**Implied Constraints for Automaton Constraints**

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**The Automaton Constraint**

DAF augmented with accumulators can encode a constraint on a sequence \( S \) of variables using an automaton whose size does not depend on the length of \( S \) [Beldiceanu & al., CP 2004].

It is unknown how to maintain domain consistency efficiently for most of them.

Invariants on accumulators are a way to enhance propagation.

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**Example**

The \( \text{nGroup}(N, S, W) \) constraint holds if and only if there are \( N \) groups of values from the set \( W \) in the sequence \( S \) of variables.

The following instance holds:

\[
\begin{align*}
N &= 3 \\
W &= \{\spadesuit, \heartsuit\} \\
S &= \{\spadesuit, \spadesuit, \heartsuit, \spadesuit, \heartsuit, \heartsuit, \spadesuit\}
\end{align*}
\]

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**nGroup automaton**

\[
\{c:=0\} \quad \{c:=c+1\}
\]

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**Available options**

**Basic**: linear inequalities containing only current accumulator values (i.e. \( c_i \geq 0 \))

**History Variables**: number of previous accumulator values (i.e. \( c_{i-2} + 1 \geq c_i \))

**State Variable**: include a variable \( q \) representing the current state (i.e. \( c_i - c_{i-1} \leq q \))

**State Specific Implied Constraints**: generate ICs that hold at specific states (i.e. \( q = s \Rightarrow c_i = c_{i+1} \))

**Index Variable**: include the current index (i.e. \( 2c_i \leq i \))

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**Experiments**

Ran on sets of random problems

- **nGroup**
- **FullGroupNval**
- **Inflection**

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