MODULE *NC_Theorem*

EXTENDS *NormalClock*, *TLAPS*

Liveness $\triangleq$ $\Diamond(hr = 8)$
Safety $\triangleq$ $(hr \in 1 \,..\, 12)$

THEOREM $HC \Rightarrow Liveness$
  OMITTED

THEOREM $HC \Rightarrow \Box Safety$
$\langle 1 \rangle$ USE DEF *Safety*
$\langle 1 \rangle 1$. $HCInit \Rightarrow Safety$ We want to refer to non-temporal part of *Safety*!
  BY DEF *HCInit*
$\langle 1 \rangle 2$. $Safety \wedge HCNext \Rightarrow Safety'$
  $\langle 2 \rangle 1$. $hr \neq 12 \vee hr = 12$
    OBVIOUS
  $\langle 2 \rangle 5$. QED
    OMITTED
$\langle 1 \rangle 3$. $Safety \wedge$ UNCHANGED $hr \Rightarrow Safety'$
  OBVIOUS
$\langle 1 \rangle 4$. QED
  BY *PTL*, $\langle 1 \rangle 1$, $\langle 1 \rangle 2$, $\langle 1 \rangle 3$ DEF *HC*

When safety is already in temporal form

SafetyFull $\triangleq$ $\Box(hr \in 1 \,..\, 12)$

THEOREM $HC \Rightarrow SafetyFull$
$\langle 1 \rangle 1$. $HCInit \Rightarrow SafetyFull!1$ We want to refer to non-temporal part of *Safety*!
  BY DEF *HCInit*
$\langle 1 \rangle 2$. $SafetyFull!1 \wedge HCNext \Rightarrow SafetyFull!1'$
  OMITTED
$\langle 1 \rangle 3$. $SafetyFull!1 \wedge$ UNCHANGED $hr \Rightarrow SafetyFull!1'$
  OBVIOUS
$\langle 1 \rangle 3$b. $HC \Rightarrow \Box SafetyFull!1$
  BY *PTL*, $\langle 1 \rangle 1$, $\langle 1 \rangle 2$, $\langle 1 \rangle 3$ DEF *HC*
$\langle 1 \rangle 4$. QED
  BY $\langle 1 \rangle 3$b DEF *SafetyFull*

Can it be simpler?

THEOREM $HC \Rightarrow SafetyFull$
$\langle 1 \rangle 1$. $HCInit \Rightarrow SafetyFull!1$ We want to refer to non-temporal part of *Safety*!
  BY DEF *HCInit*
$\langle 1 \rangle 2$. $SafetyFull!1 \wedge HCNext \Rightarrow SafetyFull!1'$

48 OMITTED

49 $\langle 1 \rangle 3$. $SafetyFull!1 \land$ UNCHANGED $hr \Rightarrow SafetyFull!1'$

50 OBVIOUS

51 $\langle 1 \rangle 4$. QED

52 BY $\langle 1 \rangle 1$, $\langle 1 \rangle 2$, $\langle 1 \rangle 3$ DEF HC, $SafetyFull$

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