

TABLE I  
COMPARING *AutoCCAG* WITH *TCA-opt*, *TCA*, *CASA* AND *CHiP* FOR 5-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>CHiP</i>	
	min (avg)	time	min (avg)	time	min (avg)	time	min (avg)	time	size	time
Apache	– (–)	>10000	– (–)	>10000	– (–)	>10000	– (–)	>10000	–	–
Bugzilla	<b>560 (561.5)</b>	8200	688 (688.9)	9665	788 (794.5)	9922	1194 (1480.7)	7788	–	–
GCC	– (–)	>10000	– (–)	>10000	– (–)	>10000	– (–)	>10000	–	–
SPIN-S	<b>1174 (1174.0)</b>	860	<b>1174 (1174.0)</b>	2908	<b>1174 (1174.0)</b>	2988	1222 (1228.8)	9589	–	–
SPIN-V	<b>5941 (6060.4)</b>	8992	8202 (8202.0)	3376	– (–)	>10000	– (–)	>10000	–	–
Banking1	<b>212 (212.0)</b>	<1	<b>212 (212.0)</b>	<1	<b>212 (212.0)</b>	<1	<b>212 (212.0)</b>	<1	–	–
Banking2	<b>152 (152.0)</b>	126	<b>152 (152.0)</b>	909	<b>152 (152.0)</b>	1241	164 (175.6)	4165	–	–
CommProtocol	<b>150 (150.0)</b>	3	<b>150 (150.0)</b>	9	<b>150 (150.0)</b>	8	152 (153.6)	17	–	–
Concurrency	<b>8 (8.0)</b>	<1	<b>8 (8.0)</b>	<1	<b>8 (8.0)</b>	<1	<b>8 (8.0)</b>	<1	–	–
Healthcare1	<b>720 (720.0)</b>	1	<b>720 (720.0)</b>	14	<b>720 (720.0)</b>	17	730 (742.0)	44	–	–
Healthcare2	<b>517 (520.9)</b>	6927	517 (521.0)	6423	521 (523.7)	6353	558 (574.2)	4525	–	–
Healthcare3	<b>3197 (3207.5)</b>	8230	3934 (3938.2)	9945	4214 (4243.6)	9973	9908 (12729.9)	9573	–	–
Healthcare4	<b>6885 (6904.5)</b>	9595	8184 (8184.0)	9527	9353 (9380.3)	9625	57417 (57417.6)	6155	–	–
Insurance	<b>452575 (452779.8)</b>	9912	491558 (491561.7)	9901	496934 (497147.8)	9946	– (–)	>10000	–	–
NetworkMgmt	<b>24664 (24679.9)</b>	9876	24665 (24680.2)	9874	24705 (24721.2)	9916	28209 (28382.9)	9737	–	–
ProcessorComm1	<b>2037 (2038.7)</b>	5987	2041 (2043.6)	7643	2042 (2044.7)	8157	2586 (2630.7)	9829	–	–
ProcessorComm2	<b>2506 (2508.9)</b>	5938	2583 (2588.3)	9600	2808 (2886.8)	9990	4293 (4895.8)	9621	–	–
Services	<b>32869 (32887.9)</b>	9315	33208 (33243.9)	9891	36510 (36616.9)	9998	42928 (43319.7)	9592	–	–
Storage1	– (–) <sup>a</sup>	– <sup>a</sup>	– (–) <sup>a</sup>	– <sup>a</sup>	– (–) <sup>a</sup>	– <sup>a</sup>	– (–) <sup>a</sup>	– <sup>a</sup>	– <sup>a</sup>	– <sup>a</sup>
Storage2	<b>486 (486.0)</b>	<1	<b>486 (486.0)</b>	<1	<b>486 (486.0)</b>	<1	<b>486 (486.0)</b>	<1	–	–
Storage3	<b>1635 (1635.0)</b>	2424	<b>1635 (1635.3)</b>	6434	<b>1635 (1635.7)</b>	5489	5885 (5885.0)	527	–	–
Storage4	<b>34005 (34027.1)</b>	9882	39222 (39228.3)	9939	43552 (43632.1)	9960	192964 (264817.2)	9297	–	–
Storage5	<b>65854 (66047.4)</b>	9562	78317 (78318.2)	9457	85304 (85411.2)	9729	– (–)	>10000	–	–
SystemMgmt	<b>270 (270.0)</b>	25	<b>270 (270.0)</b>	9	<b>270 (270.0)</b>	35	290 (295.5)	15	–	–
Telecom	<b>884 (884.0)</b>	32	<b>884 (884.0)</b>	45	<b>884 (884.0)</b>	51	1325 (1325.0)	10	–	–

<sup>a</sup> For instance ‘Storage1’, there are only 4 options in total, so this instance cannot be used as a usable instance for the 5-way CCAG problem. As a result, we mark ‘–’ for the results of all algorithms on ‘Storage1’ in this table.