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infChecker at CoCo 2024

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Description

- infChecker is a tool for checking **(in)feasibility of goals**
 $\mathcal{G} = \{F_i\}_{i=1}^m$, where $F_i = (s_{ij} \bowtie_{ij} t_{ij})_{i=1}^{n_i}$.
- \bowtie_{ij} represents **predicates** on terms defined by provability of goals $s \bowtie_{ij} t$ with respect to a *first-order theories* $\text{Th}_{\bowtie_{ij}}$.
- \bowtie_{ij} can be one of the following predicates:
 - One (CS-)rewriting step (\rightarrow , \rightarrow).
 - Zero or more (CS-)rewriting steps (\rightarrow^* , \rightarrow^*).
 - One or more (CS-)rewriting steps (\rightarrow^+ , \rightarrow^+).
 - Subterm ($\mid \supseteq$) and strict subterm ($\mid \supset$).
 - (CS-)Joinability ($\rightarrow^* \leftarrow$, $\rightarrow^* \leftarrow /$).
 - One (CS-)convertibility step ($\leftarrow \rightarrow$, \leftarrow / \rightarrow).
 - Zero or more (CS-)convertibility steps ($\leftarrow \rightarrow^*$, $\leftarrow / \rightarrow^*$).
- This year, our participation involves utilizing the same tool employed in the previous year.

An Example

- Given the TRS $\mathcal{R} = \{a \rightarrow c(b), b \rightarrow c(b)\}$, infChecker can prove the nonloopingness of a as the infeasibility of

$$(\{\overline{\mathcal{R}}, Th_{\succeq}\}, \{\neg(x, y)(a \rightarrow x, x \rightarrow^* y, y \succeq a)\})$$

by obtaining the following structure over $\mathbb{N} \cup \{-1\}$:

$$\begin{array}{ll} a^{\mathcal{A}} = -1 & b^{\mathcal{A}} = 1 \\ c^{\mathcal{A}}(x) = x & x \rightarrow^{\mathcal{A}} y \Leftrightarrow x \leq 1 \wedge y \geq 1 \\ x (\rightarrow^*)^{\mathcal{A}} y \Leftrightarrow x \leq y & x \succeq^{\mathcal{A}} y \Leftrightarrow x \leq y \end{array}$$

Implementation and Bibliography

- It is written in Haskell and implements the **Feasibility Framework**. The tool is available here:

`http://zenon.dsic.upv.es/infChecker/`

- Bibliography:

GL20 R. Gutiérrez and S. Lucas. Automatically Proving and Disproving Feasibility Conditions. In Proc. of IJCAR'2020, LNCS 12167:416–435. Springer, 2020.

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