5	0.41	0.59	0.48	0.44	0.46	0.47	0.48	0.45	0.42	0.48
systemmgmt	0.20	0.34	0.00	1.61	0.68	0.39	0.59	0.17	0.00	0.35
telecom	0.37	0.46	0.19	0.47	0.47	0.19	0.18	0.18	0.47	0.98

Table 3 The array sizes produced by SPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	42	42	42	42	43	42	42	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	39	37	38	38	38	39	37	38
Syn_11	38	38	37	37	38	37	38	37	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	38	37	38	38	38	38	38	38
Syn_19	40	40	42	42	42	42	42	42	42	42
Syn_20	48	47	48	48	48	48	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	43	43	44	43	44	44	43	44	44	43
Syn_26	26	26	26	26	27	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	44	46	46	46	45	46	45	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	16	16	16	16	16	16	16	16	16	16
concurrency	5	5	5	5	5	5	5	5	5	5
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	22	22	21	21	21	21	21	21	21	21
processorcomm2	25	25	25	25	25	25	25	25	25	25
service	100	100	100	101	100	100	101	100	100	100
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	215	215	215	215	215	215	215	215	215	215
systemmgmt	15	15	15	15	15	15	15	15	15	15
telecom	30	30	30	30	30	30	30	30	30	30

Table 4 The construction time consumed by SPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	1.15	0.54	2.42	1.36	1.69	0.74	1.73	1.23	1.81	0.89
Syn_2	0.30	0.32	0.25	0.25	0.31	0.26	0.35	0.28	0.27	0.26
Syn_3	0.21	0.20	0.18	0.18	0.19	0.21	0.20	0.18	0.21	0.19
Syn_4	0.24	0.22	0.20	0.20	0.23	0.24	0.24	0.25	0.23	0.23
Syn_5	125.43	23.58	12.76	276.72	89.54	4.23	3.17	5.00	72.26	60.85
Syn_6	0.28	0.25	0.23	0.26	0.35	0.27	0.29	0.26	0.27	0.27
Syn_7	0.22	0.19	0.18	0.19	0.19	0.20	0.22	0.20	0.20	0.19
Syn_8	1.89	2.71	6.74	37.56	12.73	17.20	15.39	9.75	4.53	13.93
Syn_9	0.28	0.30	0.22	0.21	0.25	0.26	0.24	0.37	0.25	0.26
Syn_10	20.18	41.72	41.83	371.08	255.95	329.80	41.22	10.19	84.22	143.62
Syn_11	10.01	16.22	886.74	8.04	4.23	259.67	3.75	724.12	11.94	28.44
Syn_12	0.48	0.61	0.78	0.72	0.62	0.62	0.59	0.65	0.55	0.61
Syn_13	0.39	0.39	0.30	0.29	0.36	0.31	0.50	0.36	0.39	0.32
Syn_14	0.29	0.36	0.24	0.25	0.32	0.26	0.26	0.31	0.30	0.27
Syn_15	0.25	0.23	0.21	0.21	0.25	0.24	0.23	0.28	0.26	0.24
Syn_16	0.26	0.30	0.27	0.23	0.26	0.26	0.28	0.27	0.27	0.27
Syn_17	0.63	0.77	0.87	0.62	0.49	0.73	0.51	0.64	0.61	0.44
Syn_18	23.98	13.54	14.03	385.92	38.10	5.30	2.42	1.53	4.65	4.77
Syn_19	131.52	76.51	66.16	1.82	74.63	92.08	19.30	2.87	110.48	285.08
Syn_20	83.24	293.50	121.69	233.74	432.39	56.05	549.44	55.85	285.46	5.63
Syn_21	0.29	0.48	0.27	0.24	0.29	0.30	0.30	0.28	0.29	0.32
Syn_22	0.30	0.25	0.22	0.22	0.26	0.27	0.27	0.25	0.25	0.24
Syn_23	0.20	0.19	0.18	0.18	0.21	0.19	0.20	0.20	0.20	0.18
Syn_24	16.33	5.77	182.04	65.31	25.85	354.78	659.91	212.10	941.36	157.79
Syn_25	43.61	181.29	44.31	204.30	10.76	11.35	467.32	10.22	7.97	805.54
Syn_26	93.16	44.56	914.51	894.00	9.88	382.06	56.31	4.18	421.85	228.59
Syn_27	0.23	0.26	0.20	0.21	0.25	0.24	0.26	0.26	0.25	0.25
Syn_28	84.69	221.48	7.06	16.63	7.60	445.57	141.45	510.05	76.76	27.50
Syn_29	0.48	0.43	0.34	0.39	0.75	1.25	0.35	0.49	0.84	1.15
Syn_30	0.59	0.41	1.44	0.37	0.91	0.49	0.87	0.95	0.58	1.54
SPIN-S	0.19	0.19	0.19	0.21	0.19	0.25	0.22	0.21	0.20	0.23
SPIN-V	0.42	0.38	0.32	0.56	0.38	0.44	0.52	0.47	0.39	0.47
GCC	0.76	0.86	2.76	5.40	4.79	2.86	1.39	2.78	0.72	2.22
Apache	0.37	0.45	0.38	1.06	0.34	0.36	0.36	0.40	0.40	0.50
Bugzilla	0.21	0.25	0.18	0.19	0.21	0.21	0.21	0.22	0.20	0.22
banking1_yue	0.23	0.26	0.21	0.21	0.24	0.24	0.23	0.22	0.23	0.24
banking2_yue	0.17	0.16	0.16	0.16	0.17	0.19	0.18	0.19	0.17	0.17
commprotocol	0.35	0.28	0.26	0.26	0.28	0.32	0.36	0.28	0.27	0.30
concurrency	0.16	0.16	0.15	0.15	0.18	0.18	0.17	0.17	0.17	0.18
healthcare1	0.17	0.17	0.17	0.17	0.16	0.17	0.16	0.17	0.17	0.17
healthcare2	0.23	0.20	0.23	0.20	0.24	0.25	0.29	0.21	0.21	0.22
healthcare3	0.25	0.35	5.01	0.18	0.23	0.37	5.08	0.87	0.23	1.14
healthcare4	0.24	0.32	0.36	0.19	0.23	0.80	0.37	0.23	0.51	0.21
Insurance	0.19	0.18	0.18	0.17	0.18	0.18	0.18	0.18	0.18	0.18
networkMgmt	0.23	0.21	0.17	0.18	0.21	0.20	0.20	0.19	0.20	0.25
processorcomm1	0.26	0.37	870.29	28.19	387.98	343.78	526.35	144.47	96.64	376.84
processorcomm2	0.37	0.43	0.62	0.34	0.55	0.61	1.12	4.52	0.31	0.34
service	1.42	1.19	23.39	63.03	11.81	64.23	7.01	83.55	84.39	26.37
storage1	0.20	0.19	0.17	0.17	0.18	0.18	0.17	0.18	0.17	0.18
storage2	0.13	0.14	0.14	0.13	0.13	0.13	0.13	0.14	0.13	0.13
storage3	0.23	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
storage4	0.24	0.25	0.20	0.20	0.43	0.22	0.23	0.23	0.21	0.22
storage5	0.59	0.61	0.51	0.41	0.46	0.42	0.57	0.47	0.49	0.44
systemmgmt	0.19	0.23	0.18	0.17	0.19	0.20	0.19	0.19	0.19	0.20
telecom	0.20	0.19	0.16	0.27	0.18	0.37	0.20	0.19	0.44	0.18

Table 5 The array sizes produced by APTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	41	41	41	41	41	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	37	38	38	38	38	37	38
Syn_11	38	38	37	38	38	38	37	38	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	37	37	37	37	37	37	37
Syn_19	40	40	39	40	40	40	39	40	40	40
Syn_20	48	47	47	47	47	47	47	48	47	47
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	43	43	42	43	43	43	43	43	42	42
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	44	44	44	44	44	44	44	44	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	16	16	16	16	16	16	16	16	16	16
concurrency	5	5	5	5	5	5	5	5	5	5
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	22	22	21	21	22	21	21	21	22	22
processorcomm2	25	25	25	25	25	25	25	25	25	25
service	100	100	100	100	100	100	100	100	100	100
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	215	215	215	215	215	215	215	215	215	215
systemmgmt	15	15	15	15	15	15	15	15	15	15
telecom	30	30	30	30	30	30	30	30	30	30

Table 6 The construction time consumed by APTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	1.15	0.54	1.73	0.81	2.39	1.24	1.45	2.38	1.43	1.01
Syn_2	0.30	0.32	0.32	0.31	0.25	0.27	0.32	0.28	0.33	0.29
Syn_3	0.21	0.20	0.21	0.21	0.18	0.18	0.21	0.20	0.22	0.21
Syn_4	0.24	0.22	0.24	0.24	0.20	0.21	0.27	0.24	0.26	0.27
Syn_5	125.43	23.58	110.73	81.34	81.05	135.77	100.17	63.77	63.90	321.45
Syn_6	0.28	0.25	0.27	0.25	0.23	0.22	0.29	0.26	1.50	0.31
Syn_7	0.22	0.19	0.21	0.19	0.18	0.19	0.21	0.21	0.24	0.21
Syn_8	1.89	2.71	2.34	4.61	7.35	8.82	3.71	1.61	1.86	1.38
Syn_9	0.28	0.30	0.23	0.26	0.22	0.21	0.25	0.25	0.27	0.28
Syn_10	20.18	41.72	44.46	232.26	15.79	29.02	6.44	16.70	696.86	72.15
Syn_11	10.01	16.22	541.05	3.12	4.69	2.94	372.51	6.62	13.63	7.72
Syn_12	0.48	0.61	1.26	0.73	0.67	0.66	0.54	0.64	0.76	0.51
Syn_13	0.39	0.39	0.43	0.36	0.30	0.30	0.36	0.34	0.38	0.37
Syn_14	0.29	0.36	0.33	0.33	0.23	0.22	0.30	0.33	0.31	0.39
Syn_15	0.25	0.23	0.23	0.24	0.22	0.22	0.25	0.26	0.28	0.27
Syn_16	0.26	0.30	0.26	0.28	0.23	0.23	0.28	0.28	0.31	0.29
Syn_17	0.63	0.77	0.53	0.43	0.95	0.38	0.51	0.76	0.80	0.59
Syn_18	23.98	13.54	25.01	28.10	6.87	41.68	32.16	19.93	27.08	64.46
Syn_19	131.52	76.51	225.24	181.53	116.53	708.66	720.62	111.28	81.67	181.81
Syn_20	83.24	293.50	392.18	607.35	419.43	285.45	788.86	267.31	111.76	131.34
Syn_21	0.29	0.48	0.30	0.36	0.25	0.25	0.30	0.30	0.31	0.32
Syn_22	0.30	0.25	0.27	0.28	0.23	0.22	0.27	0.28	0.28	0.27
Syn_23	0.20	0.19	0.18	0.21	0.19	0.18	0.21	0.20	0.21	0.22
Syn_24	16.33	5.77	12.48	6.36	13.38	21.95	16.82	23.12	17.31	7.62
Syn_25	43.61	181.29	672.92	109.00	26.80	74.93	17.68	8.37	250.08	350.04
Syn_26	93.16	44.56	95.95	41.27	45.64	30.11	39.84	100.91	23.48	25.98
Syn_27	0.23	0.26	0.24	0.26	0.22	0.20	0.26	0.27	0.26	0.26
Syn_28	84.69	221.48	352.87	124.73	845.25	72.66	116.61	262.46	229.24	264.56
Syn_29	0.48	0.43	0.42	1.08	0.89	0.45	0.40	0.60	0.54	0.56
Syn_30	0.59	0.41	0.49	0.42	0.82	0.35	0.51	0.36	0.51	0.51
SPIN-S	0.19	0.19	0.22	0.20	0.20	0.19	0.31	0.24	0.29	0.25
SPIN-V	0.42	0.38	0.43	1.05	0.37	0.42	0.58	0.42	0.53	0.45
GCC	0.76	0.86	2.36	0.99	0.65	2.17	0.81	4.09	0.89	12.33
Apache	0.37	0.45	0.71	0.39	0.35	0.31	0.37	0.99	0.36	0.52
Bugzilla	0.21	0.25	0.20	0.23	0.19	0.19	0.22	0.23	0.23	0.29
banking1_yue	0.23	0.26	0.28	0.23	0.22	0.19	0.25	0.26	0.26	0.26
banking2_yue	0.17	0.16	0.16	0.16	0.15	0.15	0.19	0.21	0.21	0.19
commprotocol	0.35	0.28	0.31	0.36	0.25	0.24	0.31	0.29	0.32	0.32
concurrency	0.16	0.16	0.16	0.16	0.15	0.15	0.19	0.19	0.20	0.20
healthcare1	0.17	0.17	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17
healthcare2	0.23	0.20	0.21	0.21	0.19	0.20	0.23	0.25	0.27	0.23
healthcare3	0.25	0.35	0.84	0.85	0.84	0.64	0.28	0.25	0.99	0.24
healthcare4	0.24	0.32	0.22	0.22	0.35	0.20	0.24	0.50	0.26	0.36
Insurance	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
networkMgmt	0.23	0.21	0.22	0.24	0.18	0.18	0.20	0.22	0.21	0.24
processorcomm1	0.26	0.37	640.38	362.99	0.31	45.51	578.87	617.72	0.36	0.31
processorcomm2	0.37	0.43	0.99	0.39	0.48	0.56	1.30	1.80	0.65	0.36
service	1.42	1.19	1.22	1.53	1.66	0.61	1.34	0.68	1.02	1.11
storage1	0.22	0.18	0.17	0.17	0.17	0.17	0.18	0.17	0.18	0.17
storage2	0.13	0.14	0.13	0.13	0.14	0.14	0.13	0.13	0.13	0.14
storage3	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
storage4	0.24	0.25	0.28	0.26	0.20	0.20	0.25	0.26	0.25	0.29
storage5	0.59	0.61	0.69	0.80	0.57	0.71	1.48	0.41	0.48	0.55
systemmgmt	0.19	0.23	0.18	0.22	0.16	0.17	0.21	0.21	0.23	0.22
telecom	0.20	0.19	0.23	0.21	0.19	0.18	0.22	0.23	0.26	0.25

Table 7 The array sizes produced by APPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	40	41	41	41	41	41	41	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	37	38	37	38	38	38	37	38	38	38
Syn_11	38	37	38	37	38	38	38	37	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	36	37	37	37	37	37	37
Syn_19	40	40	40	39	40	40	40	39	40	40
Syn_20	48	48	47	48	47	48	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	39	38	38	38	38
Syn_25	42	43	43	43	43	43	42	43	43	42
Syn_26	26	27	26	27	26	27	27	27	27	27
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	44	44	44	44	44	44	44	43	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	16	16	16	16	16	16	16	16	16	16
concurrency	5	5	5	5	5	5	5	5	5	5
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	22	22	22	22	22	21	22	21	21	21
processorcomm2	25	25	25	25	25	25	25	25	25	25
service	100	100	100	100	100	100	100	100	100	100
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	215	215	215	215	215	215	215	215	215	215
systemmgmt	15	15	15	15	15	15	15	15	15	15
telecom	30	30	30	30	30	30	30	30	30	30

Table 8 The construction time consumed by APPTS for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	2.13	1.14	0.70	1.20	1.24	1.22	0.68	1.46	0.56	1.36
Syn_2	0.23	0.22	0.22	0.22	0.22	0.24	0.22	0.22	0.22	0.22
Syn_3	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Syn_4	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.18	0.19	0.19
Syn_5	696.76	150.06	76.00	47.23	120.43	439.80	77.10	185.86	93.40	78.46
Syn_6	0.21	0.24	0.21	0.26	0.21	0.21	0.21	0.21	0.21	0.21
Syn_7	0.17	0.16	0.16	0.16	0.16	0.16	0.17	0.16	0.17	0.16
Syn_8	2.60	2.05	4.21	4.66	1.92	2.58	3.48	2.84	3.68	4.06
Syn_9	0.21	0.21	0.20	0.24	0.19	0.20	0.20	0.20	0.19	0.20
Syn_10	523.31	11.92	135.41	70.74	120.42	30.54	193.55	32.18	51.10	49.23
Syn_11	26.08	34.11	8.76	488.69	16.36	7.12	26.04	542.64	3.95	12.18
Syn_12	0.67	0.52	0.90	0.59	0.65	0.74	0.99	1.08	0.73	0.65
Syn_13	0.26	0.26	0.29	0.25	0.26	0.26	0.25	0.25	0.28	0.25
Syn_14	0.21	0.25	0.23	0.21	0.22	0.22	0.30	0.22	0.23	0.21
Syn_15	0.22	0.20	0.19	0.20	0.20	0.20	0.20	0.21	0.22	0.20
Syn_16	0.21	0.23	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.21
Syn_17	0.79	0.52	0.33	0.72	0.39	0.66	0.54	0.35	0.50	0.82
Syn_18	75.79	18.52	67.98	310.09	44.88	47.49	22.46	88.17	26.22	25.79
Syn_19	250.17	217.17	535.96	283.81	308.83	53.45	70.61	135.74	96.15	268.54
Syn_20	52.65	44.23	597.51	78.61	568.72	53.47	36.40	89.83	27.03	23.22
Syn_21	0.22	0.23	0.23	0.23	0.22	0.23	0.22	0.22	0.22	0.24
Syn_22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22
Syn_23	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Syn_24	25.65	29.51	55.42	51.06	10.66	7.55	16.42	42.14	12.70	31.78
Syn_25	701.29	107.70	194.54	36.33	29.91	93.73	958.68	21.52	287.00	472.75
Syn_26	66.63	0.59	32.53	0.98	56.37	20.39	1.95	2.67	2.90	3.45
Syn_27	0.20	0.20	0.19	0.20	0.20	0.20	0.19	0.20	0.20	0.20
Syn_28	292.91	190.57	53.85	225.21	198.08	185.55	131.89	438.43	717.34	200.50
Syn_29	0.98	0.50	1.35	0.95	1.01	1.21	0.94	0.52	0.42	0.72
Syn_30	0.61	0.84	1.19	0.54	0.51	1.65	0.91	0.82	0.33	6.27
SPIN-S	0.17	0.19	0.36	0.19	0.19	0.40	0.16	0.19	0.19	0.17
SPIN-V	0.56	0.46	0.49	0.88	0.41	0.93	0.76	0.62	0.96	0.70
GCC	15.91	0.50	8.21	1.34	5.98	1.23	5.03	10.06	1.13	1.03
Apache	0.27	0.49	0.27	0.28	0.30	0.29	0.40	0.28	0.26	0.71
Bugzilla	0.18	0.17	0.17	0.17	0.18	0.19	0.18	0.19	0.18	0.18
banking1_yue	0.18	0.19	0.18	0.19	0.19	0.18	0.19	0.18	0.18	0.18
banking2_yue	0.16	0.15	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15
commprotocol	0.22	0.22	0.21	0.22	0.21	0.22	0.22	0.22	0.21	0.22
concurrency	0.16	0.14	0.14	0.14	0.14	0.14	0.15	0.14	0.14	0.14
healthcare1	0.16	0.17	0.16	0.16	0.17	0.17	0.17	0.17	0.16	0.17
healthcare2	0.26	0.22	0.27	0.19	0.23	0.28	0.24	0.19	0.19	0.19
healthcare3	1.49	1.07	0.19	3.64	1.36	1.54	1.41	0.19	0.19	0.19
healthcare4	1.37	0.21	0.55	0.62	0.25	0.60	0.19	0.19	0.18	0.80
Insurance	0.19	0.18	0.18	0.18	0.19	0.18	0.18	0.18	0.18	0.18
networkMgmt	0.17	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.17	0.16
processorcomm1	0.40	0.36	0.36	0.45	0.83	601.83	0.28	754.94	601.26	639.40
processorcomm2	0.33	2.74	0.31	0.25	0.64	0.27	1.43	0.69	0.26	0.24
service	1.45	1.14	1.46	2.09	1.66	2.12	1.63	2.08	2.39	1.48
storage1	0.20	0.17	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17
storage2	0.14	0.13	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.13
storage3	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
storage4	0.19	0.19	0.18	0.19	0.19	0.19	0.20	0.18	0.18	0.96
storage5	0.29	0.30	0.34	0.57	0.53	0.92	0.46	0.35	0.48	0.81
systemmgmt	0.16	0.17	0.17	0.16	0.17	0.16	0.17	0.17	0.17	0.16
telecom	0.32	0.22	0.17	0.26	0.27	0.17	0.17	0.30	0.17	0.24

Table 9 The array sizes produced by FastCA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	43	43	43	43	43	43	43	43	43	43
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	38	38	38	38	38	38	38
Syn_11	38	38	38	38	38	38	38	38	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	38	38	38	38	38	38	38	38
Syn_19	42	42	42	42	42	42	42	42	42	42
Syn_20	49	49	49	49	49	49	49	49	49	49
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	44	44	44	44	44	44	44	44	44	44
Syn_26	27	27	27	27	27	27	27	27	27	27
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	46	46	46	46	46	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	16	16	16	16	16	16	16	16	16	16
concurrency	5	5	5	5	5	5	5	5	5	5
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	22	22	22	22	22	22	22	22	22	22
processorcomm2	25	25	25	25	25	25	25	25	25	25
service	100	100	100	100	100	100	100	100	100	100
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	215	215	215	215	215	215	215	215	215	215
systemmgmt	15	15	15	15	15	15	15	15	15	15
telecom	30	30	30	30	30	30	30	30	30	30

Table 10 The construction time consumed by FastCA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	0.49	0.49	0.49	0.49	0.49	0.50	0.49	0.49	0.49	0.49
Syn_2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Syn_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_5	4.01	3.92	3.91	4.04	3.92	4.01	3.93	3.93	3.97	3.91
Syn_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_8	1.90	1.86	1.87	1.87	1.87	1.90	1.86	1.88	1.90	1.87
Syn_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_10	486.84	476.11	481.39	482.66	473.98	486.58	485.07	478.90	482.26	482.37
Syn_11	18.74	18.28	18.35	18.28	18.27	18.66	18.20	18.32	18.29	18.28
Syn_12	1.04	1.00	1.00	1.01	1.00	1.04	1.01	1.00	1.01	1.00
Syn_13	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Syn_14	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Syn_15	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Syn_16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_17	0.39	0.38	0.38	0.38	0.37	0.38	0.38	0.38	0.38	0.37
Syn_18	52.49	51.69	51.55	51.45	51.47	52.41	51.61	51.49	51.58	51.61
Syn_19	9.27	9.09	9.13	9.18	9.12	9.24	9.12	9.13	9.11	8.99
Syn_20	44.83	43.96	44.01	43.44	44.01	44.98	44.10	43.83	44.14	43.68
Syn_21	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Syn_22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_24	265.56	262.39	258.52	258.26	261.42	265.57	262.36	260.92	258.66	260.56
Syn_25	56.85	56.65	56.54	56.40	56.69	57.60	56.69	56.52	56.56	56.69
Syn_26	8.73	8.52	8.53	8.48	8.48	8.72	8.53	8.52	8.48	8.49
Syn_27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_28	22.59	21.96	22.05	22.02	22.11	22.37	22.06	22.03	21.83	21.36
Syn_29	0.24	0.23	0.23	0.22	0.23	0.23	0.23	0.23	0.22	0.23
Syn_30	1.35	1.33	1.32	1.32	1.32	1.33	1.33	1.33	1.31	1.33
SPIN-S	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
SPIN-V	63.11	62.33	62.08	61.97	62.13	63.27	62.10	62.34	61.90	62.40
GCC	132.18	127.34	128.84	127.92	126.95	132.76	126.44	128.50	127.83	128.53
Apache	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Bugzilla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
banking1_yue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
banking2_yue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
commprotocol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
concurrency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
healthcare3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
networkMgmt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
processorcomm1	0.05	0.04	0.05	0.04	0.05	0.05	0.04	0.05	0.05	0.05
processorcomm2	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
service	0.84	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.84	0.84
storage1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage5	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
systemmgmt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
telecom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 11 The array sizes produced by WCA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	42	42	42	42	42	42	42	42	42	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	37	37	37	37	37	37	37	37	37	37
Syn_11	37	37	37	37	37	37	37	37	37	37
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	38	38	38	38	38	38	38	38
Syn_19	39	39	39	39	39	39	39	39	39	39
Syn_20	49	49	49	49	49	49	49	49	49	49
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	44	44	44	44	44	44	44	44	44	44
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	45	45	45	45	45	45	45	45	45	45
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
SPIN-S	19	19	19	19	19	19	19	19	19	19
SPIN-V	31	31	31	31	31	31	31	31	31	31
GCC	15	15	15	15	15	15	15	15	15	15
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	10	10	10	10	10	10	10	10	10	10
commprotocol	17	17	17	17	17	17	17	17	17	17
concurrency	6	6	6	6	6	6	6	6	6	6
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	14	14	14	14	14	14	14	14	14	14
healthcare3	34	34	34	34	34	34	34	34	34	34
healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
networkMgmt	110	110	110	110	110	110	110	110	110	110
processorcomm1	22	22	22	22	22	22	22	22	22	22
processorcomm2	26	26	26	26	26	26	26	26	26	26
service	106	106	106	106	106	106	106	106	106	106
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	50	50	50	50	50	50	50	50	50	50
storage4	130	130	130	130	130	130	130	130	130	130
storage5	218	218	218	218	218	218	218	218	218	218
systemmgmt	17	17	17	17	17	17	17	17	17	17
telecom	31	31	31	31	31	31	31	31	31	31

Table 12 The construction time consumed by WCA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	0.23	0.23	0.23	0.23	0.23	0.25	0.23	0.23	0.23	0.23
Syn_2	1.40	1.39	1.39	1.38	1.39	1.39	1.39	1.39	1.40	1.39
Syn_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_5	481.12	477.37	479.28	477.09	481.21	477.12	486.23	476.29	479.60	476.13
Syn_6	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Syn_7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_8	27.38	27.64	27.50	27.62	27.87	27.49	27.51	27.42	27.35	27.33
Syn_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_10	346.84	345.80	344.45	345.70	346.34	345.06	346.08	347.00	347.41	344.71
Syn_11	51.63	51.01	51.01	51.00	51.13	51.09	51.30	51.21	51.40	51.12
Syn_12	0.06	0.05	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Syn_13	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Syn_14	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Syn_15	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Syn_16	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01
Syn_17	0.08	0.08	0.04	0.04	0.06	0.05	0.04	0.04	0.04	0.05
Syn_18	3.97	3.98	4.06	4.01	3.98	3.97	3.99	3.98	4.03	3.99
Syn_19	814.50	808.97	811.20	809.96	817.15	810.43	815.99	812.12	813.24	808.93
Syn_20	1.22	1.22	1.22	1.21	1.21	1.21	1.25	1.21	1.21	1.21
Syn_21	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Syn_22	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01
Syn_23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syn_24	788.02	784.56	790.96	782.15	789.13	786.89	788.12	786.66	785.69	783.34
Syn_25	4.67	4.69	4.67	4.63	4.65	4.64	4.75	4.66	4.66	4.70
Syn_26	9.22	9.24	9.25	9.24	9.21	9.28	9.28	9.32	9.22	9.17
Syn_27	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01
Syn_28	11.06	11.03	11.04	10.98	11.31	11.06	11.18	11.08	11.06	11.05
Syn_29	0.02	0.02	0.04	0.03	0.02	0.02	0.03	0.03	0.02	0.02
Syn_30	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.03
SPIN-S	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SPIN-V	1.55	1.55	1.57	1.56	1.57	1.55	1.55	1.55	1.55	1.54
GCC	27.71	27.80	27.63	27.46	27.56	27.45	28.13	27.51	27.77	27.47
Apache	0.03	0.04	0.03	0.02	0.03	0.02	0.02	0.02	0.03	0.02
Bugzilla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
banking1_yue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
banking2_yue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
commprotocol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
concurrency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
networkMgmt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
processorcomm1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
processorcomm2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
service	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage4	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
storage5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
systemmgmt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
telecom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 13 The array sizes produced by CASA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	38	38	38	39	37	39	39	39	38	42
Syn_2	31	33	31	30	37	30	30	31	30	34
Syn_3	18	19	19	18	21	18	18	19	18	18
Syn_4	22	22	21	24	22	26	23	21	21	20
Syn_5	47	48	47	57	60	48	47	46	57	50
Syn_6	24	24	24	25	24	24	24	26	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	39	41	40	41	42	42	41	39	41	39
Syn_9	21	20	20	20	20	20	20	20	20	20
Syn_10	44	44	45	44	46	44	45	43	44	44
Syn_11	43	41	41	43	41	42	43	42	41	42
Syn_12	39	39	41	37	40	42	39	43	40	43
Syn_13	37	38	38	38	36	37	36	37	37	37
Syn_14	41	37	38	36	39	36	39	37	36	38
Syn_15	34	32	31	30	32	33	30	35	31	30
Syn_16	24	24	25	24	24	24	24	24	24	25
Syn_17	42	39	41	38	42	40	38	39	37	40
Syn_18	42	41	42	42	42	47	43	42	43	41
Syn_19	58	48	48	50	47	49	48	50	47	49
Syn_20	53	53	56	55	53	57	54	55	54	55
Syn_21	37	36	36	37	36	38	36	36	39	36
Syn_22	36	36	36	36	36	36	37	37	36	36
Syn_23	12	12	12	12	12	12	12	12	13	15
Syn_24	42	44	41	48	43	48	43	41	43	44
Syn_25	49	48	48	47	48	51	59	48	50	49
Syn_26	30	30	33	32	32	31	31	32	31	32
Syn_27	37	36	36	36	37	38	36	36	36	36
Syn_28	50	55	52	51	49	50	51	52	51	52
Syn_29	32	30	28	29	33	31	31	33	29	32
Syn_30	20	21	20	18	21	20	20	21	20	20
SPIN-S	19	21	20	20	19	21	22	19	19	20
SPIN-V	46	38	37	35	38	41	35	38	39	34
GCC	25	20	19	20	26	20	20	22	19	22
Apache	33	33	35	36	35	33	34	33	33	31
Bugzilla	17	16	17	18	16	16	16	16	17	16
banking1_yue	13	13	13	13	13	13	13	13	13	13
banking2_yue	11	10	10	10	11	10	10	10	10	10
commprotocol	16	16	16	16	16	16	16	16	16	16
concurrency	5	5	5	5	5	5	5	5	5	5
healthcare1	30	30	30	30	30	30	30	30	30	30
healthcare2	15	15	15	15	15	15	15	15	15	15
healthcare3	35	37	36	34	34	36	35	35	36	37
healthcare4	47	48	48	47	48	47	47	46	47	47
Insurance	540	545	543	543	541	536	530	537	542	527
networkMgmt	117	117	116	116	116	118	110	120	110	115
processorcomm1	25	24	23	22	25	23	24	24	24	23
processorcomm2	28	29	29	26	28	31	26	28	29	27
service	109	103	114	104	105	105	103	104	100	107
storage1	17	17	17	17	17	17	17	17	17	17
storage2	18	18	18	18	18	18	18	18	18	18
storage3	51	54	50	51	53	53	54	50	50	53
storage4	130	131	132	130	130	131	132	131	131	130
storage5	215	215	220	217	222	215	220	221	224	221
systemmgmt	15	17	15	17	15	20	15	16	16	15
telecom	31	30	30	30	30	30	30	30	30	30

Table 14 The construction time consumed by CASA for 2-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	444.38	274.13	391.36	119.61	271.93	126.38	216.69	133.31	395.73	35.48
Syn_2	85.54	12.11	12.53	84.31	9.13	12.90	16.67	17.82	23.63	8.97
Syn_3	0.66	0.66	0.65	1.24	0.71	0.67	0.69	0.70	6.55	0.68
Syn_4	4.16	4.57	2.93	3.29	4.14	2.63	4.24	6.85	6.56	18.04
Syn_5	408.20	365.29	940.80	55.46	48.06	297.63	981.70	382.48	202.17	298.01
Syn_6	8.92	13.74	9.21	7.13	10.11	10.44	8.91	4.91	5.88	14.21
Syn_7	0.51	0.52	1.04	0.49	0.49	0.48	0.51	0.51	0.53	0.49
Syn_8	540.01	269.67	240.90	579.68	48.17	97.06	120.79	524.40	248.92	339.94
Syn_9	6.93	7.09	6.86	8.00	6.79	7.15	7.82	6.88	6.45	6.71
Syn_10	224.64	245.17	352.50	383.64	91.80	342.91	379.82	312.70	362.13	161.67
Syn_11	59.57	345.51	407.18	110.97	371.97	215.89	105.42	205.83	370.02	715.96
Syn_12	183.31	211.04	64.98	206.21	572.44	97.39	415.11	44.03	98.77	36.56
Syn_13	26.78	28.72	26.75	25.97	143.13	25.14	48.26	46.02	27.88	26.69
Syn_14	16.44	20.79	22.16	373.47	16.97	131.66	16.50	53.64	127.81	26.42
Syn_15	5.99	8.03	6.62	10.13	4.96	5.03	33.25	3.46	10.34	75.81
Syn_16	17.79	10.90	6.86	56.39	8.26	17.29	10.28	10.42	10.83	6.55
Syn_17	106.61	96.63	61.68	127.58	38.45	97.53	168.06	184.82	507.81	138.88
Syn_18	303.47	608.74	204.62	403.41	146.73	42.40	235.77	369.46	106.52	269.24
Syn_19	358.46	422.49	419.80	147.42	465.58	212.69	602.57	248.06	244.81	307.46
Syn_20	859.76	512.51	206.76	353.80	490.98	124.80	369.23	269.29	339.41	415.50
Syn_21	27.89	62.55	99.93	17.73	40.31	17.32	188.67	35.25	17.40	34.97
Syn_22	12.23	6.67	7.41	8.34	8.84	21.45	5.89	5.98	11.43	6.17
Syn_23	2.15	3.57	2.31	13.93	2.44	4.93	2.31	3.55	1.78	1.07
Syn_24	430.34	63.21	521.46	33.53	217.81	37.06	152.77	402.55	164.37	107.99
Syn_25	852.58	854.90	326.17	362.37	425.05	123.61	40.29	646.80	198.98	262.44
Syn_26	213.57	94.70	20.50	18.55	27.67	52.53	29.81	44.85	166.80	16.89
Syn_27	4.34	8.61	10.74	6.63	7.05	6.91	10.05	9.73	7.46	9.76
Syn_28	845.23	179.22	729.66	422.49	779.99	658.40	394.85	347.29	519.95	354.85
Syn_29	26.38	64.16	26.83	75.32	20.69	26.95	32.53	24.14	136.07	30.92
Syn_30	27.90	3.62	4.13	35.70	6.14	10.85	55.51	6.06	8.95	9.07
SPIN-S	8.28	2.64	4.11	3.19	5.03	1.45	0.62	5.57	9.18	2.92
SPIN-V	14.15	25.89	7.35	48.69	15.46	16.87	141.83	186.11	37.00	314.65
GCC	345.25	290.74	41.94	478.41	158.38	361.13	970.07	345.20	234.99	413.49
Apache	48.22	52.59	38.37	30.60	37.66	37.63	43.97	72.79	51.84	84.28
Bugzilla	1.72	7.56	2.81	1.66	4.97	2.99	2.31	1.99	1.66	3.84
banking1_yue	0.14	0.29	0.13	0.13	0.13	0.13	0.13	0.14	0.15	0.63
banking2_yue	0.20	1.05	0.50	0.55	0.22	0.50	0.51	0.56	0.24	0.52
commprotocol	3.36	1.01	1.37	1.03	1.25	1.42	1.59	1.53	1.58	1.65
concurrency	0.11	0.09	0.09	0.09	0.11	0.09	0.10	0.11	0.10	0.10
healthcare1	0.26	0.26	0.25	0.25	0.25	0.23	0.26	0.25	0.26	0.27
healthcare2	0.54	0.25	0.49	0.25	0.57	0.27	0.54	0.25	0.25	0.24
healthcare3	4.18	1.65	2.43	7.66	2.51	2.74	1.34	2.34	3.34	2.88
healthcare4	6.97	4.14	4.14	6.47	18.62	3.85	5.52	8.05	4.53	19.95
Insurance	12.38	10.46	12.57	18.71	9.95	20.79	88.23	19.24	19.42	203.53
networkMgmt	3.97	3.40	5.45	4.56	3.52	1.56	65.79	2.77	132.57	2.11
processorcomm1	0.66	1.42	2.82	21.91	0.69	2.52	1.28	1.45	1.45	2.87
processorcomm2	6.10	1.89	1.99	6.46	1.98	0.97	170.31	3.84	1.38	3.51
service	2.46	4.89	2.40	25.70	6.52	10.98	14.46	6.48	23.39	6.88
storage1	0.27	0.28	0.27	0.26	0.26	0.26	0.28	0.28	0.26	0.27
storage2	0.17	0.17	0.17	0.18	0.17	0.15	0.17	0.18	0.17	0.18
storage3	1.26	0.76	1.31	1.31	0.81	1.33	0.77	0.71	0.73	0.83
storage4	9.11	3.00	3.40	8.39	19.82	3.39	3.10	3.82	7.16	36.83
storage5	653.68	372.53	85.80	184.60	63.01	301.14	66.40	56.66	24.21	76.10
systemmgmt	0.33	0.20	0.33	0.24	0.35	0.55	0.34	0.60	0.21	0.33
telecom	0.26	0.29	0.29	0.29	0.29	0.85	0.29	0.29	0.30	0.86

Table 15 The array sizes produced by DPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	244	245	247	246	245	248	247	246	245	247
Syn_2	136	135	138	138	135	136	137	136	172	142
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	332	334	330	331	333	335	333	332	330	333
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	259	258	261	260	259	257	258	259	259	259
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	287	282	285	285	285	282	285	281	284	283
Syn_11	273	274	273	274	275	272	273	273	274	272
Syn_12	217	216	216	216	217	217	217	216	216	217
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	217	218	219	216	217	216	216	217	217
Syn_18	280	282	280	281	281	283	283	281	282	281
Syn_19	320	318	320	318	321	321	320	316	321	321
Syn_20	414	411	412	410	414	413	415	414	416	411
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	288	286	288	288	285	289	285	286	291	287
Syn_25	355	355	355	353	355	354	354	353	355	355
Syn_26	164	162	162	162	164	164	163	159	162	163
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	373	370	372	371	370	374	374	371	372	373
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	68	68	68	67	68	68	67	68	68	67
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	285	250	266	284	269	284	228	272	277	226
GCC	103	90	95	90	100	102	79	106	95	105
Apache	137	137	139	139	140	139	142	138	142	141
Bugzilla	49	48	48	48	48	48	48	48	48	48
banking1_yue	45	45	45	45	45	45	45	45	45	45
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	49	49	45	42	42	43	42	42	42	42
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	50	50	50	50	50	50	50	50	50	50
healthcare3	152	152	153	151	152	152	151	152	152	152
healthcare4	241	243	240	240	242	243	241	239	241	240
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	104	104	104	104	104	104	104	104	104	104
processorcomm2	124	125	124	126	126	125	125	124	125	126
service	852	854	856	948	855	959	851	946	875	848
storage1	25	25	25	25	25	25	25	25	25	25
storage2	54	54	54	54	54	54	54	54	54	54
storage3	222	222	222	222	222	222	222	222	222	222
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1712	1715	1713	1715	1711	1715	1718	1709	1710	1714
systemmgmt	45	45	45	45	45	45	45	45	45	45
telecom	120	120	120	120	120	120	120	120	120	120

Table 16 The construction time consumed by DPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	448.73	564.95	283.45	272.35	361.71	461.07	406.16	255.07	407.21	486.15
Syn_2	217.34	245.81	275.18	89.44	604.58	319.65	418.92	717.40	1.92	34.76
Syn_3	17.92	122.22	33.36	120.80	36.72	158.22	57.94	30.13	132.52	211.48
Syn_4	6.97	24.22	6.32	3.26	8.20	16.60	2.17	14.70	12.68	38.15
Syn_5	752.06	470.29	872.12	279.85	563.51	559.60	763.10	803.89	908.25	610.98
Syn_6	22.40	28.15	10.71	34.82	7.51	5.68	6.45	24.08	17.40	6.05
Syn_7	7.99	1.03	0.93	9.75	5.28	6.27	0.59	1.19	7.45	0.50
Syn_8	630.29	651.24	555.80	696.95	752.24	893.85	583.97	995.48	557.39	993.04
Syn_9	26.84	0.83	8.23	5.83	9.11	6.41	3.69	3.50	13.09	13.43
Syn_10	332.36	917.01	346.08	434.34	681.13	489.12	511.59	931.70	835.39	827.79
Syn_11	306.04	320.19	246.64	324.74	600.81	551.55	949.06	663.12	136.91	711.84
Syn_12	225.34	484.44	624.57	770.74	734.78	849.82	721.37	530.12	438.22	469.21
Syn_13	65.49	143.72	45.91	91.81	23.44	37.08	32.62	46.52	96.07	81.97
Syn_14	4.00	6.98	7.04	15.34	6.23	4.49	3.92	5.99	15.97	12.29
Syn_15	18.38	4.79	3.65	5.08	15.05	19.62	31.49	14.62	23.33	6.90
Syn_16	42.05	33.44	103.66	44.48	32.21	21.38	2.94	31.54	41.68	17.50
Syn_17	407.54	590.40	348.47	333.80	328.42	764.33	320.57	561.49	712.58	535.49
Syn_18	568.60	589.80	631.88	675.16	679.16	809.45	382.33	681.37	327.72	601.98
Syn_19	904.90	707.72	496.12	713.91	368.56	885.23	647.04	596.25	401.56	948.50
Syn_20	589.40	990.68	844.21	937.10	731.41	924.58	890.95	761.63	429.33	940.82
Syn_21	2.12	2.78	1.93	2.55	3.66	3.68	3.95	5.06	2.30	2.01
Syn_22	3.81	8.75	6.70	6.77	4.23	1.29	3.97	3.27	3.75	3.59
Syn_23	0.88	0.33	4.01	0.29	1.59	0.88	2.77	0.38	3.33	0.30
Syn_24	804.84	245.76	465.79	486.71	354.66	193.99	858.25	660.36	154.19	303.50
Syn_25	314.46	768.80	886.06	624.06	363.42	423.55	522.48	668.37	918.82	999.44
Syn_26	146.67	231.01	969.31	366.35	137.31	532.87	720.33	542.22	574.15	980.54
Syn_27	2.55	5.44	6.58	1.89	7.06	2.34	3.02	12.26	2.46	1.66
Syn_28	511.77	646.06	393.39	415.63	626.01	599.13	316.49	981.56	433.13	468.77
Syn_29	67.82	25.88	58.88	175.10	52.58	138.28	70.16	89.32	47.01	146.18
Syn_30	108.66	234.21	91.07	689.33	278.03	146.76	725.55	244.56	787.91	653.41
SPIN-S	0.99	2.44	1.83	1.92	1.94	6.43	1.37	0.68	0.22	3.39
SPIN-V	0.89	1.61	1.02	0.93	1.05	0.97	3.43	1.18	0.95	4.86
GCC	12.96	18.31	15.59	21.01	13.10	12.67	359.31	17.05	14.81	13.28
Apache	574.26	697.16	619.82	649.77	662.18	551.55	889.88	943.41	996.13	626.81
Bugzilla	10.88	1.91	36.79	7.95	3.85	17.06	5.18	2.41	19.98	15.90
banking1_yue	1.24	1.99	2.54	0.84	1.30	1.17	2.85	1.88	0.57	3.95
banking2_yue	0.19	0.50	0.47	0.77	1.11	0.16	2.03	0.17	0.17	0.17
commprotocol	0.00	0.00	0.38	0.25	0.54	0.43	0.88	0.72	0.82	1.00
concurrency	0.24	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.00
healthcare1	0.26	0.44	0.42	0.87	0.20	0.19	0.64	0.44	0.19	0.20
healthcare2	311.44	27.50	106.89	26.36	258.09	24.53	3.21	55.57	128.01	323.60
healthcare3	87.59	218.69	97.63	194.67	108.26	40.04	372.51	137.14	36.37	71.99
healthcare4	872.07	517.58	911.68	899.77	562.11	231.76	806.91	827.62	534.27	740.78
Insurance	6.09	6.68	9.44	10.30	5.95	8.45	6.11	7.99	7.10	4.88
networkMgmt	1.36	1.90	0.79	1.03	0.56	1.09	1.23	0.57	1.18	0.86
processorcomm1	541.17	663.64	598.49	540.95	504.26	582.97	578.68	128.49	500.42	179.34
processorcomm2	707.55	248.39	232.20	117.98	54.51	348.45	104.94	694.63	79.84	94.14
service	931.19	875.27	616.13	0.70	851.53	0.63	581.43	0.72	31.93	967.08
storage1	0.21	0.19	0.19	0.18	0.18	0.17	0.17	0.18	0.17	0.00
storage2	0.17	0.16	0.19	0.15	0.18	0.17	0.18	0.17	0.18	0.15
storage3	7.43	16.65	14.51	13.67	17.52	5.84	10.21	15.02	17.47	18.50
storage4	209.55	159.14	115.14	128.55	138.72	67.40	135.27	172.06	123.16	97.73
storage5	943.81	773.20	713.08	242.66	591.89	593.31	453.66	862.19	555.57	626.22
systemmgmt	3.60	2.67	1.94	26.48	0.93	2.17	2.40	1.85	0.24	2.77
telecom	0.20	0.18	0.91	0.19	2.63	0.44	0.69	0.21	0.44	0.45

Table 17 The array sizes produced by SPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	249	246	248	245	247	247	246	246	245	249
Syn_2	131	131	132	125	131	125	127	130	131	128
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	334	334	333	330	333	331	332	335	330	333
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	258	258	258	256	258	258	257	258	258	259
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	281	279	283	281	283	279	283	279	281	281
Syn_11	272	272	272	271	271	275	275	271	271	274
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	280	284	280	280	281	280	281	280	280	283
Syn_19	318	319	319	322	318	314	322	322	320	317
Syn_20	411	413	410	413	411	412	414	412	410	409
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	286	284	283	285	285	286	285	284	286	286
Syn_25	350	351	352	348	349	349	349	350	349	351
Syn_26	158	159	162	163	160	161	163	163	160	162
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	369	373	368	370	371	370	374	370	371	371
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	65	65	66	65	65	66	66	65	66	65
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	193	193	192	193	193	193	193	193	193	193
GCC	79	79	79	79	77	78	78	78	78	79
Apache	137	137	139	138	138	139	138	139	138	138
Bugzilla	48	48	48	48	48	48	48	48	48	48
banking1_yue	45	45	45	45	45	45	45	45	45	45
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	41	41	41	41	41	41	41	41	41	41
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	49	50	50	50	50	50	50	50	49	50
healthcare3	152	151	150	150	151	150	150	151	149	150
healthcare4	239	242	241	242	241	243	240	239	241	242
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	104	104	104	104	104	104	104	104	104	104
processorcomm2	130	127	128	129	128	129	126	131	128	126
service	825	821	822	824	821	820	823	821	821	820
storage1	25	25	25	25	25	25	25	25	25	25
storage2	54	54	54	54	54	54	54	54	54	54
storage3	225	224	226	222	228	225	223	223	225	226
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1712	1720	1715	1711	1711	1714	1718	1710	1714	1714
systemmgmt	45	45	45	45	45	45	45	45	45	45
telecom	120	120	120	120	120	120	120	120	120	120

Table 18 The construction time consumed by SPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	109.28	331.33	727.65	356.19	571.10	311.12	423.68	748.30	822.44	280.56
Syn_2	619.89	224.32	134.85	810.41	407.35	451.32	183.63	765.68	263.95	492.46
Syn_3	35.71	221.56	43.45	21.36	245.20	52.97	42.35	690.43	73.85	66.43
Syn_4	1.84	4.37	5.58	9.70	4.57	3.87	22.02	20.24	14.12	56.56
Syn_5	257.90	398.98	654.89	550.86	332.47	344.64	421.45	332.56	370.63	351.60
Syn_6	7.92	69.39	9.63	21.90	14.70	2.44	6.46	23.97	7.03	6.09
Syn_7	3.59	2.10	2.71	1.11	2.70	4.29	7.95	8.97	5.71	4.40
Syn_8	229.43	570.35	497.36	355.70	622.36	802.25	256.31	364.54	575.03	428.98
Syn_9	18.50	9.15	1.63	9.16	7.76	5.70	1.00	5.60	24.31	8.15
Syn_10	710.99	880.36	540.78	586.28	520.43	947.99	429.45	796.67	431.91	603.30
Syn_11	387.60	406.90	386.83	921.34	956.93	437.10	461.58	911.27	837.29	530.82
Syn_12	139.37	323.45	172.99	194.10	153.93	176.68	429.89	108.67	507.32	479.77
Syn_13	7.49	26.24	9.75	9.26	27.10	17.29	63.47	59.44	9.47	16.00
Syn_14	5.44	15.25	10.29	10.00	4.56	6.42	3.33	16.11	9.25	4.36
Syn_15	17.88	10.28	31.27	5.75	35.95	10.36	13.16	12.17	4.68	7.29
Syn_16	155.50	38.48	16.13	44.41	93.21	36.53	31.62	52.55	46.34	88.07
Syn_17	283.77	680.87	110.82	120.70	114.87	237.07	386.39	243.52	162.94	125.81
Syn_18	905.20	257.14	562.53	538.57	579.06	427.50	720.89	814.90	399.84	372.49
Syn_19	442.49	546.09	511.82	294.59	516.13	854.39	419.31	524.08	341.85	662.31
Syn_20	359.93	373.98	621.62	265.36	552.36	872.48	452.35	618.85	904.57	596.42
Syn_21	8.46	4.05	2.93	4.31	7.68	4.21	2.76	3.00	2.75	1.87
Syn_22	3.68	66.78	2.78	7.31	9.81	4.53	12.33	4.17	2.18	3.97
Syn_23	3.50	8.52	11.96	1.74	0.30	11.57	14.82	3.70	0.26	0.70
Syn_24	258.62	350.00	386.24	373.52	735.51	529.76	617.13	393.31	478.40	199.90
Syn_25	531.70	976.02	815.43	675.23	627.23	968.22	991.47	606.87	526.40	807.27
Syn_26	614.31	591.02	534.08	340.31	832.72	436.74	267.95	211.55	918.87	604.44
Syn_27	2.84	3.83	3.64	3.55	5.84	2.82	5.39	2.45	3.21	5.85
Syn_28	884.56	703.39	886.35	429.46	574.63	825.64	767.46	522.61	343.01	865.13
Syn_29	25.64	18.16	10.46	18.61	30.15	26.75	31.03	21.57	25.85	10.99
Syn_30	818.50	847.29	907.05	934.83	351.97	334.81	351.41	683.70	324.63	696.12
SPIN-S	4.10	20.53	2.93	18.62	12.28	16.13	10.45	13.28	1.52	7.15
SPIN-V	292.11	261.61	101.30	160.45	350.58	741.77	326.78	229.26	752.42	107.90
GCC	248.28	386.67	361.87	105.37	339.13	956.39	549.06	684.12	552.43	417.88
Apache	780.75	994.52	960.13	873.32	831.72	395.35	639.63	716.28	787.50	916.41
Bugzilla	25.97	48.47	45.44	12.92	74.53	9.00	28.81	50.36	20.33	21.96
banking1_yue	0.55	0.39	0.47	0.38	0.33	0.33	0.41	0.60	0.35	0.41
banking2_yue	0.16	0.18	0.19	0.18	0.19	0.16	0.18	0.18	0.19	0.17
commprotocol	1.26	0.32	1.85	0.35	0.28	0.45	0.35	0.78	0.41	0.24
concurrency	0.24	0.15	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.00
healthcare1	0.24	0.20	0.20	0.20	0.19	0.22	0.24	0.18	0.19	0.19
healthcare2	488.09	349.00	9.06	47.63	98.91	21.75	17.98	111.74	887.38	121.25
healthcare3	102.47	141.54	307.61	328.74	156.24	908.05	283.99	275.00	732.82	456.80
healthcare4	780.91	650.77	878.30	912.65	812.12	812.74	743.25	702.40	936.79	700.33
Insurance	7.20	5.90	7.59	4.82	8.28	3.48	4.99	4.63	11.42	5.13
networkMgmt	1.05	1.19	0.93	0.93	1.00	0.77	2.35	0.83	1.46	0.80
processorcomm1	81.14	92.98	141.63	634.98	156.95	46.35	53.03	142.72	269.83	715.06
processorcomm2	54.08	647.48	169.35	11.43	52.90	632.27	854.69	56.30	568.50	584.01
service	935.14	989.54	901.95	998.35	723.83	946.12	763.64	823.06	985.40	886.51
storage1	0.19	0.20	0.19	0.17	0.19	0.17	0.17	0.17	0.18	0.00
storage2	0.18	0.17	0.17	0.17	0.16	0.17	0.16	0.16	0.17	0.16
storage3	677.31	980.99	381.13	14.33	53.87	110.33	266.47	173.80	624.68	987.54
storage4	62.05	234.57	257.33	142.88	151.52	503.34	130.74	179.44	184.17	172.63
storage5	661.58	959.41	586.58	763.62	976.78	474.14	790.71	990.48	706.78	275.85
systemmgmt	0.21	0.22	0.20	0.22	0.22	0.23	0.19	0.27	0.20	0.23
telecom	0.25	0.26	0.86	1.18	0.21	0.33	0.21	0.21	0.21	0.26

Table 19 The array sizes produced by APTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	245	241	242	244	244	243	242	242	244	242
Syn_2	129	124	128	130	129	128	124	128	127	130
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	329	328	327	331	332	331	329	331	330	331
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	252	253	252	252	254	254	253	253	253	253
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	281	281	280	279	278	283	279	279	280	284
Syn_11	270	270	268	267	268	269	268	270	269	269
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	276	277	276	276	278	277	277	277	274	278
Syn_19	317	317	319	321	320	320	316	316	317	320
Syn_20	406	411	410	409	412	414	411	412	411	410
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	280	280	283	280	283	284	281	284	284	283
Syn_25	349	349	348	348	350	347	348	347	348	349
Syn_26	159	159	161	159	160	158	158	160	159	159
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	370	369	367	373	369	369	372	367	368	369
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	65	65	66	66	66	65	66	66	66
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	193	193	193	194	193	194	194	193	194	194
GCC	78	78	81	79	80	80	77	79	79	80
Apache	140	138	139	140	141	139	140	138	136	142
Bugzilla	48	48	48	48	48	48	48	48	48	48
banking1_yue	45	45	45	45	45	45	45	45	45	45
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	41	41	41	41	41	41	41	41	41	41
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	50	49	50	50	50	49	50	49	50	50
healthcare3	153	151	150	151	153	153	151	151	153	151
healthcare4	243	247	244	249	244	242	247	239	243	240
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	106	105	104	104	105	105	104	105	104	105
processorcomm2	126	127	127	127	129	127	131	128	128	128
service	819	816	814	819	818	812	817	818	813	817
storage1	25	25	25	25	25	25	25	25	25	25
storage2	54	54	54	54	54	54	54	54	54	54
storage3	223	224	228	223	224	225	225	223	224	224
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1710	1712	1711	1716	1711	1713	1716	1710	1713	1712
systemmgmt	45	45	45	45	45	45	45	45	45	45
telecom	120	120	120	120	120	120	120	120	120	120

Table 20 The construction time consumed by APTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	487.73	447.89	866.43	661.37	428.53	830.05	913.73	549.23	747.78	792.01
Syn_2	710.08	608.12	614.41	613.99	886.89	681.55	953.66	863.00	658.70	972.06
Syn_3	45.35	347.54	249.57	187.18	49.17	166.86	473.92	99.00	49.27	105.68
Syn_4	18.20	17.96	10.06	9.78	9.89	15.02	8.33	4.30	10.70	19.78
Syn_5	944.34	595.42	961.08	555.23	936.54	551.78	898.50	619.82	905.84	815.45
Syn_6	21.61	32.66	17.79	4.58	8.91	32.86	9.53	31.51	24.80	42.87
Syn_7	298.37	25.07	171.13	1.69	130.08	104.86	87.60	0.49	3.73	19.45
Syn_8	986.54	998.02	823.57	981.45	897.06	652.43	898.45	668.20	871.64	800.11
Syn_9	16.93	4.55	14.84	22.97	31.55	9.57	7.52	10.31	3.97	11.91
Syn_10	960.40	879.32	862.28	978.72	842.13	792.80	976.05	871.11	990.42	878.81
Syn_11	865.87	744.56	974.42	793.22	560.76	567.43	612.05	645.35	967.36	988.47
Syn_12	336.48	83.47	501.28	406.97	301.66	248.20	539.23	356.71	114.39	392.52
Syn_13	16.83	14.77	11.70	20.87	14.28	20.29	24.64	32.63	21.20	44.28
Syn_14	6.45	5.86	7.52	7.69	6.08	4.13	3.21	6.23	4.39	6.32
Syn_15	11.65	4.85	4.50	13.79	4.47	24.63	10.75	12.58	24.86	13.26
Syn_16	64.58	10.79	65.91	81.36	41.37	8.12	14.01	97.50	50.19	62.16
Syn_17	223.25	122.48	318.61	385.30	187.50	452.81	125.29	99.72	138.64	186.33
Syn_18	616.30	900.17	887.43	977.05	973.37	961.06	803.19	899.51	909.40	747.02
Syn_19	661.98	647.08	876.39	487.67	500.71	962.48	822.24	844.64	898.55	888.32
Syn_20	854.58	819.74	575.97	721.29	759.65	480.80	982.58	847.49	872.30	996.53
Syn_21	3.57	2.51	1.93	4.00	2.33	2.26	3.36	2.51	2.23	3.73
Syn_22	8.01	2.46	12.09	7.23	6.09	7.28	1.93	8.17	2.67	8.04
Syn_23	63.21	0.27	0.36	29.77	9.05	19.54	57.56	0.53	2.04	1.01
Syn_24	936.61	960.21	819.65	872.90	796.96	672.81	463.83	418.42	717.28	876.04
Syn_25	465.97	688.10	799.80	942.89	981.42	846.18	828.43	762.07	869.29	973.96
Syn_26	518.50	998.34	527.65	699.61	685.35	519.42	915.20	798.88	789.26	771.16
Syn_27	7.56	4.73	5.66	5.81	2.44	2.43	2.56	11.25	7.22	3.77
Syn_28	856.51	852.24	938.74	503.63	889.44	702.82	730.69	922.25	956.56	989.92
Syn_29	13.70	28.35	21.16	15.31	70.11	49.79	27.12	30.47	17.73	49.68
Syn_30	218.21	742.86	971.70	450.60	427.11	194.86	440.05	191.67	578.26	136.49
SPIN-S	0.79	1.57	2.96	2.34	2.97	1.63	1.45	0.94	3.74	0.61
SPIN-V	105.31	233.30	170.93	65.20	271.80	207.60	100.53	555.28	270.65	134.86
GCC	988.09	184.62	257.13	283.66	253.55	246.31	707.76	254.61	643.29	385.05
Apache	581.29	570.15	953.34	750.03	392.72	860.13	671.99	893.93	762.67	605.72
Bugzilla	8.41	61.14	14.77	105.88	140.56	54.36	23.19	50.99	20.79	7.86
banking1_yue	0.60	0.52	0.32	0.30	0.37	0.45	0.37	0.38	0.32	0.27
banking2_yue	0.21	0.20	0.21	0.29	0.20	0.22	0.18	0.21	0.21	0.20
commprotocol	0.35	0.45	0.75	0.50	0.64	0.52	0.71	0.84	0.45	0.36
concurrency	0.25	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15
healthcare1	0.20	0.21	0.19	0.23	0.22	0.22	0.19	0.22	0.22	0.20
healthcare2	148.33	27.09	13.62	10.20	26.78	892.40	89.54	784.65	110.98	34.75
healthcare3	53.45	84.63	326.90	433.69	27.45	62.23	175.96	55.63	77.26	47.89
healthcare4	688.10	681.97	112.62	46.18	175.25	443.75	259.00	542.96	346.67	963.81
Insurance	9.14	6.73	7.27	2.65	8.62	8.11	8.98	5.22	5.34	7.68
networkMgmt	0.73	1.15	1.03	1.16	1.18	1.23	1.37	0.81	1.08	0.93
processorcomm1	12.96	46.07	51.83	21.64	92.12	65.94	67.00	22.56	213.15	106.12
processorcomm2	670.62	904.06	432.47	56.43	5.40	425.20	313.14	753.42	289.04	298.83
service	861.00	943.89	935.69	884.60	804.56	844.41	949.97	898.48	954.94	785.03
storage1	0.21	0.19	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.17
storage2	0.18	0.17	0.18	0.19	0.19	0.19	0.19	0.19	0.16	0.17
storage3	291.73	18.44	2.69	30.91	8.78	7.79	11.05	17.52	10.94	7.48
storage4	42.44	159.06	258.55	250.90	168.09	127.13	177.77	132.91	182.88	142.77
storage5	817.67	982.68	629.56	879.85	600.49	740.82	930.07	902.10	991.87	821.14
systemmgmt	0.23	0.22	0.23	0.23	0.21	0.23	0.26	0.30	0.25	0.20
telecom	0.21	0.33	0.26	0.23	0.24	0.21	0.22	0.21	0.25	0.79

Table 21 The array sizes produced by APPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	238	240	240	241	241	241	242	242	237	238
Syn_2	127	128	129	126	127	124	128	129	128	127
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	326	328	328	325	327	325	330	327	326	325
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	251	249	247	248	249	250	248	250	249	250
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	276	274	274	273	275	275	275	276	275	275
Syn_11	265	266	266	269	268	265	268	268	266	266
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	273	272	273	272	273	273	274	273	274	274
Syn_19	314	316	314	318	318	316	317	312	314	313
Syn_20	406	406	407	407	409	407	407	408	405	404
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	278	278	280	281	281	279	278	279	280	278
Syn_25	343	345	345	345	346	345	343	342	344	344
Syn_26	156	158	158	157	156	156	158	158	160	158
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	366	364	364	366	365	369	364	367	364	367
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	65	65	66	65	66	65	64	65	65
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	193	193	194	193	193	192	193	193	192	193
GCC	80	79	79	77	78	78	78	78	77	78
Apache	136	134	139	137	137	136	136	137	140	137
Bugzilla	48	48	48	48	48	48	48	48	48	48
banking1_yue	45	45	45	45	45	45	45	45	45	45
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	41	41	41	41	41	41	41	41	41	41
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	50	49	50	50	50	50	49	50	50	50
healthcare3	151	151	150	152	152	150	152	152	151	152
healthcare4	242	242	247	244	245	239	242	243	242	244
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	105	104	105	104	104	106	105	105	106	105
processorcomm2	128	128	128	127	127	126	128	128	127	128
service	803	805	805	802	805	803	803	806	806	803
storage1	25	25	25	25	25	25	25	25	25	25
storage2	54	54	54	54	54	54	54	54	54	54
storage3	224	224	225	228	224	223	226	229	225	226
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1708	1709	1706	1710	1708	1708	1712	1711	1706	1710
systemmgmt	45	45	45	45	45	45	45	45	45	45
telecom	120	120	120	120	120	120	120	120	120	120

Table 22 The construction time consumed by APPTS for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	868.79	891.33	703.17	386.50	798.41	476.07	871.01	925.15	940.57	940.57
Syn_2	389.38	973.84	774.10	665.43	686.02	890.95	550.13	927.13	398.47	398.47
Syn_3	363.06	77.25	57.20	273.25	61.42	16.79	55.70	48.65	83.68	195.95
Syn_4	6.38	4.77	19.12	3.10	1.92	8.43	1.05	5.36	5.76	5.76
Syn_5	947.32	841.35	867.04	754.77	923.67	798.26	977.18	741.14	997.61	997.61
Syn_6	12.37	2.97	10.37	2.24	37.34	13.01	5.94	2.71	12.15	12.15
Syn_7	0.53	2.68	179.09	83.83	5.56	0.84	24.32	26.35	3.23	17.51
Syn_8	820.17	705.52	915.07	914.26	778.51	863.04	577.85	977.39	954.34	954.34
Syn_9	12.67	7.86	4.52	0.60	5.68	3.39	7.57	9.89	8.42	8.42
Syn_10	926.22	751.77	830.28	858.14	806.53	958.61	823.21	884.64	869.66	869.66
Syn_11	963.77	551.46	841.92	731.72	967.77	444.44	867.57	519.86	689.77	689.77
Syn_12	67.11	106.39	177.36	253.32	80.33	77.02	116.23	98.27	91.37	91.37
Syn_13	6.94	7.16	25.77	7.41	7.56	10.14	8.55	6.69	10.79	10.79
Syn_14	4.62	2.52	2.87	2.79	2.49	2.83	5.92	7.25	3.22	3.22
Syn_15	20.49	8.58	5.66	1.64	6.69	6.96	3.40	2.40	9.13	9.13
Syn_16	86.46	71.51	19.88	62.01	35.03	35.51	36.23	7.80	49.22	49.22
Syn_17	55.97	118.63	96.35	61.64	109.63	56.52	35.47	58.35	52.88	52.88
Syn_18	719.27	912.54	802.84	932.52	659.89	761.63	746.05	959.23	947.14	947.14
Syn_19	487.82	713.15	484.37	344.15	768.61	820.20	908.99	784.53	979.10	979.10
Syn_20	828.78	981.71	624.54	773.77	882.41	799.09	633.35	940.04	961.46	961.46
Syn_21	2.01	3.21	1.88	2.39	2.21	1.55	1.79	2.03	2.94	2.94
Syn_22	5.39	2.02	8.38	3.24	2.40	3.80	1.56	5.26	1.57	1.57
Syn_23	0.64	1.35	25.15	1.06	0.24	0.89	13.39	8.31	45.92	45.92
Syn_24	962.18	924.79	515.56	912.19	595.23	999.51	521.22	896.70	860.23	860.23
Syn_25	815.69	939.13	855.79	486.35	986.24	920.50	881.46	849.34	946.75	946.75
Syn_26	469.67	936.99	919.81	813.71	473.30	812.64	413.22	428.19	961.00	961.00
Syn_27	2.49	1.30	1.32	4.04	1.31	4.76	1.35	1.12	1.32	1.32
Syn_28	509.94	555.64	886.21	762.82	768.59	971.24	851.77	725.54	940.85	940.85
Syn_29	10.24	14.62	10.74	16.64	13.59	7.63	9.72	11.57	8.00	8.00
Syn_30	197.83	516.59	232.62	131.99	70.31	608.49	162.87	298.21	176.47	176.47
SPIN-S	1.51	4.43	2.06	1.50	3.52	4.25	2.91	1.37	2.64	2.64
SPIN-V	163.36	79.99	78.66	123.45	222.89	162.03	259.34	83.79	115.77	115.77
GCC	94.34	671.65	230.71	679.61	456.51	265.45	188.32	302.41	934.45	934.45
Apache	566.62	606.61	152.80	769.43	411.87	572.71	408.48	173.42	536.68	536.68
Bugzilla	42.11	38.44	1.69	37.78	9.44	10.51	24.33	31.27	87.70	87.70
banking1_yue	0.39	0.31	0.25	0.34	0.36	0.53	0.30	0.33	0.26	0.26
banking2_yue	0.18	0.18	0.19	0.18	0.19	0.19	0.19	0.17	0.18	0.18
commprotocol	0.36	0.62	0.41	0.81	0.49	1.86	1.14	1.24	0.71	0.71
concurrency	0.24	0.15	0.15	0.14	0.15	0.15	0.14	0.15	0.14	0.15
healthcare1	0.19	0.21	0.20	0.19	0.37	0.21	0.20	0.20	0.19	0.19
healthcare2	15.58	390.15	123.50	6.56	48.64	104.91	20.68	30.41	120.37	120.37
healthcare3	41.86	17.97	973.95	39.60	32.81	311.70	113.32	771.09	84.06	84.06
healthcare4	32.41	334.60	168.72	95.96	333.88	82.55	80.10	206.06	66.78	66.78
Insurance	2.93	1.87	1.15	1.87	1.57	1.98	2.38	2.40	2.04	2.04
networkMgmt	0.60	0.67	0.52	0.53	0.53	0.52	0.63	0.39	0.55	0.55
processorcomm1	35.38	85.87	18.50	13.07	5.97	13.39	14.27	7.44	20.36	20.36
processorcomm2	714.22	221.00	589.30	319.44	296.00	452.92	128.12	684.14	84.27	84.27
service	943.77	938.31	873.05	872.59	813.18	949.01	988.80	842.89	996.64	996.64
storage1	0.19	0.17	0.17	0.19	0.17	0.18	0.18	0.17	0.17	0.18
storage2	0.17	0.16	0.16	0.16	0.17	0.17	0.18	0.16	0.17	0.17
storage3	10.52	6.30	45.07	10.43	3.67	10.87	9.67	6.12	8.75	8.75
storage4	52.62	42.76	42.00	42.90	39.14	33.69	64.41	52.80	28.77	28.77
storage5	290.23	811.45	574.82	540.38	271.15	218.01	465.15	355.90	544.13	544.13
systemmgmt	0.22	0.19	0.19	0.20	0.29	0.27	0.25	0.19	0.21	0.21
telecom	0.23	0.22	0.28	0.39	0.57	0.19	0.20	0.27	0.21	0.21

Table 23 The array sizes produced by FastCA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	245	245	245	245	245	245	245	245	245	245
Syn_2	135	135	135	135	135	135	135	135	135	135
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	332	332	332	332	332	332	332	332	332	332
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	255	255	255	255	255	255	255	255	255	255
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	283	283	283	283	283	283	283	283	283	283
Syn_11	270	270	270	270	270	270	270	270	270	270
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	284	284	284	284	284	284	284	284	284	284
Syn_19	315	315	315	315	314	314	314	314	314	314
Syn_20	413	413	413	413	413	413	413	413	413	413
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	284	284	284	284	284	284	284	284	284	284
Syn_25	352	352	352	352	352	352	352	352	352	352
Syn_26	162	162	162	162	162	162	162	162	162	162
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	367	367	367	367	367	367	367	367	367	367
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	67	67	67	67	67	67	67	67	67	67
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	196	196	196	196	196	196	196	196	196	196
GCC	76	76	76	76	76	76	76	76	76	76
Apache	135	135	135	135	135	135	135	135	135	135
Bugzilla	48	48	48	48	48	48	48	48	48	48
banking1_yue	45	45	45	45	45	45	45	45	45	45
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	41	41	41	41	41	41	41	41	41	41
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	51	51	51	51	51	51	51	51	51	51
healthcare3	151	151	151	151	151	151	151	151	151	151
healthcare4	239	239	239	239	239	239	239	239	239	239
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	104	104	104	104	104	104	104	104	104	104
processorcomm2	126	126	126	126	126	126	126	126	126	126
service	817	817	817	817	817	817	817	817	817	817
storage1	25	25	25	25	25	25	25	25	25	25
storage2	54	54	54	54	54	54	54	54	54	54
storage3	222	222	222	222	222	222	222	222	222	222
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1707	1707	1707	1707	1707	1707	1707	1707	1707	1707
systemmgmt	45	45	45	45	45	45	45	45	45	45
telecom	120	120	120	120	120	120	120	120	120	120

Table 24 The construction time consumed by FastCA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	436.34	433.32	429.17	429.18	416.71	418.42	417.04	421.94	429.10	435.03
Syn_2	629.37	630.57	640.55	634.70	607.68	610.36	608.58	602.83	664.76	665.93
Syn_3	2.48	2.50	2.51	2.51	2.51	2.50	2.49	2.48	2.51	2.50
Syn_4	2.82	2.80	2.81	2.82	2.73	2.76	2.71	2.77	2.83	2.82
Syn_5	355.54	357.41	350.33	345.61	344.05	345.36	342.70	339.37	359.31	358.65
Syn_6	1.07	1.06	1.08	1.09	1.04	1.02	1.03	1.03	1.08	1.09
Syn_7	21.65	21.79	21.90	21.93	23.17	21.46	21.41	21.03	23.00	22.85
Syn_8	873.84	862.89	855.72	850.72	825.27	828.11	827.30	831.07	869.23	875.94
Syn_9	0.53	0.53	0.53	0.54	0.53	0.53	0.53	0.52	0.57	0.58
Syn_10	185.35	182.97	182.55	177.41	178.31	178.21	178.26	176.83	207.31	206.85
Syn_11	149.51	154.76	148.75	151.32	143.66	143.08	143.73	143.96	148.88	147.88
Syn_12	226.05	226.36	224.63	221.85	214.08	213.70	213.36	213.15	193.75	195.98
Syn_13	24.03	24.33	24.35	24.78	23.38	23.38	23.26	22.56	21.02	20.87
Syn_14	3.73	3.76	3.67	3.82	3.60	3.57	3.49	3.53	3.36	3.41
Syn_15	3.03	3.03	3.05	3.10	3.02	3.00	2.98	2.95	2.99	2.98
Syn_16	16.66	16.71	16.76	16.61	16.10	16.23	16.26	16.24	16.25	16.33
Syn_17	235.76	236.32	231.58	229.75	221.81	222.74	221.51	221.98	196.19	199.59
Syn_18	232.61	229.58	231.22	234.14	221.54	220.07	217.77	217.68	196.96	195.51
Syn_19	562.79	562.33	567.01	572.06	989.07	990.04	987.30	984.94	928.53	928.30
Syn_20	294.13	296.21	296.18	293.21	285.10	286.85	286.19	283.25	265.44	266.38
Syn_21	1.15	1.10	1.13	1.10	1.01	1.03	1.02	1.06	1.03	1.02
Syn_22	0.57	0.56	0.56	0.57	0.55	0.58	0.55	0.56	0.56	0.55
Syn_23	1.78	1.78	1.79	1.79	1.77	1.80	1.77	1.77	1.78	1.79
Syn_24	627.66	631.06	621.26	613.95	582.17	584.92	583.86	583.68	561.03	565.82
Syn_25	171.14	175.19	171.04	172.65	163.00	162.75	161.26	160.85	151.58	148.50
Syn_26	199.32	200.42	201.15	198.29	185.73	187.25	185.62	186.41	186.88	185.82
Syn_27	0.49	0.50	0.47	0.48	0.46	0.46	0.47	0.49	0.47	0.47
Syn_28	567.56	559.62	570.28	571.62	538.92	539.04	534.00	533.32	506.51	505.68
Syn_29	20.24	21.07	19.06	19.95	17.66	19.57	20.19	18.78	17.17	17.39
Syn_30	289.59	309.89	283.24	288.38	271.25	268.61	269.43	272.83	274.70	273.19
SPIN-S	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
SPIN-V	233.14	232.43	233.48	235.07	234.20	233.26	233.14	233.43	229.97	231.15
GCC	182.18	189.02	180.54	174.49	170.56	174.53	170.92	169.33	157.14	158.73
Apache	924.22	951.92	937.16	922.19	865.45	857.63	863.03	857.91	776.95	782.71
Bugzilla	1.12	1.12	1.15	1.15	1.11	1.11	1.10	1.10	1.12	1.12
banking1_yue	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
banking2_yue	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
commprotocol	10.95	10.96	10.93	10.94	10.96	10.98	10.97	10.96	11.00	10.97
concurrency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare2	10.92	10.94	10.96	10.94	10.96	10.95	10.96	10.95	10.99	10.97
healthcare3	247.00	244.66	249.24	249.60	248.66	247.05	249.20	245.21	250.54	247.21
healthcare4	416.73	418.75	417.57	419.16	410.10	411.13	418.12	411.46	407.72	413.88
Insurance	0.48	0.49	0.48	0.48	0.48	0.49	0.49	0.49	0.49	0.49
networkMgmt	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
processorcomm1	24.76	24.78	24.80	24.76	24.92	24.78	24.96	25.03	24.97	24.97
processorcomm2	97.61	97.27	97.48	97.50	98.09	97.75	99.16	98.21	97.75	96.17
service	699.49	699.10	684.05	698.85	697.53	694.34	698.23	686.79	690.77	687.48
storage1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage2	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
storage3	0.58	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
storage4	1.35	1.35	1.35	1.34	1.35	1.35	1.36	1.36	1.36	1.37
storage5	404.55	409.01	408.41	407.85	414.02	412.49	405.66	411.73	406.89	413.18
systemmgmt	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
telecom	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 25 The array sizes produced by WCA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	249	249	249	249	249	249	249	249	249	249
Syn_2	133	133	133	133	133	133	133	133	133	133
Syn_3	50	50	50	50	50	50	50	50	50	50
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	328	328	328	328	328	328	328	328	328	328
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	26	26	26	26	26	26	26	26	26	26
Syn_8	257	257	257	257	257	257	257	257	257	257
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	277	277	277	277	277	277	277	277	277	277
Syn_11	277	277	277	277	277	277	277	277	277	277
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	276	276	276	276	276	276	276	276	276	276
Syn_19	306	306	306	306	306	306	306	306	306	306
Syn_20	409	409	409	409	409	409	409	409	409	409
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	291	291	291	291	291	291	291	291	291	291
Syn_25	350	350	350	350	350	350	350	350	350	350
Syn_26	165	165	165	165	165	165	165	165	165	165
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	366	366	366	366	366	366	366	366	366	366
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	65	65	65	65	65	65	65	65	65	65
SPIN-S	80	80	80	80	80	80	80	80	80	80
SPIN-V	195	195	195	195	195	195	195	195	195	195
GCC	70	70	70	70	70	70	70	70	70	70
Apache	135	135	135	135	135	135	135	135	135	135
Bugzilla	48	48	48	48	48	48	48	48	48	48
banking1_yue	46	46	46	46	46	46	46	46	46	46
banking2_yue	30	30	30	30	30	30	30	30	30	30
commprotocol	47	47	47	47	47	47	47	47	47	47
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	96	96	96	96	96	96	96	96	96	96
healthcare2	53	53	53	53	53	53	53	53	53	53
healthcare3	161	161	161	161	161	161	161	161	161	161
healthcare4	269	269	269	269	269	269	269	269	269	269
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
networkMgmt	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
processorcomm1	112	112	112	112	112	112	112	112	112	112
processorcomm2	137	137	137	137	137	137	137	137	137	137
service	907	907	907	907	907	907	907	907	907	907
storage1	25	25	25	25	25	25	25	25	25	25
storage2	55	55	55	55	55	55	55	55	55	55
storage3	236	236	236	236	236	236	236	236	236	236
storage4	910	910	910	910	910	910	910	910	910	910
storage5	1705	1705	1705	1705	1705	1705	1705	1705	1705	1705
systemmgmt	46	46	46	46	46	46	46	46	46	46
telecom	121	121	121	121	121	121	121	121	121	121

Table 26 The construction time consumed by WCA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	307.75	291.65	307.81	295.04	314.62	305.46	311.51	302.07	311.29	302.11
Syn_2	51.75	52.72	51.54	52.14	52.60	53.57	53.60	53.12	52.49	53.76
Syn_3	0.09	0.09	0.08	0.09	0.08	0.08	0.08	0.09	0.09	0.09
Syn_4	0.76	0.76	0.77	0.77	0.76	0.78	0.77	0.78	0.77	0.77
Syn_5	981.32	998.35	980.54	992.65	973.43	994.36	979.44	992.50	972.32	996.48
Syn_6	0.86	0.85	0.86	0.86	0.87	0.96	0.90	0.89	0.91	0.96
Syn_7	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Syn_8	521.06	514.34	604.80	515.19	525.66	523.92	526.05	517.45	519.21	516.37
Syn_9	0.39	0.39	0.38	0.39	0.38	0.41	0.38	0.38	0.38	0.38
Syn_10	973.09	979.92	969.16	976.34	972.66	975.67	977.31	979.34	969.52	983.23
Syn_11	344.52	353.15	350.14	348.03	347.58	349.74	350.33	346.74	349.21	351.25
Syn_12	34.60	35.46	36.65	36.11	37.03	37.48	36.78	36.93	36.91	37.41
Syn_13	5.35	5.39	5.22	5.33	5.35	5.61	5.41	5.42	5.48	5.66
Syn_14	1.81	1.81	1.79	1.82	1.76	1.82	1.80	1.78	1.81	1.85
Syn_15	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.48	0.47
Syn_16	1.25	1.19	1.19	1.20	1.19	1.18	1.20	1.21	1.20	1.17
Syn_17	62.51	60.91	64.23	61.44	64.28	62.92	64.03	62.88	63.33	62.60
Syn_18	570.79	538.52	572.62	541.20	579.00	547.04	578.04	547.11	574.89	546.56
Syn_19	699.31	696.34	701.26	698.49	698.47	698.96	698.91	695.97	697.23	696.31
Syn_20	634.02	621.18	633.58	628.39	637.37	631.10	634.61	628.17	635.43	629.75
Syn_21	1.15	1.13	1.10	1.12	1.23	1.24	1.27	1.22	1.22	1.20
Syn_22	0.71	0.75	0.72	0.72	0.72	0.76	0.71	0.69	0.71	0.72
Syn_23	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Syn_24	845.22	847.56	850.21	853.57	854.28	853.96	863.15	852.69	855.56	857.58
Syn_25	598.23	582.92	603.29	583.21	604.87	578.11	600.14	580.51	601.14	587.25
Syn_26	345.11	336.76	347.58	334.60	347.88	338.83	343.91	342.86	345.69	343.67
Syn_27	0.57	0.57	0.57	0.57	0.57	0.58	0.56	0.60	0.57	0.57
Syn_28	749.72	756.06	746.22	754.79	747.61	752.47	743.95	749.23	747.09	753.72
Syn_29	6.46	5.99	6.44	6.25	6.92	6.64	6.87	6.44	6.63	6.67
Syn_30	126.18	121.23	123.97	121.30	129.42	121.89	126.86	120.51	126.73	121.91
SPIN-S	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
SPIN-V	38.97	39.01	39.16	38.90	39.24	39.16	39.45	39.58	39.58	39.53
GCC	730.36	726.96	744.66	732.07	739.78	747.82	745.62	735.76	737.98	733.45
Apache	139.92	129.44	145.09	134.27	148.72	141.43	147.85	139.76	147.87	140.90
Bugzilla	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.34	0.34
banking1_yue	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
banking2_yue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
commprotocol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
concurrency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
healthcare2	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
healthcare3	0.21	0.20	0.21	0.21	0.21	0.20	0.20	0.21	0.20	0.20
healthcare4	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Insurance	1.17	1.18	1.18	1.18	1.17	1.18	1.17	1.18	1.17	1.20
networkMgmt	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
processorcomm1	0.51	0.51	0.51	0.51	0.50	0.50	0.50	0.51	0.51	0.50
processorcomm2	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
service	0.48	0.48	0.48	0.48	0.48	0.80	0.48	0.48	0.48	0.48
storage1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
storage3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
storage4	0.38	0.38	0.38	0.38	0.38	0.40	0.38	0.39	0.39	0.39
storage5	1.36	1.38	1.36	1.39	1.41	1.38	1.37	1.38	1.37	1.38
systemmgmt	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
telecom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 27 The array sizes produced by CASA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	580	783	579	458	783	781	781	464	781	785
Syn_2	247	247	246	247	247	247	247	247	247	248
Syn_3	60	61	64	61	59	62	61	60	61	67
Syn_4	99	105	104	103	102	99	98	106	109	98
Syn_5	-	-	-	-	-	-	-	-	-	-
Syn_6	152	143	151	152	146	151	146	149	147	153
Syn_7	27	26	28	28	27	27	28	27	27	26
Syn_8	-	-	-	-	-	-	-	-	-	-
Syn_9	75	75	80	85	77	80	80	80	78	83
Syn_10	-	-	-	-	-	-	-	-	-	-
Syn_11	797	797	797	799	799	797	794	798	801	799
Syn_12	-	-	-	-	-	-	-	-	-	-
Syn_13	-	-	-	-	-	-	-	-	-	-
Syn_14	385	342	343	349	349	344	385	336	385	345
Syn_15	180	184	177	182	179	182	175	181	183	178
Syn_16	159	168	173	163	163	163	177	177	164	165
Syn_17	-	-	-	-	-	-	-	-	-	-
Syn_18	-	-	-	-	-	-	-	-	-	-
Syn_19	-	-	-	-	-	-	-	-	-	-
Syn_20	-	-	-	-	-	-	-	-	-	-
Syn_21	332	328	330	330	330	330	328	328	328	328
Syn_22	212	215	210	214	202	210	208	210	207	225
Syn_23	38	38	42	38	38	38	38	37	38	39
Syn_24	-	-	-	-	-	-	-	-	-	-
Syn_25	-	-	-	-	-	-	-	-	-	-
Syn_26	457	466	469	585	413	467	263	571	571	472
Syn_27	228	221	230	231	222	238	225	228	224	226
Syn_28	-	-	-	-	-	-	-	-	-	-
Syn_29	-	-	-	-	459	-	-	459	459	-
Syn_30	97	97	94	101	99	98	102	92	97	96
SPIN-S	91	95	100	99	97	102	94	96	106	94
SPIN-V	270	277	259	275	275	272	274	281	269	271
GCC	-	-	-	-	-	-	-	-	-	-
Apache	-	-	-	-	-	-	-	-	-	-
Bugzilla	68	61	66	61	63	63	68	66	62	63
banking1_yue	45	45	52	45	45	46	46	47	47	47
banking2_yue	30	30	30	30	30	30	31	30	31	30
commprotocol	41	42	43	43	41	42	43	42	42	42
concurrency	8	8	8	8	8	8	8	8	8	8
healthcare1	98	96	97	96	96	98	98	96	96	100
healthcare2	57	54	54	54	56	55	55	56	56	54
healthcare3	205	179	177	172	170	182	177	182	178	174
healthcare4	317	319	316	313	325	303	324	319	320	316
Insurance	7669	7609	7757	7714	7744	7749	7684	7687	7769	7692
networkMgmt	1121	1142	1144	1100	1100	1170	1126	1100	1131	1133
processorcomm1	120	123	120	123	123	119	125	131	122	120
processorcomm2	143	155	149	161	145	142	150	150	146	159
service	877	879	882	881	902	892	888	883	909	890
storage1	25	25	25	25	25	25	25	25	25	25
storage2	56	54	57	56	57	55	57	55	57	56
storage3	240	248	249	247	247	249	245	245	242	251
storage4	1021	1014	1029	1021	1018	1026	1020	1028	1008	1019
storage5	2355	2382	2361	2360	2375	2390	2387	2379	2397	2336
systemmgmt	48	47	47	50	47	51	48	50	46	45
telecom	120	122	121	120	120	122	121	120	120	120

Table 28 The construction time consumed by CASA for 3-way CCAG (cutoff time=1000s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	879.53	937.18	992.62	968.49	997.37	900.38	925.40	998.79	939.50	905.22
Syn_2	890.59	889.79	950.73	843.32	944.66	891.74	908.93	968.22	978.28	979.83
Syn_3	38.63	29.19	23.51	15.27	45.84	26.89	38.20	43.67	29.72	38.28
Syn_4	795.30	573.90	914.26	562.97	865.76	799.90	821.43	658.67	439.72	765.68
Syn_5	-	-	-	-	-	-	-	-	-	-
Syn_6	991.80	994.41	978.86	957.78	997.78	964.24	940.44	938.67	967.63	972.26
Syn_7	167.17	336.12	83.43	47.17	89.74	316.37	47.16	88.45	156.52	265.96
Syn_8	-	-	-	-	-	-	-	-	-	-
Syn_9	922.15	848.68	746.69	647.79	734.88	918.41	726.32	715.26	724.83	697.74
Syn_10	-	-	-	-	-	-	-	-	-	-
Syn_11	934.74	947.09	993.90	957.54	987.97	963.10	974.34	907.83	980.21	991.65
Syn_12	-	-	-	-	-	-	-	-	-	-
Syn_13	-	-	-	-	-	-	-	-	-	-
Syn_14	750.83	995.02	999.92	960.27	989.34	993.28	715.62	972.89	726.30	998.13
Syn_15	842.37	950.18	816.48	912.88	935.45	812.92	950.90	937.89	951.64	966.02
Syn_16	994.86	932.74	935.05	974.94	961.08	985.59	926.46	931.97	981.82	932.23
Syn_17	-	-	-	-	-	-	-	-	-	-
Syn_18	-	-	-	-	-	-	-	-	-	-
Syn_19	-	-	-	-	-	-	-	-	-	-
Syn_20	-	-	-	-	-	-	-	-	-	-
Syn_21	956.96	828.56	867.20	883.91	887.80	969.18	842.69	822.69	803.78	819.82
Syn_22	982.03	951.19	986.56	947.86	978.17	962.65	965.03	963.36	982.13	879.49
Syn_23	62.42	69.18	25.77	23.88	60.71	72.56	28.30	41.44	23.82	64.53
Syn_24	-	-	-	-	-	-	-	-	-	-
Syn_25	-	-	-	-	-	-	-	-	-	-
Syn_26	911.98	982.04	959.31	919.14	899.34	995.37	956.04	972.53	943.19	983.07
Syn_27	993.39	997.97	991.20	942.41	997.51	938.25	996.70	954.46	997.24	866.57
Syn_28	-	-	-	-	-	-	-	-	-	-
Syn_29	-	-	-	-	996.15	-	-	985.69	961.60	-
Syn_30	862.10	983.23	984.28	971.79	937.17	971.19	846.70	939.62	982.76	981.19
SPIN-S	330.05	90.65	36.55	40.89	93.32	18.19	309.26	88.55	11.37	189.80
SPIN-V	940.01	939.50	921.92	989.57	993.23	966.74	867.88	939.80	923.58	953.63
GCC	-	-	-	-	-	-	-	-	-	-
Apache	-	-	-	-	-	-	-	-	-	-
Bugzilla	174.76	254.31	259.91	751.65	288.13	460.17	250.28	161.81	165.05	201.88
banking1_yue	1.86	0.99	0.22	13.01	1.79	1.74	0.88	0.98	0.76	0.68
banking2_yue	7.77	7.97	9.26	8.04	32.16	7.69	15.62	7.76	7.65	7.79
commprotocol	15.21	3.90	4.00	6.10	5.22	4.14	5.39	3.83	7.22	2.70
concurrency	0.10	0.10	0.20	0.10	0.12	0.10	0.10	0.10	0.10	0.10
healthcare1	3.01	2.90	3.27	5.40	7.01	5.31	2.42	4.91	4.46	5.02
healthcare2	15.00	378.29	199.28	191.36	27.41	93.03	23.65	8.75	24.23	146.31
healthcare3	78.32	717.82	419.10	860.63	969.84	504.42	725.44	558.99	672.80	924.64
healthcare4	945.34	840.73	999.24	942.76	998.99	987.76	869.49	868.26	916.09	885.37
Insurance	943.48	948.36	938.15	963.10	864.69	934.32	919.52	936.58	827.00	995.94
networkMgmt	83.12	27.52	31.92	907.77	985.52	22.42	79.48	866.65	56.50	56.69
processorcomm1	594.05	267.83	436.72	296.68	255.71	455.15	107.43	44.68	555.64	184.24
processorcomm2	393.01	227.01	426.77	145.13	651.69	671.93	312.68	248.03	439.86	136.27
service	975.46	944.81	869.08	991.97	851.32	996.94	996.22	980.41	734.62	999.61
storage1	13.99	14.02	14.16	14.08	14.10	13.90	14.04	13.95	14.02	13.86
storage2	0.82	8.15	0.49	0.49	0.46	1.32	0.44	1.39	0.46	0.53
storage3	14.39	14.98	14.04	18.46	15.60	19.00	16.37	31.29	18.53	13.74
storage4	993.16	993.19	998.29	985.21	996.21	981.29	989.67	959.04	946.03	983.86
storage5	1000.00	981.48	996.77	982.70	951.25	964.96	968.63	993.85	966.74	955.47
systemmgmt	4.30	2.49	8.84	3.03	4.09	5.27	2.56	3.02	13.40	29.46
telecom	7.58	3.14	8.33	7.31	3.04	5.24	3.13	3.86	5.23	24.25

Table 29 The array sizes produced by SPTS for 2-way CCAG (cutoff time=200s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	42	42	42	42	42	43	42	42	43	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	39	39	40	39	38	39	38	38	39	39
Syn_11	38	38	38	38	38	38	38	38	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	38	38	38	38	38	38	38	38
Syn_19	42	43	42	42	42	42	42	42	42	42
Syn_20	49	49	49	48	48	49	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	39	38	39	38	39	38	38	38	39
Syn_25	44	43	43	44	44	44	44	44	44	44
Syn_26	27	27	27	27	26	27	27	27	27	27
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	46	46	46	46	46	45	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	22	22	21	22	22	21	22	22	22	22
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 30 The array sizes produced by SPTS for 2-way CCAG (cutoff time=400s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	42	42	42	42	42	42	42	42	42	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	39	38	38	38	38	39	38
Syn_11	38	37	38	38	38	37	38	38	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	38	38	38	38	38	38	38	38
Syn_19	42	42	43	42	42	42	41	43	42	42
Syn_20	48	48	49	48	49	48	48	49	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	39	38	38	39	39
Syn_25	43	44	44	44	44	43	44	43	44	43
Syn_26	26	27	26	26	27	27	26	27	26	27
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	45	46	45	46	46	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	22	22	21	21	22	21	21	22	22	22
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 31 The array sizes produced by SPTS for 2-way CCAG (cutoff time=600s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	42	42	42	42	42	42	42	42	42	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	39	39	38	38	39	39	39	38
Syn_11	38	37	37	37	38	38	38	37	38	37
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	38	38	38	38	38	38	38	38	38
Syn_19	42	42	42	42	42	42	42	42	42	42
Syn_20	48	48	48	48	48	48	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	44	43	44	44	44	44	44	44	44	44
Syn_26	27	26	27	27	26	27	26	26	27	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	46	45	46	46	46	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	21	21	21	22	21	21	21	22	21	21
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 32 The array sizes produced by SPTS for 2-way CCAG (cutoff time=800s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	42	42	42	42	42	42	42	42	42	42
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	38	37	38	38	38	39	38
Syn_11	38	38	37	38	38	38	37	37	37	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	38	38	38	38	37	38	38	38	38	38
Syn_19	42	42	42	42	42	42	42	42	42	42
Syn_20	48	48	48	48	48	49	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	39	38	38	38	38	38	38
Syn_25	43	44	44	44	43	44	44	44	44	44
Syn_26	26	26	26	26	27	26	27	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	46	46	46	46	46	46	46	46	46	46
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	21	21	21	21	22	21	21	22	21	21
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 33 The array sizes produced by SPTS for 3-way CCAG (cutoff time=200s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	252	249	249	249	248	246	249	249	250	249
Syn_2	133	135	134	135	134	132	132	133	131	134
Syn_3	51	52	51	52	51	51	51	51	52	52
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	338	337	339	336	338	339	338	337	335	336
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	259	261	261	264	262	262	260	262	261	262
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	288	290	287	285	287	287	288	287	288	289
Syn_11	276	274	275	273	277	272	276	275	278	277
Syn_12	217	218	217	218	219	216	217	217	217	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	217	216	218	217	217	216	217	217	219
Syn_18	283	284	285	285	283	284	284	284	283	287
Syn_19	328	324	327	325	328	326	327	325	328	327
Syn_20	418	418	417	415	417	419	419	418	417	421
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	287	289	291	288	288	288	289	289	285	291
Syn_25	358	359	359	357	358	354	360	353	358	354
Syn_26	165	162	164	163	164	166	163	163	162	165
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	375	378	377	376	380	376	379	379	379	377
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	67	67	68	67	66	67	67	67	67	67
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	194	193	194	195	194	193	195	194	194	194
GCC	81	80	80	82	82	81	81	82	81	80
Apache	141	147	142	142	145	146	143	142	145	142
Bugzilla	48	48	48	48	48	49	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	50	50	50	50	50
Healthcare3	152	150	150	151	151	152	151	150	152	152
Healthcare4	245	243	246	244	245	245	241	246	245	244
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	104	105	105	104	104	104	104	104	104	105
Proc.Comm2	129	131	131	131	132	127	132	129	130	130
Service	848	845	837	843	841	848	843	842	846	846
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	227	225	234	226	224	224	230	226	227	232
Storage4	910	910	910	910	912	913	910	910	911	910
Storage5	1723	1726	1717	1735	1729	1722	1723	1723	1720	1727
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 34 The array sizes produced by SPTS for 3-way CCAG (cutoff time=400s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	246	246	245	248	247	248	247	250	248	250
Syn_2	132	131	125	133	128	131	133	133	134	131
Syn_3	51	51	51	51	51	51	52	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	333	335	337	333	334	334	334	334	335	335
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	260	260	259	259	262	259	260	258	259	261
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	284	286	287	282	285	286	283	284	283	284
Syn_11	274	272	273	273	274	274	273	272	272	273
Syn_12	216	217	216	216	217	216	216	216	216	217
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	217	216	216	216	216	216	216
Syn_18	279	282	280	281	283	284	283	282	280	284
Syn_19	320	321	321	322	323	323	322	325	325	323
Syn_20	414	414	415	414	413	417	415	415	417	413
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	289	287	288	285	285	287	285	287	287	285
Syn_25	356	353	354	352	358	354	354	356	352	354
Syn_26	161	162	163	160	161	160	160	163	163	162
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	373	377	374	373	372	372	378	377	373	372
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	66	66	66	65	66	65	66	66	67
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	193	194	194	193	193	194	194	194	193	194
GCC	81	79	80	82	80	79	81	79	80	80
Apache	140	143	142	141	141	140	140	143	141	142
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	49	50	50	50	50	49	49	50	50
Healthcare3	151	151	152	151	149	152	150	151	151	150
Healthcare4	241	244	241	243	245	242	242	245	243	241
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	104	104	104	104	104	104	104	104	104	104
Proc.Comm2	129	128	129	129	130	129	129	129	129	129
Service	831	829	835	835	832	832	830	829	836	829
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	223	227	227	225	223	223	227	224	228	225
Storage4	910	910	910	910	910	910	911	910	910	910
Storage5	1724	1722	1719	1715	1717	1719	1719	1723	1725	1717
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 35 The array sizes produced by SPTS for 3-way CCAG (cutoff time=600s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	247	244	247	247	246	247	248	248	248	246
Syn_2	130	130	133	132	131	131	133	133	132	131
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	335	332	335	334	335	331	334	333	331	332
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	259	259	261	257	260	260	259	258	260	258
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	283	285	284	285	285	283	280	287	285	284
Syn_11	273	271	273	273	272	274	273	270	272	271
Syn_12	216	216	216	216	216	216	216	216	216	217
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	217	216	216	216	216	216	216	216	216	216
Syn_18	281	281	281	281	279	283	282	280	284	279
Syn_19	323	320	319	321	323	319	321	320	324	320
Syn_20	409	415	413	413	412	413	413	415	412	411
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	285	288	288	286	288	289	286	287	289	288
Syn_25	353	352	353	352	352	355	354	353	354	350
Syn_26	162	161	162	163	160	163	164	161	163	164
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	373	374	372	369	370	371	372	374	373	372
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	65	65	66	66	67	66	66	67	66	65
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	194	193	194	192	193	193	194	193	192	193
GCC	79	78	78	79	79	81	77	78	80	77
Apache	139	143	140	140	142	143	137	141	141	140
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	50	50	50	50	50
Healthcare3	151	151	150	150	149	150	151	149	150	150
Healthcare4	244	242	241	243	243	243	246	244	243	243
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	104	103	103	104	104	104	104	104	104	104
Proc.Comm2	126	128	129	127	129	127	129	128	129	130
Service	834	827	824	830	823	829	830	821	828	831
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	224	224	229	225	231	225	224	223	225	224
Storage4	910	910	910	910	910	910	910	910	910	910
Storage5	1716	1720	1716	1717	1716	1716	1714	1719	1720	1718
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 36 The array sizes produced by SPTS for 3-way CCAG (cutoff time=800s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	248	249	246	247	248	247	246	247	248	246
Syn_2	131	133	131	131	132	131	130	129	132	128
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	333	332	331	331	333	332	334	333	334	332
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	258	259	258	260	259	258	260	259	258	258
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	281	281	282	281	280	282	281	282	282	282
Syn_11	269	276	274	275	275	269	271	275	272	274
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	280	282	281	279	281	283	280	280	279	279
Syn_19	323	318	318	320	322	319	319	324	319	320
Syn_20	412	411	411	413	414	411	412	410	413	413
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	284	286	286	285	287	285	284	285	285	286
Syn_25	348	351	352	350	352	352	349	351	348	352
Syn_26	162	160	163	162	163	163	160	162	164	161
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	372	371	373	374	370	371	371	368	373	373
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	65	65	66	64	65	67	66	66	65
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	193	193	192	194	193	194	192	193	193	194
GCC	80	78	80	79	78	79	79	79	77	78
Apache	137	137	137	140	141	139	139	139	140	138
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	50	50	50	50	50
Healthcare3	150	151	150	150	150	151	150	150	151	149
Healthcare4	242	242	242	241	239	241	243	242	241	241
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	104	104	104	105	104	103	104	104	104	104
Proc.Comm2	128	130	129	128	127	130	125	128	127	129
Service	817	825	828	822	817	820	824	824	823	825
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	225	224	224	225	225	222	224	226	225	224
Storage4	910	910	910	910	910	910	910	910	910	910
Storage5	1711	1715	1714	1710	1714	1714	1714	1716	1712	1713
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 37 The array sizes produced by APTS for 2-way CCAG (cutoff time=200s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	41	41	41	41	42	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	38	38	38	38	38	38	38
Syn_11	38	38	37	38	38	37	37	37	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	37	37	37	37	37	37	37
Syn_19	40	40	40	40	40	40	40	40	40	41
Syn_20	48	48	48	47	48	48	48	48	48	48
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	43	43	43	43	43	43	43	43	43	43
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	45	44	45	45	44	45	45	44	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	22	22	21	22	22	22	22	21	21	22
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 38 The array sizes produced by APTS for 2-way CCAG (cutoff time=400s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	41	41	41	41	41	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	38	38	38	38	38	38	38
Syn_11	38	38	38	38	38	38	38	38	38	38
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	37	37	37	37	37	37	37
Syn_19	40	40	39	40	40	40	40	40	39	40
Syn_20	48	48	48	48	48	48	48	48	48	47
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	43	43	43	43	43	42	42	43	43	43
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	45	44	44	44	44	44	44	44	45	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	22	21	21	22	22	21	22	22	22	22
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 39 The array sizes produced by APTS for 2-way CCAG (cutoff time=600s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	41	41	41	41	41	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	37	38	37	37	38	38	38	38	38
Syn_11	38	38	38	37	37	37	38	37	37	37
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	37	37	37	37	37	37	37
Syn_19	40	40	40	40	40	40	40	40	40	40
Syn_20	48	48	48	47	47	48	48	48	47	47
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	43	43	43	42	43	43	42	43	43	43
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	44	44	44	44	44	44	44	44	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	22	21	22	22	21	22	22	22	21	22
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 40 The array sizes produced by APTS for 2-way CCAG (cutoff time=800s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	36	36	36	36	36	36	36	36	36	36
Syn_2	30	30	30	30	30	30	30	30	30	30
Syn_3	18	18	18	18	18	18	18	18	18	18
Syn_4	20	20	20	20	20	20	20	20	20	20
Syn_5	41	41	41	41	41	41	41	41	41	41
Syn_6	24	24	24	24	24	24	24	24	24	24
Syn_7	9	9	9	9	9	9	9	9	9	9
Syn_8	36	36	36	36	36	36	36	36	36	36
Syn_9	20	20	20	20	20	20	20	20	20	20
Syn_10	38	38	38	38	38	38	38	38	37	38
Syn_11	37	38	38	37	37	38	37	37	38	37
Syn_12	36	36	36	36	36	36	36	36	36	36
Syn_13	36	36	36	36	36	36	36	36	36	36
Syn_14	36	36	36	36	36	36	36	36	36	36
Syn_15	30	30	30	30	30	30	30	30	30	30
Syn_16	24	24	24	24	24	24	24	24	24	24
Syn_17	36	36	36	36	36	36	36	36	36	36
Syn_18	37	37	37	37	37	37	37	36	37	37
Syn_19	40	39	39	40	40	40	40	40	40	40
Syn_20	48	47	47	47	47	47	48	48	48	47
Syn_21	36	36	36	36	36	36	36	36	36	36
Syn_22	36	36	36	36	36	36	36	36	36	36
Syn_23	12	12	12	12	12	12	12	12	12	12
Syn_24	38	38	38	38	38	38	38	38	38	38
Syn_25	42	42	43	43	43	43	42	42	43	43
Syn_26	26	26	26	26	26	26	26	26	26	26
Syn_27	36	36	36	36	36	36	36	36	36	36
Syn_28	44	44	44	44	44	44	44	44	44	44
Syn_29	25	25	25	25	25	25	25	25	25	25
Syn_30	16	16	16	16	16	16	16	16	16	16
Spin_S	19	19	19	19	19	19	19	19	19	19
Spin_V	31	31	31	31	31	31	31	31	31	31
GCC	16	16	16	16	16	16	16	16	16	16
Apache	30	30	30	30	30	30	30	30	30	30
Bugzilla	16	16	16	16	16	16	16	16	16	16
Banking1	13	13	13	13	13	13	13	13	13	13
Banking2	10	10	10	10	10	10	10	10	10	10
Commproto.	16	16	16	16	16	16	16	16	16	16
Concurrency	5	5	5	5	5	5	5	5	5	5
Healthcare1	30	30	30	30	30	30	30	30	30	30
Healthcare2	14	14	14	14	14	14	14	14	14	14
Healthcare3	34	34	34	34	34	34	34	34	34	34
Healthcare4	46	46	46	46	46	46	46	46	46	46
Insurance	527	527	527	527	527	527	527	527	527	527
NetworkMg.	110	110	110	110	110	110	110	110	110	110
Proc.Comm1	21	22	21	21	21	22	22	22	21	21
Proc.Comm2	25	25	25	25	25	25	25	25	25	25
Service	100	100	100	100	100	100	100	100	100	100
Storage1	17	17	17	17	17	17	17	17	17	17
Storage2	18	18	18	18	18	18	18	18	18	18
Storage3	50	50	50	50	50	50	50	50	50	50
Storage4	130	130	130	130	130	130	130	130	130	130
Storage5	215	215	215	215	215	215	215	215	215	215
SystemMg.	15	15	15	15	15	15	15	15	15	15
Telecom	30	30	30	30	30	30	30	30	30	30

Table 41 The array sizes produced by APTS for 3-way CCAG (cutoff time=200s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	246	247	250	248	248	247	248	246	247	248
Syn_2	134	134	131	132	134	129	133	132	134	134
Syn_3	52	52	51	52	51	52	52	52	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	334	338	337	336	338	337	338	336	337	338
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	26	25	25	25	26	25	25	25	25	25
Syn_8	258	263	260	260	259	259	257	258	261	258
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	291	284	292	290	288	288	288	287	289	289
Syn_11	273	275	274	274	273	274	275	273	275	275
Syn_12	218	217	219	216	217	217	216	216	216	218
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	218	216	216	217	216	216	216	216	216	216
Syn_18	285	280	283	281	282	285	285	282	282	285
Syn_19	326	326	325	325	324	330	329	326	329	325
Syn_20	420	419	418	419	417	420	421	418	417	418
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	288	289	286	289	288	288	290	288	291	287
Syn_25	358	357	355	354	355	356	356	356	357	355
Syn_26	163	162	163	162	160	163	162	161	163	160
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	377	380	380	380	379	377	376	380	378	377
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	68	66	67	67	67	68	68	66	67
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	194	193	195	193	193	193	193	194	194	193
GCC	79	81	81	81	82	80	80	80	79	81
Apache	144	142	144	147	142	143	144	142	143	142
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	50	49	50	50	50
Healthcare3	152	152	153	154	153	153	153	152	152	151
Healthcare4	244	241	250	248	248	244	247	248	251	247
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	105	106	105	103	105	105	105	105	104	103
Proc.Comm2	130	131	131	128	132	128	131	131	131	127
Service	849	845	841	838	835	845	840	844	840	846
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	227	225	227	227	224	224	227	224	225	226
Storage4	910	911	910	910	911	910	910	910	910	910
Storage5	1725	1730	1730	1724	1725	1723	1724	1728	1718	1725
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 42 The array sizes produced by APTS for 3-way CCAG (cutoff time=400s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	244	246	244	243	245	247	245	244	245	246
Syn_2	129	130	130	132	130	133	131	127	131	132
Syn_3	51	51	51	51	51	52	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	333	332	333	335	333	337	334	333	333	335
Syn_6	96	96	96	96	96	96	96	96	96	96
Syn_7	25	25	26	26	25	25	25	25	25	25
Syn_8	257	258	258	258	255	257	257	256	257	256
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	282	284	285	286	284	285	287	283	283	282
Syn_11	271	272	272	274	273	271	270	272	273	272
Syn_12	216	216	216	216	216	217	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	281	280	279	280	280	280	281	281	279	283
Syn_19	325	323	321	323	321	325	326	321	323	327
Syn_20	417	417	414	413	411	415	415	414	416	413
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	284	286	284	287	285	286	284	284	286	286
Syn_25	353	354	353	355	352	353	353	353	353	353
Syn_26	162	161	161	160	162	162	160	159	159	161
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	374	374	376	375	376	377	374	375	371	372
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	65	67	67	66	65	67	67	66	67	66
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	194	194	193	193	194	194	193	193	194	193
GCC	80	80	79	81	80	81	78	80	79	81
Apache	140	140	144	141	144	142	142	140	140	141
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	50	50	50	50	50
Healthcare3	151	151	152	151	153	152	151	153	151	153
Healthcare4	242	244	244	247	244	246	248	250	245	249
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	105	105	105	105	105	105	106	104	105	103
Proc.Comm2	128	125	130	129	130	129	129	130	128	128
Service	828	830	835	830	828	827	831	836	829	836
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	224	225	224	225	224	224	224	226	226	228
Storage4	910	910	910	910	910	910	910	910	910	910
Storage5	1717	1725	1717	1722	1719	1714	1719	1719	1721	1717
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 43 The array sizes produced by APTS for 3-way CCAG (cutoff time=600s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	244	243	244	245	244	243	245	244	245	245
Syn_2	131	128	131	131	131	132	130	130	129	133
Syn_3	51	51	51	51	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	334	329	333	334	333	333	337	332	333	333
Syn_6	97	96	96	96	96	96	96	96	96	96
Syn_7	25	26	25	25	25	25	25	26	25	25
Syn_8	256	253	253	256	254	256	258	255	254	254
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	284	283	282	281	282	282	283	281	281	282
Syn_11	271	272	270	269	268	272	269	268	271	272
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	217	216	216	216	216
Syn_18	279	279	279	279	279	279	278	279	279	278
Syn_19	322	321	321	318	321	325	319	318	319	321
Syn_20	416	416	412	415	414	413	413	410	412	412
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	284	283	284	285	286	283	285	285	282	284
Syn_25	349	353	349	352	352	348	351	351	350	352
Syn_26	160	161	159	158	159	160	159	157	160	162
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	373	370	370	373	372	373	373	372	372	370
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	67	66	66	65	66	67	66	66	65	66
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	194	193	193	193	194	193	194	193	193	193
GCC	78	78	79	80	77	80	79	81	78	79
Apache	140	141	138	142	139	141	139	139	141	143
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	49	50	50	50	50	49	50	50
Healthcare3	150	151	152	153	153	151	152	154	153	153
Healthcare4	245	246	243	241	244	242	239	242	242	241
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	105	105	105	105	105	105	105	106	104	105
Proc.Comm2	126	129	127	129	125	129	130	126	129	129
Service	824	823	825	819	822	826	823	814	819	824
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	231	224	223	224	224	226	224	225	225	225
Storage4	910	910	910	910	910	910	910	910	910	910
Storage5	1717	1716	1718	1714	1712	1717	1710	1721	1718	1718
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 44 The array sizes produced by APTS for 3-way CCAG (cutoff time=800s)

Benchmark	1	2	3	4	5	6	7	8	9	10
Syn_1	241	244	244	245	243	243	243	245	241	245
Syn_2	131	129	128	131	130	125	131	131	127	127
Syn_3	51	51	51	52	51	51	51	51	51	51
Syn_4	80	80	80	80	80	80	80	80	80	80
Syn_5	330	332	329	330	331	332	331	333	331	331
Syn_6	97	96	96	96	96	96	96	96	96	96
Syn_7	25	25	25	25	25	25	25	25	25	25
Syn_8	253	254	253	256	253	254	255	254	256	253
Syn_9	60	60	60	60	60	60	60	60	60	60
Syn_10	280	280	281	283	280	279	279	282	283	282
Syn_11	271	271	271	271	272	268	271	270	270	273
Syn_12	216	216	216	216	216	216	216	216	216	216
Syn_13	180	180	180	180	180	180	180	180	180	180
Syn_14	216	216	216	216	216	216	216	216	216	216
Syn_15	150	150	150	150	150	150	150	150	150	150
Syn_16	96	96	96	96	96	96	96	96	96	96
Syn_17	216	216	216	216	216	216	216	216	216	216
Syn_18	277	276	277	279	275	278	277	278	276	277
Syn_19	317	318	318	321	319	317	317	318	319	317
Syn_20	412	414	413	412	412	412	411	413	410	413
Syn_21	216	216	216	216	216	216	216	216	216	216
Syn_22	144	144	144	144	144	144	144	144	144	144
Syn_23	36	36	36	36	36	36	36	36	36	36
Syn_24	283	282	283	284	284	284	282	283	283	285
Syn_25	346	351	347	349	349	350	348	349	347	349
Syn_26	159	160	159	157	159	160	160	160	159	157
Syn_27	180	180	180	180	180	180	180	180	180	180
Syn_28	371	372	372	372	371	370	369	370	374	372
Syn_29	125	125	125	125	125	125	125	125	125	125
Syn_30	66	67	66	66	64	66	65	66	66	65
Spin_S	80	80	80	80	80	80	80	80	80	80
Spin_V	193	192	194	193	193	193	194	194	193	194
GCC	79	78	80	80	79	79	80	79	79	80
Apache	139	141	140	139	140	140	139	139	140	142
Bugzilla	48	48	48	48	48	48	48	48	48	48
Banking1	45	45	45	45	45	45	45	45	45	45
Banking2	30	30	30	30	30	30	30	30	30	30
Commproto.	41	41	41	41	41	41	41	41	41	41
Concurrency	8	8	8	8	8	8	8	8	8	8
Healthcare1	96	96	96	96	96	96	96	96	96	96
Healthcare2	50	50	50	50	50	49	49	50	50	50
Healthcare3	152	153	153	154	150	153	152	152	151	152
Healthcare4	240	245	241	243	244	246	246	243	244	241
Insurance	6851	6851	6851	6851	6851	6851	6851	6851	6851	6851
NetworkMg.	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Proc.Comm1	105	105	105	104	105	105	106	104	105	105
Proc.Comm2	129	131	127	128	126	127	127	126	129	127
Service	821	820	818	821	816	815	820	820	816	820
Storage1	25	25	25	25	25	25	25	25	25	25
Storage2	54	54	54	54	54	54	54	54	54	54
Storage3	223	226	226	226	224	224	225	226	226	227
Storage4	910	910	910	910	910	910	910	910	910	910
Storage5	1713	1715	1711	1711	1716	1712	1713	1717	1713	1714
SystemMg.	45	45	45	45	45	45	45	45	45	45
Telecom	120	120	120	120	120	120	120	120	120	120

Table 45 The construction time consumed by APTS for 2-way CCAG (iterative number=100,000)

Benchmark	size	1	2	3	4	5	6	7	8	9	10
Syn_1	34	6.17	6.30	4.66	4.74	4.68	5.96	4.74	4.70	4.67	4.70
Syn_2	28	4.16	3.72	3.71	3.71	3.75	3.89	3.75	3.77	3.77	3.56
Syn_3	17	3.54	1.83	1.89	1.84	1.84	1.88	1.86	1.85	1.86	1.92
Syn_4	19	4.88	2.97	2.97	3.00	3.03	3.05	3.14	3.06	3.06	3.12
Syn_5	38	7.26	7.25	7.23	7.21	7.21	7.31	7.29	7.26	7.30	7.26
Syn_6	22	3.28	3.22	3.25	3.23	3.21	3.29	3.27	3.33	3.29	3.25
Syn_7	8	2.12	2.11	2.09	2.10	2.12	2.12	2.12	2.12	2.11	2.12
Syn_8	34	5.24	5.27	5.27	5.13	5.14	5.24	5.20	5.15	5.25	5.27
Syn_9	19	2.60	2.57	2.67	2.57	2.60	2.67	2.67	2.63	2.64	2.61
Syn_10	35	6.55	6.55	6.44	6.38	6.51	6.55	6.60	6.58	6.47	6.59
Syn_11	35	5.20	5.08	5.08	5.13	5.02	5.18	5.17	5.15	5.06	5.16
Syn_12	34	5.62	5.74	5.77	5.59	5.69	5.67	5.61	5.66	5.72	5.62
Syn_13	34	4.49	4.45	4.43	4.47	4.43	4.47	4.55	4.50	4.49	4.54
Syn_14	34	3.97	3.93	3.94	3.95	3.90	3.97	3.94	3.95	3.94	3.97
Syn_15	28	3.09	3.10	3.12	3.09	3.08	3.12	3.16	3.11	3.12	3.13
Syn_16	22	3.51	3.55	3.38	3.42	3.45	3.65	3.58	3.63	3.54	3.61
Syn_17	34	5.29	5.25	5.30	5.33	5.17	5.28	5.31	5.24	5.23	5.25
Syn_18	35	6.03	5.96	5.99	6.07	6.01	6.03	6.01	6.01	5.95	6.12
Syn_19	37	8.27	8.33	8.22	8.33	8.19	8.18	8.31	8.40	8.35	8.34
Syn_20	44	7.21	7.14	7.12	7.16	7.19	7.20	7.13	7.23	7.20	7.24
Syn_21	34	3.61	3.62	3.60	3.56	3.60	3.63	3.63	3.64	3.61	3.64
Syn_22	34	2.92	2.99	2.96	2.91	2.90	2.98	2.97	2.94	2.96	2.98
Syn_23	11	1.96	1.97	1.97	1.96	1.97	2.01	2.04	1.99	1.99	2.01
Syn_24	36	5.33	5.22	5.25	5.23	5.20	5.34	5.30	5.32	5.31	5.32
Syn_25	39	6.36	6.34	6.38	6.30	6.37	6.38	6.39	6.44	6.42	6.37
Syn_26	24	4.47	4.46	4.45	4.51	4.39	4.54	4.53	4.48	4.53	4.47
Syn_27	34	3.01	2.95	3.00	3.00	2.96	3.02	3.04	3.03	3.01	3.02
Syn_28	41	7.93	7.85	7.88	7.91	7.85	7.91	8.04	7.94	7.96	7.83
Syn_29	23	5.96	6.07	6.05	5.99	6.02	6.06	6.08	6.11	6.08	6.16
Syn_30	15	3.79	3.77	3.82	3.77	3.79	3.84	3.84	3.81	3.78	3.84
Spin_S	18	1.86	1.87	1.88	1.88	1.90	1.88	1.90	1.89	1.90	1.90
Spin_V	29	3.48	3.49	3.47	3.43	3.45	3.48	3.45	3.45	3.48	3.49
GCC	15	6.17	6.16	6.13	6.23	6.21	6.08	6.20	6.13	6.27	6.09
Apache	28	6.20	6.08	6.26	6.02	6.02	6.27	6.15	5.98	6.28	6.20
Bugzilla	15	2.87	2.86	2.83	2.82	2.86	2.92	2.93	2.90	2.93	2.89
Banking1	12	1.98	1.96	1.98	1.96	1.96	1.97	1.95	1.94	1.98	1.96
Banking2	9	1.68	1.68	1.67	1.67	1.67	1.72	1.72	1.71	1.73	1.71
Commproto.	15	1.65	1.68	1.64	1.67	1.64	1.67	1.67	1.67	1.67	1.67
Concurrency	4	1.43	1.10	1.09	1.10	1.09	1.15	1.10	1.10	1.10	1.10
Healthcare1	28	1.70	1.62	1.61	1.60	1.61	1.68	1.63	1.65	1.64	1.62
Healthcare2	13	1.97	2.01	1.99	1.98	1.99	2.03	2.05	2.02	2.02	2.01
Healthcare3	32	2.47	2.40	2.43	2.49	2.53	2.36	2.68	2.56	2.55	2.43
Healthcare4	43	2.93	2.90	2.89	2.55	2.90	2.95	2.94	2.94	2.95	2.98
Insurance	500	8.69	8.83	8.83	8.86	8.86	8.87	8.94	8.89	8.90	8.93
NetworkMg.	104	3.40	3.40	3.40	3.41	3.41	3.44	3.46	3.47	3.46	3.46
Proc.Comm1	19	2.20	2.21	2.21	2.23	2.21	2.23	2.22	2.23	2.22	2.23
Proc.Comm2	23	2.52	2.67	2.67	2.73	2.48	2.85	2.78	2.83	2.90	2.85
Service	95	4.81	4.93	4.83	4.83	4.83	4.89	4.90	4.86	4.83	4.88
Storage1	16	1.30	1.30	1.33	1.31	1.31	1.34	1.34	1.34	1.34	1.34
Storage2	17	1.41	1.42	1.42	1.42	1.43	1.47	1.45	1.45	1.47	1.46
Storage3	47	2.37	2.37	2.39	2.41	2.39	2.41	2.37	2.42	2.41	2.42
Storage4	123	3.72	3.81	3.77	3.77	3.80	3.84	3.83	3.82	3.83	3.82
Storage5	204	5.49	5.59	5.60	5.59	5.59	5.63	5.68	5.72	5.62	5.66
SystemMg.	14	1.55	1.54	1.53	1.53	1.53	1.57	1.58	1.57	1.56	1.55
Telecom	28	1.70	1.71	1.71	1.71	1.71	1.75	1.74	1.74	1.76	1.74

Table 46 The construction time consumed by APTS for 3-way CCAG (iterative number=100,000)

Benchmark	size	1	2	3	4	5	6	7	8	9	10
Syn_1	228	101.19	99.44	100.93	99.78	104.66	106.20	106.91	104.91	107.13	102.86
Syn_2	117	97.58	95.16	93.98	95.08	101.53	102.09	101.76	101.38	100.49	100.33
Syn_3	48	15.52	15.54	15.65	15.36	15.63	15.38	15.66	15.55	15.77	15.87
Syn_4	76	46.00	45.26	44.99	44.53	44.88	46.22	45.96	46.95	46.66	45.88
Syn_5	310	258.02	245.43	235.41	233.11	235.39	276.19	251.31	261.54	274.24	255.28
Syn_6	91	59.01	58.15	58.31	57.32	57.92	58.60	60.37	58.07	60.12	58.88
Syn_7	23	15.68	15.85	15.61	15.75	15.73	15.70	16.22	15.92	15.88	15.77
Syn_8	239	124.54	128.14	122.73	119.82	122.03	132.56	137.56	143.05	128.17	136.59
Syn_9	57	40.23	41.02	38.20	38.31	48.04	49.62	41.54	42.21	39.83	39.74
Syn_10	264	229.64	227.57	235.47	225.15	207.87	253.60	249.10	244.80	252.66	249.27
Syn_11	253	112.15	107.78	108.14	110.81	109.13	112.07	112.27	113.14	112.22	115.93
Syn_12	205	183.15	185.69	184.08	193.65	178.10	209.90	193.05	207.35	205.61	206.11
Syn_13	171	103.84	107.93	108.23	104.20	109.92	110.10	115.23	114.46	112.05	112.80
Syn_14	205	63.11	63.71	64.12	62.63	66.52	65.52	64.75	63.13	65.29	65.56
Syn_15	142	40.09	38.85	40.85	39.26	39.15	39.34	40.10	41.46	40.94	40.58
Syn_16	91	73.49	73.24	73.42	72.90	72.15	75.65	78.27	76.50	75.12	73.46
Syn_17	205	144.30	149.22	146.04	147.32	146.83	158.07	157.31	159.15	157.59	148.24
Syn_18	260	160.92	154.58	161.91	161.92	159.36	164.81	163.57	163.76	160.58	166.31
Syn_19	300	379.66	382.67	364.91	383.66	384.39	405.88	414.75	415.52	403.39	413.22
Syn_20	385	281.42	286.03	282.10	288.91	268.69	292.51	297.19	306.85	326.86	300.70
Syn_21	205	48.23	49.25	47.86	49.88	48.19	53.23	50.15	50.94	50.52	49.10
Syn_22	136	48.37	49.49	49.05	50.54	48.82	50.84	50.65	50.02	50.78	50.07
Syn_23	34	15.45	15.47	15.58	15.23	15.56	15.81	15.69	15.54	15.63	15.64
Syn_24	266	128.02	129.85	133.71	131.54	134.62	138.31	138.88	143.43	139.31	143.97
Syn_25	329	185.80	192.03	191.44	192.18	183.88	193.46	221.43	204.34	214.39	207.87
Syn_26	150	84.83	81.78	85.50	85.66	84.92	89.14	86.86	87.73	87.92	82.95
Syn_27	171	44.19	44.27	44.82	43.92	44.28	44.49	44.57	46.23	44.94	43.72
Syn_28	348	317.12	323.45	312.47	315.56	323.29	344.02	326.36	362.85	351.22	339.46
Syn_29	118	154.69	150.25	148.58	152.22	150.42	167.14	161.12	153.53	156.98	148.80
Syn_30	61	71.71	72.80	72.76	69.01	72.56	72.74	69.87	68.00	68.80	70.53
Spin_S	76	12.01	11.91	12.04	11.98	11.85	12.05	11.91	12.12	11.72	11.75
Spin_V	183	37.92	38.03	38.22	37.98	37.81	39.38	38.65	38.35	38.30	38.20
GCC	73	215.55	219.99	221.16	216.89	213.06	243.49	223.67	223.39	213.82	221.25
Apache	129	256.23	246.38	264.08	255.29	245.58	242.93	244.50	240.29	254.41	252.15
Bugzilla	45	49.71	53.56	48.41	52.88	50.24	51.29	48.18	49.05	50.52	50.67
Banking1	42	4.75	4.73	4.75	4.75	4.74	4.78	4.67	4.67	4.71	4.71
Banking2	28	6.92	6.99	6.94	6.82	6.87	7.12	6.88	6.92	6.94	6.95
Commproto.	38	4.04	4.01	4.01	4.01	3.98	4.10	3.94	3.98	3.99	3.98
Concurrency	7	1.45	1.40	1.40	1.40	1.39	1.53	1.41	1.42	1.43	1.42
Healthcare1	91	6.86	6.79	6.95	6.75	6.86	7.05	6.81	6.72	7.20	6.69
Healthcare2	46	11.35	11.32	11.37	11.32	11.29	11.43	11.30	11.44	11.31	11.34
Healthcare3	142	43.17	41.12	42.58	41.60	41.78	42.18	41.86	42.69	42.05	42.76
Healthcare4	227	84.49	79.51	76.71	81.41	81.81	79.17	78.65	76.69	83.22	75.37
Insurance	6508	240.36	239.97	237.04	238.49	241.04	233.09	240.99	239.58	241.15	237.47
NetworkMg.	1045	37.12	37.14	36.45	36.49	36.63	36.52	36.66	36.38	36.87	36.97
Proc.Comm1	98	16.63	16.67	16.65	16.66	16.61	16.75	16.60	16.76	16.72	16.79
Proc.Comm2	119	29.95	33.56	32.89	30.13	29.34	32.07	33.72	33.34	33.24	33.18
Service	771	64.15	63.87	63.66	63.72	64.06	63.22	64.16	63.31	64.09	63.44
Storage1	23	1.73	1.74	1.76	1.73	1.73	1.74	1.73	1.72	1.75	1.74
Storage2	51	4.74	4.75	4.73	4.72	4.73	4.76	4.71	4.71	4.72	4.74
Storage3	211	10.56	10.65	10.83	10.76	10.73	10.71	10.73	10.15	10.66	10.67
Storage4	864	67.86	68.35	66.92	67.91	67.67	67.09	67.24	67.26	68.35	67.59
Storage5	1624	95.32	95.40	94.50	96.76	96.03	94.23	97.53	95.93	95.71	95.07
SystemMg.	42	6.72	6.69	6.74	6.60	6.56	6.77	6.72	6.58	6.57	6.72
Telecom	114	7.15	7.41	7.34	7.34	7.26	7.35	7.30	7.28	7.33	7.19

Table 47 The construction time consumed by APPTS for 2-way CCAG (iterative number=100,000)

Benchmark	size	1	2	3	4	5	6	7	8	9	10
Syn_1	34	5.93	5.78	5.49	5.57	5.62	5.50	5.55	5.79	5.48	5.51
Syn_2	28	6.11	5.40	5.07	5.18	5.07	5.22	5.22	5.11	5.10	5.12
Syn_3	17	4.77	3.99	4.01	3.95	3.92	4.23	4.16	4.20	4.10	4.18
Syn_4	19	5.17	4.62	4.73	4.96	4.76	4.95	4.82	4.83	4.91	4.74
Syn_5	38	7.57	7.74	7.52	7.45	7.62	7.59	7.45	7.59	7.61	7.66
Syn_6	22	5.13	4.80	4.91	4.80	4.87	4.93	4.81	4.82	4.98	4.87
Syn_7	8	4.33	4.31	4.59	4.38	4.24	4.56	4.36	4.17	4.59	4.18
Syn_8	34	6.20	6.14	6.08	5.98	5.84	5.95	6.04	6.21	6.21	5.89
Syn_9	19	4.56	4.88	4.70	4.67	5.01	4.75	4.81	4.53	4.55	4.96
Syn_10	35	7.30	7.23	7.02	7.07	7.01	7.12	7.37	7.15	7.06	7.00
Syn_11	35	6.34	6.09	5.99	6.05	5.81	6.05	6.17	5.90	6.01	6.00
Syn_12	34	6.19	6.18	6.32	6.27	6.24	6.37	6.15	6.00	6.24	6.13
Syn_13	34	5.67	5.74	5.57	5.45	5.69	5.54	5.74	5.58	5.60	5.66
Syn_14	34	5.13	5.24	5.31	5.09	5.23	5.24	5.20	5.25	5.16	5.29
Syn_15	28	4.72	4.84	4.65	4.75	4.72	4.77	4.63	4.56	4.70	4.73
Syn_16	22	5.27	5.18	4.88	5.24	5.14	5.19	5.07	5.02	5.09	5.14
Syn_17	34	6.15	6.03	5.95	6.12	5.82	5.79	6.14	5.92	5.91	5.85
Syn_18	35	6.85	6.54	6.44	6.56	6.56	6.43	6.69	6.41	6.33	6.65
Syn_19	37	8.38	8.40	8.22	8.27	8.16	8.33	8.50	8.49	8.30	8.33
Syn_20	44	7.55	7.59	7.42	8.02	7.55	7.86	7.63	7.77	7.81	7.67
Syn_21	34	5.12	5.05	5.09	5.18	5.13	5.27	4.83	5.12	4.81	4.92
Syn_22	34	4.83	4.76	4.70	4.81	4.78	4.81	4.84	4.73	4.85	4.77
Syn_23	11	4.18	4.23	3.87	3.96	4.02	4.14	4.09	3.85	4.19	4.20
Syn_24	36	6.13	6.16	5.92	6.04	5.97	5.94	6.07	5.92	5.80	6.15
Syn_25	39	7.11	7.18	6.97	7.33	7.08	7.31	7.22	7.06	7.01	7.26
Syn_26	24	6.22	6.02	6.22	6.14	6.05	6.34	6.22	6.31	6.18	6.18
Syn_27	34	4.89	4.90	4.54	4.75	4.61	4.83	4.68	4.70	4.68	4.91
Syn_28	41	7.98	7.82	7.80	7.76	7.79	7.81	7.85	7.72	7.81	7.67
Syn_29	23	6.85	6.85	6.80	6.82	6.80	6.85	6.95	6.81	6.81	6.78
Syn_30	15	5.62	5.75	5.55	5.44	5.68	5.48	5.62	5.42	5.37	5.50
Spin_S	18	4.49	4.36	4.26	4.33	4.32	4.28	4.19	4.29	4.19	4.30
Spin_V	29	5.38	5.46	4.95	5.42	5.35	5.45	5.34	5.51	5.35	5.43
GCC	15	7.19	7.02	7.19	7.33	7.02	7.02	7.08	7.07	7.13	7.08
Apache	28	6.77	6.80	6.81	6.76	6.49	6.74	6.78	6.56	6.88	6.62
Bugzilla	15	4.88	4.82	5.07	4.83	4.87	4.85	4.92	4.80	4.87	4.91
Banking1	12	3.85	3.91	4.11	4.05	3.87	4.05	4.08	4.05	4.05	3.98
Banking2	9	4.21	4.21	4.05	4.01	4.13	4.08	4.03	4.24	4.19	4.33
Commproto.	15	3.82	3.73	3.84	3.90	3.95	3.62	3.85	3.82	3.70	3.97
Concurrency	4	2.42	2.44	2.11	2.40	2.39	2.08	1.77	2.10	2.08	2.44
Healthcare1	28	4.08	4.23	4.24	4.17	4.25	4.22	4.21	4.19	4.05	4.28
Healthcare2	13	4.40	4.02	3.94	4.23	3.98	4.02	3.83	3.82	4.20	4.00
Healthcare3	32	4.24	4.32	4.35	4.27	4.31	4.36	4.15	4.39	4.17	4.20
Healthcare4	43	4.29	4.29	4.42	4.19	4.34	4.44	4.41	4.39	4.56	4.52
Insurance	500	7.40	7.29	7.23	7.25	7.48	7.41	7.53	7.06	7.28	7.41
NetworkMg.	104	4.56	4.64	4.53	4.64	4.63	4.45	4.59	4.40	4.56	4.71
Proc.Comm1	19	4.59	4.50	4.35	4.34	4.26	4.49	4.44	4.35	4.43	4.40
Proc.Comm2	23	4.46	4.44	4.49	4.68	4.56	4.58	4.53	4.50	4.57	4.81
Service	95	5.03	5.06	4.95	4.84	4.92	4.99	4.96	5.02	4.98	5.13
Storage1	16	4.08	4.08	4.11	4.09	4.17	4.08	4.12	4.09	4.14	4.15
Storage2	17	3.90	3.75	3.79	4.03	3.78	3.92	3.91	4.03	3.88	3.88
Storage3	47	4.52	4.32	4.46	4.40	4.46	4.17	4.38	4.33	4.37	4.38
Storage4	123	4.77	4.69	4.65	4.82	4.77	4.71	4.64	4.57	4.68	4.72
Storage5	204	5.71	5.50	5.66	5.62	5.69	5.70	5.64	5.53	5.50	5.63
SystemMg.	14	4.01	4.00	4.07	3.98	3.94	3.89	4.02	3.97	3.91	3.94
Telecom	28	4.40	3.90	4.12	3.93	3.85	4.06	3.99	3.78	4.01	4.18

Table 48 The construction time consumed by APPTS for 3-way CCAG (iterative number=100,000)

Benchmark	size	1	2	3	4	5	6	7	8	9	10
Syn_1	228	42.10	42.84	42.06	41.68	41.64	41.81	41.54	41.86	41.97	41.69
Syn_2	117	42.62	42.50	41.80	42.15	42.94	42.53	42.33	42.47	41.95	42.09
Syn_3	48	10.10	10.30	10.31	9.86	10.23	9.69	9.92	9.98	10.05	10.06
Syn_4	76	20.33	20.46	20.10	20.06	20.18	20.33	20.29	20.54	20.43	20.66
Syn_5	310	131.20	128.08	129.99	126.06	128.50	127.45	127.97	135.97	126.06	132.81
Syn_6	91	27.41	27.28	27.39	27.24	27.32	27.03	27.70	26.78	27.75	27.25
Syn_7	23	11.27	11.69	11.70	11.67	11.89	11.83	11.61	12.01	12.14	11.35
Syn_8	239	59.10	57.04	56.60	57.34	56.67	57.29	56.65	58.08	56.97	58.52
Syn_9	57	18.52	19.02	18.24	18.49	21.43	21.37	18.97	19.02	18.31	18.32
Syn_10	264	115.78	113.57	115.64	115.25	111.13	113.73	115.62	117.40	120.01	112.38
Syn_11	253	43.42	42.73	42.36	42.79	42.55	42.50	43.09	43.02	42.69	43.26
Syn_12	205	98.87	95.88	92.90	95.16	93.16	95.98	93.99	100.90	94.72	98.49
Syn_13	171	55.39	53.95	54.12	53.67	54.50	54.37	54.05	56.04	54.70	54.83
Syn_14	205	31.16	30.14	30.24	30.11	30.90	30.77	30.35	29.48	30.75	30.91
Syn_15	142	18.35	17.96	19.16	18.37	18.07	18.47	18.08	19.00	18.40	18.21
Syn_16	91	33.47	33.52	33.62	33.83	33.48	34.20	33.21	33.84	33.33	32.98
Syn_17	205	75.71	72.42	71.85	69.79	71.59	71.63	72.23	74.87	73.21	71.19
Syn_18	260	74.57	69.60	69.67	69.68	69.33	69.81	69.16	70.30	71.84	73.65
Syn_19	300	225.71	213.56	217.77	214.17	215.40	212.83	215.69	226.51	219.58	226.86
Syn_20	385	145.72	140.28	139.87	142.56	136.90	143.18	143.62	155.53	152.33	150.44
Syn_21	205	26.86	26.35	26.38	26.50	26.53	26.37	26.51	26.65	26.43	26.21
Syn_22	136	24.84	25.12	24.98	25.05	24.92	25.13	25.47	25.03	24.96	24.68
Syn_23	34	9.72	9.74	9.97	9.52	9.57	9.80	9.47	9.48	9.73	9.71
Syn_24	266	59.68	58.65	59.83	59.21	59.78	59.10	58.63	60.35	61.83	61.99
Syn_25	329	88.27	88.17	85.86	87.24	85.95	86.33	86.45	89.21	87.59	90.64
Syn_26	150	38.73	37.11	37.73	37.54	37.29	37.91	37.21	37.94	37.57	37.77
Syn_27	171	20.88	20.68	20.79	20.56	20.55	20.51	20.73	20.88	20.76	20.58
Syn_28	348	201.00	183.11	180.98	185.70	186.20	183.66	182.21	194.83	198.25	191.80
Syn_29	118	78.46	72.85	72.84	75.00	73.66	72.71	74.19	77.04	75.27	75.58
Syn_30	61	33.11	32.66	32.73	31.84	32.99	31.80	31.57	31.61	31.42	32.83
Spin_S	76	8.18	8.03	7.72	7.99	8.26	7.85	7.90	7.94	7.81	8.01
Spin_V	183	29.13	28.57	28.35	28.53	28.71	28.91	28.96	29.01	28.97	29.02
GCC	73	218.93	204.46	207.73	207.48	207.83	210.59	208.05	215.66	221.68	221.30
Apache	129	116.60	110.53	115.70	114.26	112.22	112.41	110.74	114.52	108.73	114.01
Bugzilla	45	21.84	21.85	22.08	21.73	21.95	21.71	21.20	21.68	21.66	22.10
Banking1	42	5.11	5.06	5.14	5.10	4.91	5.03	4.97	5.13	5.02	5.01
Banking2	28	6.56	6.45	6.46	6.46	6.44	6.46	6.48	6.54	6.55	6.63
Commproto.	38	4.79	4.85	4.70	4.91	4.96	4.79	4.78	4.85	4.94	4.81
Concurrency	7	3.11	3.01	3.18	2.43	2.93	2.88	2.89	3.20	2.93	2.78
Healthcare1	91	5.74	5.65	5.71	5.73	5.69	5.62	5.67	5.71	5.69	5.64
Healthcare2	46	8.38	8.04	8.46	8.14	7.83	8.38	8.26	8.34	8.09	7.72
Healthcare3	142	16.09	15.49	16.37	15.56	15.67	16.26	16.14	16.01	15.62	15.79
Healthcare4	227	23.58	22.98	23.30	23.15	22.65	23.42	22.99	22.45	23.15	22.66
Insurance	6508	61.56	60.07	60.57	60.59	60.46	60.02	59.77	59.65	59.07	60.03
NetworkMg.	1045	13.43	12.90	14.01	13.44	13.31	13.02	13.25	13.72	12.48	12.87
Proc.Comm1	98	12.33	12.45	12.16	11.99	12.23	12.31	11.91	12.31	11.82	12.24
Proc.Comm2	119	14.61	14.58	14.65	15.27	14.84	15.34	14.51	14.76	15.70	15.01
Service	771	20.88	20.45	20.87	19.82	21.24	20.37	20.72	20.02	20.65	19.96
Storage1	23	4.09	4.20	4.23	4.17	4.13	4.08	4.12	3.91	4.27	3.98
Storage2	51	5.07	4.87	5.05	4.95	4.94	4.84	5.05	4.99	4.91	4.99
Storage3	211	8.19	8.24	8.70	8.09	8.59	8.34	8.40	7.98	8.46	8.32
Storage4	864	18.96	18.65	18.12	18.24	18.27	18.21	18.36	18.05	18.77	18.39
Storage5	1624	26.34	26.00	26.22	26.27	25.82	25.63	25.78	26.27	26.46	26.15
SystemMg.	42	5.95	5.96	6.04	5.92	5.87	6.02	5.94	5.99	6.05	6.04
Telecom	114	5.96	6.05	5.99	6.09	6.02	6.06	6.04	5.99	6.11	5.99