5.33 arith_sliding

DESCRIPTION LINKS GRAPH AUTOMATON

Origin

Used in the definition of some automaton

Constraint

`arith_sliding(VARIABLES, RELOP, VALUE)`

Arguments

VARIABLES	:	collection(var−dvar)
RELOP	:	atom
VALUE	:	int

Restrictions

required(VARIABLES, var)
RELOP $\in [=, \neq, <, \geq, >, \leq]$

Purpose

Enforce for all sequences of variables $\mathtt{var}_1, \mathtt{var}_2, \ldots, \mathtt{var}_i$ $(1 \leq i \leq |\mathtt{VARIABLES}|)$ of the VARIABLES collection to have $(\mathtt{var}_1 + \mathtt{var}_2 + \cdots + \mathtt{var}_i)$ RELOP VALUE.

Example

$(\langle 0, 0, 1, 2, 0, 0, -3\rangle, <, 4)$

The arith_sliding constraint holds since all the following seven inequalities hold:

- $0 < 4$,
- $0 + 0 < 4$,
- $0 + 0 + 1 < 4$,
- $0 + 0 + 1 + 2 < 4$,
- $0 + 0 + 1 + 2 + 0 < 4$,
- $0 + 0 + 1 + 2 + 0 + 0 < 4$,
- $0 + 0 + 1 + 2 + 0 + 0 - 3 < 4$.

All solutions

Figure 5.92 gives all solutions to the following non ground instance of the arith_sliding constraint: $\mathtt{V}_1 \in [0, 5]$, $\mathtt{V}_2 \in [2, 3]$, $\mathtt{V}_3 \in [0, 4]$, arith_sliding$(\langle \mathtt{V}_1, \mathtt{V}_2, \mathtt{V}_3\rangle, \leq, \mathbf{3})$.

① $(\langle 0, 2, 0\rangle, \leq, \mathbf{3})$
② $(\langle 0, 2, 1\rangle, \leq, \mathbf{3})$
③ $(\langle 0, 3, 0\rangle, \leq, \mathbf{3})$
④ $(\langle 1, 2, 0\rangle, \leq, \mathbf{3})$

Figure 5.92: All solutions corresponding to the non ground example of the arith_sliding constraint of the **All solutions** slot

Typical

$|\mathtt{VARIABLES}| > 1$
RELOP $\in [<, \geq, >, \leq]$

Arg. properties

- Contractible wrt. VARIABLES when RELOP $\in$ $[<, \leq]$ and $\texttt{minval}(\texttt{VARIABLES.var}) \geq 0$.
- Suffix-contractible wrt. VARIABLES.

See also

common keyword: sum_ctr *(arithmetic constraint)*.

implies: sum_ctr.

part of system of constraints: arith.

used in graph description: arith.

Keywords

characteristic of a constraint: hypergraph, automaton, automaton with counters.

combinatorial object: sequence.

constraint type: arithmetic constraint, decomposition, sliding sequence constraint.

Arc input(s)	VARIABLES
Arc generator	$PATH\_1 \mapsto$ collection
Arc arity	$*$
Arc constraint(s)	arith(collection, RELOP, VALUE)
Graph property(ies)	**NARC**$= \|$VARIABLES$\|$

Automaton Figure 5.93 depicts the automaton associated with the `arith_sliding` constraint. To each item of the collection `VARIABLES` corresponds a signature variable S_i that is equal to 0.

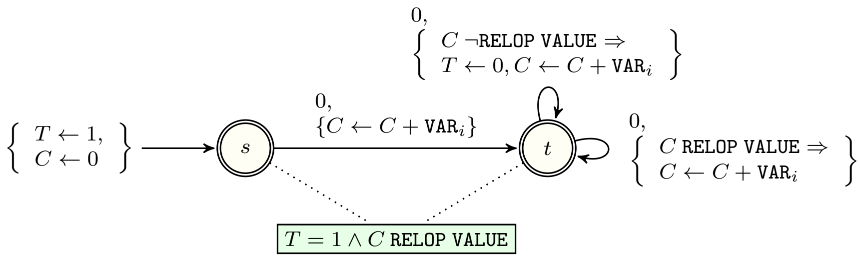

Figure 5.93: Automaton of the `arith_sliding` constraint (T is initially set to 1 and reset to 0 as soon as one of the sliding constraints does not hold)

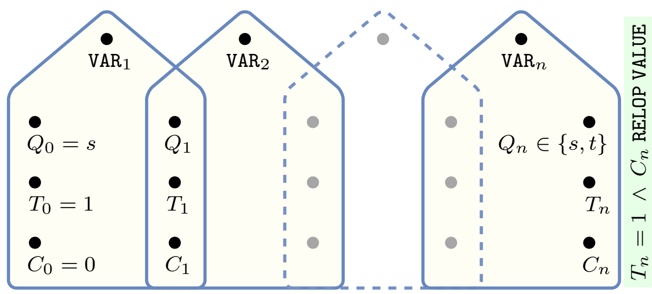

Figure 5.94: Hypergraph of the reformulation corresponding to the automaton (with two counters) of the `arith_sliding` constraint (since all states of the automaton are accepting there is no restriction on the last variable Q_n)