5.335 same_and_global_cardinality

DESCRIPTION LINKS GRAPH

Origin Conjoin same and global_cardinality

Constraint same_and_global_cardinality(VARIABLES1, VARIABLES2, VALUES)

Synonyms sgcc, same_gcc, same_and_gcc, swc, same_with_cardinalities.

Arguments

VARIABLES1	:	collection(var−dvar)
VARIABLES2	:	collection(var−dvar)
VALUES	:	collection(val−int, noccurrence−dvar)

Restrictions

$|\texttt{VARIABLES1}| = |\texttt{VARIABLES2}|$
required(VARIABLES1, var)
required(VARIABLES2, var)
required(VALUES, [val, noccurrence])
distinct(VALUES, val)
$\texttt{VALUES.noccurrence} \geq 0$
$\texttt{VALUES.noccurrence} \leq |\texttt{VARIABLES1}|$

Purpose The variables of the VARIABLES2 collection correspond to the variables of the VARIABLES1 collection according to a permutation. In addition, each value $\texttt{VALUES}[i].\texttt{val}$ (with $i \in [1, |\texttt{VALUES}|]$) should be taken by exactly $\texttt{VALUES}[i].\texttt{noccurrence}$ variables of the VARIABLES1 collection. Finally, each variable of VARIABLES1 should be assigned a value of $\texttt{VALUES}[i].\texttt{val}$ (with $i \in [1, |\texttt{VALUES}|]$).

Example

$$\left\langle \begin{array}{l} \langle 1, 9, 1, 5, 2, 1 \rangle, \\ \langle 9, 1, 1, 1, 2, 5 \rangle, \\ \left\langle \begin{array}{ll} \texttt{val} - 1 & \texttt{noccurrence} - 3, \\ \texttt{val} - 2 & \texttt{noccurrence} - 1, \\ \texttt{val} - 5 & \texttt{noccurrence} - 1, \\ \texttt{val} - 7 & \texttt{noccurrence} - 0, \\ \texttt{val} - 9 & \texttt{noccurrence} - 1 \end{array} \right\rangle \end{array} \right\rangle$$

The same_and_global_cardinality constraint holds since:

- The values 1, 9, 1, 5, 2, 1 assigned to VARIABLES1 correspond to a permutation of the values 9, 1, 1, 1, 2, 5 assigned to VARIABLES2.
- The values 1, 2, 5, 7 and 6 are respectively used 3, 1, 1, 0 and 1 times.

Typical

$|\texttt{VARIABLES1}| > 1$
$\texttt{range}(\texttt{VARIABLES1.var}) > 1$
$\texttt{range}(\texttt{VARIABLES2.var}) > 1$
$|\texttt{VALUES}| > 1$
$\texttt{range}(\texttt{VALUES.noccurrence}) > 1$
$|\texttt{VARIABLES1}| > |\texttt{VALUES}|$

Symmetries

- Arguments are permutable w.r.t. permutation (VARIABLES1, VARIABLES2) (VALUES).
- Items of VARIABLES1 are permutable.
- Items of VARIABLES2 are permutable.
- Items of VALUES are permutable.
- An occurrence of a value of VARIABLES1.var or VARIABLES2.var that does not belong to VALUES.val can be replaced by any other value that also does not belong to VALUES.val.
- All occurrences of two distinct values in VARIABLES1.var, VARIABLES2.var or VALUES.val can be swapped; all occurrences of a value in VARIABLES1.var, VARIABLES2.var or VALUES.val can be renamed to any unused value.

Arg. properties

Contractible wrt. VALUES.

Usage

See the same_and_global_cardinality_low_up constraint.

Algorithm

The filtering algorithm presented in [50] can be reused for pruning the variables of the VARIABLES1 and the VARIABLES2 collection. This algorithm does not restrict the noccurrence variables of the VALUES collection.

See also

implies: global_cardinality, same.

related: k_alldifferent *(two overlapping* alldifferent *plus restriction on values).*

specialisation: same_and_global_cardinality_low_up *(*variable *replaced by* fixed interval*).*

Keywords

application area: assignment.

combinatorial object: permutation, multiset.

constraint arguments: constraint between two collections of variables.

constraint type: value constraint.

filtering: flow.

modelling: equality between multisets.

problems: demand profile.

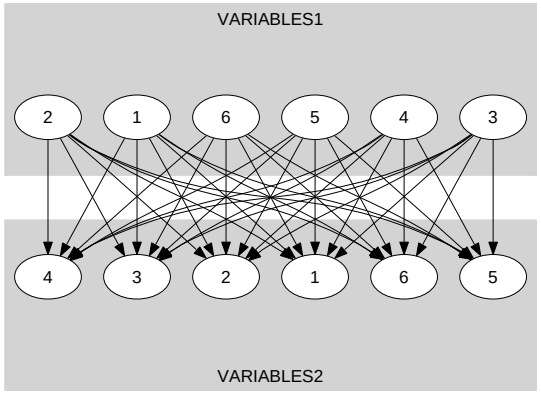
2028**NSINK**, **NSOURCE**, CC(**NSINK**, **NSOURCE**), *PRODUCT*; **NVERTEX**, *SELF*, ∀

Arc input(s)	VARIABLES1 VARIABLES2
Arc generator	*PRODUCT* ↦ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var = variables2.var
Graph property(ies)	• for all connected components: **NSOURCE**=**NSINK** • **NSOURCE**= |VARIABLES1| • **NSINK**= |VARIABLES2|

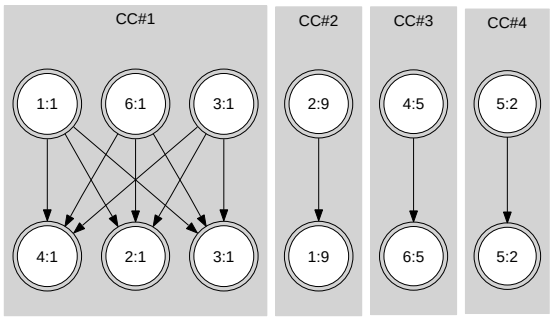
For all items of VALUES:

Arc input(s)	VARIABLES1
Arc generator	*SELF* ↦ collection(variables)
Arc arity	1
Arc constraint(s)	variables.var = VALUES.val
Graph property(ies)	**NVERTEX**= VALUES.noccurrence

Graph model Parts (A) and (B) of Figure 5.668 respectively show the initial and final graph associated with the first graph constraint of the **Example** slot. Since we use the **NSOURCE** and **NSINK** graph properties, the source and sink vertices of the final graph are stressed with a double circle. Since there is a constraint on each connected component of the final graph we also show the different connected components. Each of them corresponds to an equivalence class according to the arc constraint.



(A)



CC#1:NSOURCE=3,NSINK=3
CC#2:NSOURCE=1,NSINK=1
CC#3:NSOURCE=1,NSINK=1
CC#4:NSOURCE=1,NSINK=1

(B)

Figure 5.668: Initial and final graph of the `same_and_global_cardinality` constraint