⎯⎯⎯⎯⎯⎯⎯⎯ MODULE $CCTest$ ⎯⎯⎯⎯⎯⎯⎯⎯

Test of CC Module

5 EXTENDS CC

6 ├⎯⎯

Test case: The following histories are from Figure 2 of the $POPL$'2017 paper.

Naming Conventions:

− ha: history of Figure 2(a)
− $hasa$: session a of history ha

$TODO$:

- to add more test cases
- to automatically generate test cases that do or do not satisfy the specs

20 $hasa \triangleq \langle W(\text{"x"}, 1, 1), R(\text{"x"}, 2, 2) \rangle$
21 $hasb \triangleq \langle W(\text{"x"}, 2, 3), R(\text{"x"}, 1, 4) \rangle$
22 $ha \triangleq \{hasa, hasb\}$ CM but not CCv

24 $hbsa \triangleq \langle W(\text{"z"}, 1, 1), W(\text{"x"}, 1, 2), W(\text{"y"}, 1, 3) \rangle$
25 $hbsb \triangleq \langle W(\text{"x"}, 2, 4), R(\text{"z"}, 0, 5), R(\text{"y"}, 1, 6), R(\text{"x"}, 2, 7) \rangle$
26 $hb \triangleq \{hbsa, hbsb\}$ CCv but not CM

28 $hcsa \triangleq \langle W(\text{"x"}, 1, 1) \rangle$
29 $hcsb \triangleq \langle W(\text{"x"}, 2, 2), R(\text{"x"}, 1, 3), R(\text{"x"}, 2, 4) \rangle$
30 $hc \triangleq \{hcsa, hcsb\}$ CC but not CM nor CCv

32 $hdsa \triangleq \langle W(\text{"x"}, 1, 1), R(\text{"y"}, 0, 2), W(\text{"y"}, 1, 3), R(\text{"x"}, 1, 4) \rangle$
33 $hdsb \triangleq \langle W(\text{"x"}, 2, 5), R(\text{"y"}, 0, 6), W(\text{"y"}, 2, 7), R(\text{"x"}, 2, 8) \rangle$
34 $hd \triangleq \{hdsa, hdsb\}$ CC, CM, and CCv but no SC

36 $hesa \triangleq \langle W(\text{"x"}, 1, 1), W(\text{"y"}, 1, 2) \rangle$
37 $hesb \triangleq \langle R(\text{"y"}, 1, 3), W(\text{"x"}, 2, 4) \rangle$
38 $hesc \triangleq \langle R(\text{"x"}, 2, 5), R(\text{"x"}, 1, 6) \rangle$
39 $he \triangleq \{hesa, hesb, hesc\}$ not CC (nor CM, nor CCv)

41 $all \triangleq \{ha, hb, hc, hd, he\}$

42 ├⎯⎯

43 THEOREM $WellFormedTheorem \triangleq$ test of well-formedness of histories
44      $\forall h \in all : WellFormed(h)$

45 ├⎯⎯

Test of program order

49 $CardOfProgramOrderOfHistory(h) \triangleq$
50   LET $CardOfProgramOrderOfSession(s) \triangleq$
51   IF $Len(s) \leq 1$ THEN 0 ELSE $Sum(1 .. Len(s) - 1)$
52   IN $ReduceSet(\text{LAMBDA } s, x : CardOfProgramOrderOfSession(s) + x, h, 0)$

54 THEOREM $ProgramOrderCardinalityTheorem \triangleq$
55      $\forall h \in \{ha, hb, hc, hd, he\} :$

56          $Cardinality(ProgramOrder(h)) = CardOfProgramOrderOfHistory(h)$

58   THEOREM $POPastTest \;\overset{\Delta}{=}$
59        $\wedge\; POPast(ha,\, R(\text{``x''},\, 2,\, 2)) \;\; = \{\, W(\text{``x''},\, 1,\, 1)\}$
60        $\wedge\; POPast(hb,\, R(\text{``y''},\, 1,\, 6)) \;\; = \{\, W(\text{``x''},\, 2,\, 4),\, R(\text{``z''},\, 0,\, 5)\}$
61        $\wedge\; POPast(hc,\, W(\text{``x''},\, 2,\, 2)) = \{\}$
62        $\wedge\; POPast(hd,\, R(\text{``x''},\, 1,\, 4)) \;\; = \{\, W(\text{``x''},\, 1,\, 1),\, R(\text{``y''},\, 0,\, 2),\, W(\text{``y''},\, 1,\, 3)\}$
63        $\wedge\; POPast(he,\, W(\text{``x''},\, 2,\, 4)) = \{\, R(\text{``y''},\, 1,\, 3)\}$
64 ├──┤

Test of axioms

68 ├──┤

Test of the definitions of causal consistency

72   $CCvTest \;\overset{\Delta}{=}$
73       $\wedge\; PrintT(\neg CCv(ha))$ 4
74     $\wedge\; CCv(hb) \setminus * \; 7$
75       $\wedge\; PrintT(\neg CCv(hc))$ 4
76     $\wedge\; CCv(hd) \setminus * \; 8$
77       $\wedge\; PrintT(\neg CCv(he))$ 6
78   LET sat $\;\overset{\Delta}{=}\; \{hb,\, hd\}$
79   IN $\wedge\, \forall\, h \in$ sat: $CCv(h)$
80        $\wedge\, \forall\, h \in all\setminus$ sat: $\neg CCv(h)$
81 └──┘

* Modification History
* Last modified *Tue Apr* 13 09:07:14 *CST* 2021 by *hengxin*
* Created *Fri Apr* 09 11:53:33 *CST* 2021 by *hengxin*