5.235 longest_change

DESCRIPTION LINKS GRAPH AUTOMATON

Origin Derived from change.

Constraint longest_change(SIZE, VARIABLES, CTR)

Arguments

SIZE	:	dvar
VARIABLES	:	collection(var−dvar)
CTR	:	atom

Restrictions

SIZE ≥ 0
SIZE $\leq |$VARIABLES$|$
required(VARIABLES, var)
CTR $\in [=, \neq, <, \geq, >, \leq]$

Purpose SIZE is the maximum number of consecutive variables of the collection VARIABLES for which constraint CTR holds in an uninterrupted way (0 if the constraint CTR does not hold at all). We count a change when X CTR Y holds; X and Y are two consecutive variables of the collection VARIABLES.

Example $(4, \langle 8, 8, 3, 4, 1, 1, 5, 5, 2\rangle, \neq)$

The longest_change constraint holds since its first argument SIZE $= 4$ is fixed to the length of the longest subsequence of consecutive values of the collection $\langle 8, 8, 3, 4, 1, 1, 5, 5, 2\rangle$ such that two consecutive values are distinct (i.e., subsequence 8 3 4 1).

Typical

$|$VARIABLES$| > 2$
range(VARIABLES.var) > 1
CTR $\in [\neq]$

Symmetry One and the same constant can be added to the var attribute of all items of VARIABLES.

Arg. properties

Functional dependency: SIZE determined by VARIABLES and CTR.

See also **root concept:** change.

Keywords

characteristic of a constraint: automaton, automaton with counters.

constraint arguments: reverse of a constraint, pure functional dependency.

constraint network structure: sliding cyclic(1) constraint network(3).

constraint type: timetabling constraint.

filtering: glue matrix.

modelling: functional dependency.

Arc input(s)	VARIABLES
Arc generator	$PATH \mapsto$ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var CTR variables2.var
Graph property(ies)	**MAX_NCC**= SIZE

Graph model In order to specify the longest_change constraint, we use **MAX_NCC**, which is the number of vertices of the largest connected component. Since the initial graph corresponds to a path, this will be the length of the longest path in the final graph.

Parts (A) and (B) of Figure 5.501 respectively show the initial and final graph associated with the **Example** slot. Since we use the **MAX_NCC** graph property we show the largest connected component of the final graph. It corresponds to the longest period of uninterrupted changes: sequence $8, 3, 4, 1$ that involves 4 consecutive variables.

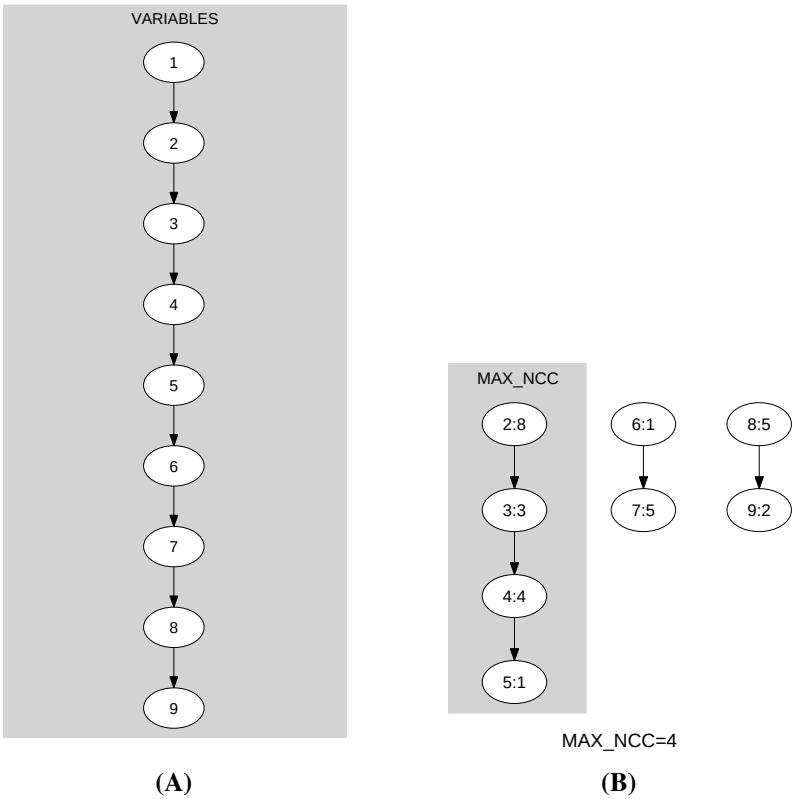
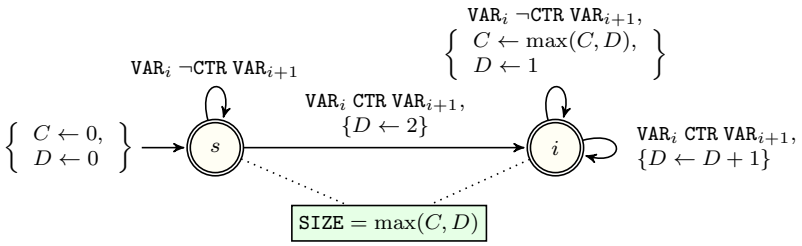


Figure 5.501: Initial and final graph of the longest_change constraint

Automaton

Figure 5.502 depicts the automaton associated with the `longest_change` constraint. To each pair of consecutive variables $(\texttt{VAR}_i, \texttt{VAR}_{i+1})$ of the collection VARIABLES corresponds a 0-1 signature variable S_i. The following signature constraint links $\texttt{VAR}_i$, $\texttt{VAR}_{i+1}$ and S_i: $\texttt{VAR}_i$ CTR $\texttt{VAR}_{i+1} \Leftrightarrow S_i$.



Glue matrix where $\overrightarrow{C}$, $\overrightarrow{D}$ and $\overleftarrow{C}$, $\overleftarrow{D}$ resp. represent the counters values C, D at the end of a prefix and at the end of the corresponding reverse suffix that partitions the sequence VARIABLES.

	s	i
s	0	$\max\left(\overleftarrow{D}, \overleftarrow{C}\right)$
i	$\max\left(\overrightarrow{C}, \overrightarrow{D}\right)$	$\max\left(\overrightarrow{C}, \overrightarrow{D} + \overleftarrow{D} - 1, \overleftarrow{C}\right)$

Figure 5.502: Automaton of the `longest_change` constraint and its glue matrix

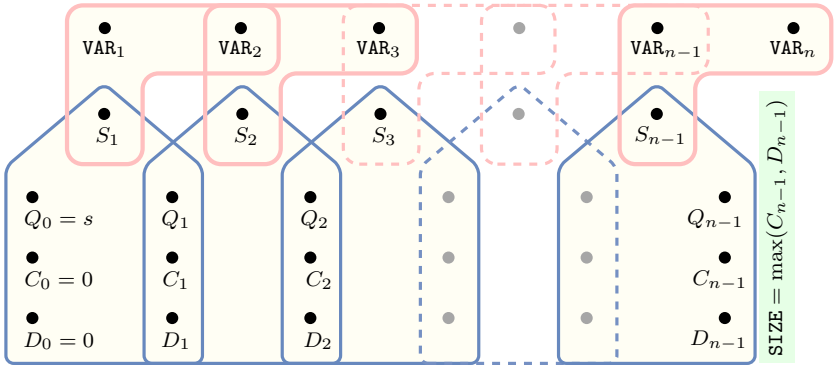


Figure 5.503: Hypergraph of the reformulation corresponding to the automaton of the `longest_change` constraint