

TABLE I
COMPARING *AutoCCAG* WITH *TCA-opt*, *TCA*, *CASA*, *HHSA* AND *CHiP* FOR 2-WAY CCAG ON THE REAL-WORLD AND IBM BENCHMARKS. THE RUN TIME IS MEASURED IN SECOND.

Instance	<i>AutoCCAG</i>		<i>TCA-opt</i>		<i>TCA</i>		<i>CASA</i>		<i>HHSA</i>		<i>CHiP</i>	
	min (avg)	time	min (avg)	time	min (avg)	time	min (avg)	time	min (avg)	time	size	time
Apache	30 (30.0)	<1	30 (30.0)	1	30 (30.0)	2	33 (35.3)	3	31 (31.9)	52	31	957
Bugzilla	16 (16.0)	<1	16 (16.0)	<1	16 (16.0)	<1	16 (16.4)	<1	16 (16.2)	3	16	147
GCC	16 (16.0)	33	16 (16.0)	343	16 (16.1)	373	19 (21.7)	36	19 (19.8)	36	17	471
SPIN-S	19 (19.0)	<1	19 (19.0)	1	19 (19.0)	<1	19 (19.7)	<1	19 (19.2)	2	19	35
SPIN-V	31 (31.0)	108	32 (32.0)	369	32 (32.1)	366	36 (39.9)	3	31 (32.3)	14	32	334
Banking1	13 (13.0)	<1	13 (13.0)	<1	13 (13.0)	<1	13 (13.0)	<1	13 (13.0)	<1	13	35
Banking2	10 (10.0)	<1	10 (10.0)	<1	10 (10.0)	<1	10 (10.1)	<1	10 (10.0)	<1	10	19
CommProtocol	16 (16.0)	<1	16 (16.0)	<1	16 (16.0)	<1	16 (16.0)	<1	16 (16.0)	7	16	292
Concurrency	5 (5.0)	<1	5 (5.0)	<1	5 (5.0)	<1	5 (5.0)	<1	5 (5.0)	<1	5	11
Healthcare1	30 (30.0)	<1	30 (30.0)	<1	30 (30.0)	<1	30 (30.1)	<1	30 (30.0)	<1	30	141
Healthcare2	14 (14.0)	<1	14 (14.0)	<1	14 (14.0)	<1	14 (14.9)	<1	14 (14.0)	1	14	40
Healthcare3	34 (34.0)	<1	34 (34.0)	<1	34 (34.0)	<1	34 (35.3)	<1	34 (34.1)	3	34	208
Healthcare4	46 (46.0)	<1	46 (46.0)	<1	46 (46.0)	2	46 (46.9)	<1	46 (46.0)	4	46	413
Insurance	527 (527.0)	<1	527 (527.0)	<1	527 (527.0)	<1	527 (540.6)	3	527 (527.0)	15	527	936
NetworkMgmt	110 (110.0)	<1	110 (110.0)	<1	110 (110.0)	<1	110 (117.0)	<1	110 (110.0)	1	110	82
ProcessorComm1	22 (22.0)	<1	22 (22.0)	1	22 (22.0)	2	22 (24.1)	<1	22 (22.7)	<1	22	65
ProcessorComm2	25 (25.0)	<1	25 (25.0)	2	25 (25.0)	3	26 (27.6)	<1	25 (27.3)	3	27	320
Services	100 (100.0)	1	100 (100.1)	254	100 (100.2)	261	102 (105.1)	<1	100 (100.0)	3	106	4220
Storage1	17 (17.0)	<1	17 (17.0)	<1	17 (17.0)	<1	17 (17.2)	<1	17 (17.0)	3	17	71
Storage2	18 (18.0)	<1	18 (18.0)	<1	18 (18.0)	<1	18 (18.0)	<1	18 (18.0)	1	18	28
Storage3	50 (50.0)	<1	50 (50.0)	<1	50 (50.0)	<1	50 (51.7)	<1	50 (50.0)	1	50	455
Storage4	130 (130.0)	<1	130 (130.0)	<1	130 (130.0)	<1	130 (130.4)	<1	130 (130.0)	2	— ^a	— ^a
Storage5	215 (215.0)	<1	215 (215.0)	1	215 (215.0)	<1	215 (221.3)	8	215 (215.0)	13	215	1856
SystemMgmt	15 (15.0)	<1	15 (15.0)	<1	15 (15.0)	<1	15 (16.1)	<1	15 (15.0)	<1	15	33
Telecom	30 (30.0)	<1	30 (30.0)	<1	30 (30.0)	<1	30 (30.2)	<1	30 (30.0)	<1	30	122

^a As originally reported in the literature [1], *SQ-CHiP* finds a CCA with the size of 117 with the running time of 699 seconds on instance ‘Storage4’. However, for solving 2-way CCAG, the model files for ‘Storage4’ adopted in our work and in the literature [1] are not exactly the same. Thus we mark ‘—’ for the result of *SQ-CHiP* on ‘Storage4’ in this table. Nevertheless, we have performed 10 independent runs of *AutoCCAG* on ‘Storage4’ as used in the literature [1], and all 10 runs can find CCAs with the size of 117 in less than 1 second.

References:

- [1] H. Mercan, C. Yilmaz, and K. Kaya, “CHiP: A configurable hybrid parallel covering array constructor,” IEEE Transactions on Software Engineering, vol. 45, no. 12, pp. 1270–1291, 2019.