5.256 min_index

DESCRIPTION LINKS GRAPH

Origin N. Beldiceanu

Constraint min_index(MIN_INDEX, VARIABLES)

Arguments

MIN_INDEX	:	dvar
VARIABLES	:	collection(index−int, var−dvar)

Restrictions

|VARIABLES| > 0
MIN_INDEX ≥ 0
MIN_INDEX ≤ |VARIABLES|
required(VARIABLES, [index, var])
VARIABLES.index ≥ 1
VARIABLES.index ≤ |VARIABLES|
distinct(VARIABLES, index)

Purpose MIN_INDEX is one of the indices of the collection of variables VARIABLES corresponding to its minimum value.

Example

$$\left\langle \begin{array}{l} 2, \left\{ \begin{array}{ll} \texttt{index} - 1 & \texttt{var} - 3, \\ \texttt{index} - 2 & \texttt{var} - 2, \\ \texttt{index} - 3 & \texttt{var} - 7, \\ \texttt{index} - 4 & \texttt{var} - 2, \\ \texttt{index} - 5 & \texttt{var} - 6 \end{array} \right\}, \\ 4, \left\{ \begin{array}{ll} \texttt{index} - 1 & \texttt{var} - 3, \\ \texttt{index} - 2 & \texttt{var} - 2, \\ \texttt{index} - 3 & \texttt{var} - 7, \\ \texttt{index} - 4 & \texttt{var} - 2, \\ \texttt{index} - 5 & \texttt{var} - 6 \end{array} \right\} \end{array} \right\rangle$$

The attribute var = 2 of the second and fourth items of the collection VARIABLES is the minimum value over values 3, 2, 7, 2, 6. Consequently, both min_index constraints hold since their first arguments MIN_INDEX are respectively set to 2 and 4.

Typical

|VARIABLES| > 0
range(VARIABLES.var) > 1

Symmetries

- Items of VARIABLES are permutable.
- One and the same constant can be added to the var attribute of all items of VARIABLES.

Usage Within the context of scheduling, assume the variables of the VARIABLES collection correspond to the starts of a set of tasks. Then MIN_INDEX gives the indexes of those tasks that can be scheduled first.

See also **comparison swapped:** `max_index`.

Keywords **characteristic of a constraint:** minimum.
constraint type: order constraint.
modelling: functional dependency.

Arc input(s)	VARIABLES
Arc generator	$CLIQUE \mapsto \texttt{collection}(\texttt{variables1}, \texttt{variables2})$
Arc arity	2
Arc constraint(s)	$\bigvee \begin{pmatrix} \texttt{variables1.key} = \texttt{variables2.key}, \\ \texttt{variables1.var} < \texttt{variables2.var} \end{pmatrix}$
Graph property(ies)	$\textbf{ORDER}(0, 0, \texttt{index}) = \texttt{MIN\_INDEX}$

Graph model Parts (A) and (B) of Figure 5.555 respectively show the initial and final graph associated with the two examples of the **Example** slot. Since we use the **ORDER** graph property, the vertices of rank 0 (without considering the loops) of the final graph are outlined with a thick circle.

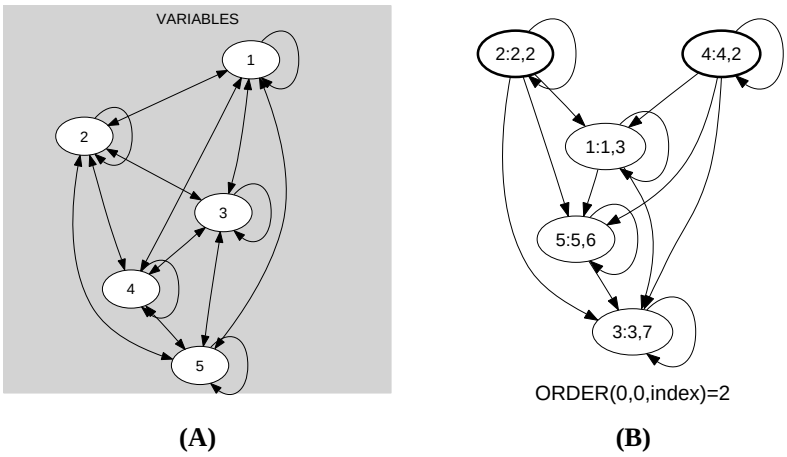

Figure 5.555: Initial and final graph of the `min_index` constraint