5.212 k_used_by

DESCRIPTION LINKS GRAPH

Origin Derived from used_by

Constraint k_used_by(SETS)

Type VARIABLES : collection(var−dvar)

Argument SETS : collection(set − VARIABLES)

Restrictions
required(VARIABLES, var)
|VARIABLES| ≥ 1
required(SETS, set)
|SETS| > 1
non_increasing_size(SETS, set)

Purpose Given |SETS| sets of domain variables, the k_used_by constraint forces a used_by constraint between each pair of consecutive sets.

Example

$$\left(\left\langle \begin{array}{l} \texttt{set} - \langle 1,9,1,5,2,1\rangle, \\ \texttt{set} - \langle 9,1,1,1,2,5\rangle, \\ \texttt{set} - \langle 1,1,2,5\rangle \end{array} \right\rangle\right)$$

The k_used_by constraint holds since:

- The multiset of values $\{\{1,1,1,2,5,9\}\}$ associated with the second collection of variables is included into the multiset $\{\{1,1,1,2,5,9\}\}$ associated with the first collection of variables.
- The multiset of values $\{\{1,1,2,5\}\}$ associated with the third collection of variables is included into the multiset $\{\{1,1,1,2,5,9\}\}$ associated with the second collection of variables.

Typical |VARIABLES| > 1

Symmetries
- Items of SETS are permutable.
- Items of SETS.set are permutable.
- All occurrences of two distinct values of SETS.set.var can be swapped; all occurrences of a value of SETS.set.var can be renamed to any unused value.

Arg. properties
Contractible wrt. SETS.

Remark Similarly to the k_same constraint [151], finding out whether the k_used_by constraint has a solution or not is NP-hard when we have more than one used_by constraint.

See also

common keyword: k_used_by_interval, k_used_by_modulo, k_used_by_partition (*system of constraints*).

implied by: k_same.

part of system of constraints: used_by.

used in graph description: used_by.

Keywords

characteristic of a constraint: sort based reformulation.

combinatorial object: multiset.

constraint type: system of constraints, decomposition.

modelling: inclusion.

Arc input(s)	SETS
Arc generator	$PATH \mapsto$ collection(set1, set2)
Arc arity	2
Arc constraint(s)	used_by(set1.set, set2.set)
Graph property(ies)	NARC$= \lvert$SETS$\rvert - 1$

Graph model Parts (A) and (B) of Figure 5.484 respectively show the initial and final graph associated with the **Example** slot. To each vertex corresponds a collection of variables, while to each arc corresponds a used_by constraint.

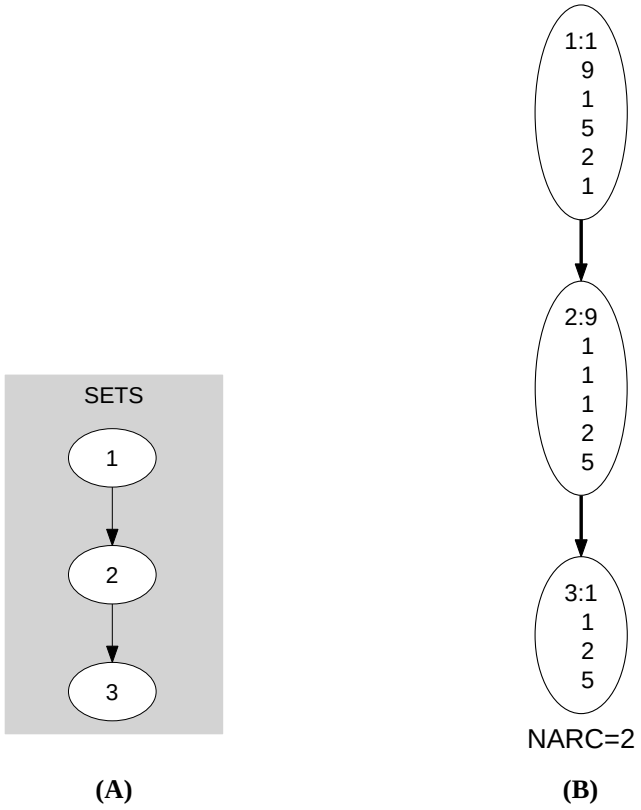

Figure 5.484: Initial and final graph of the k_used_by constraint