5.182 in_same_partition

DESCRIPTION LINKS GRAPH AUTOMATON

Origin

Used for defining several entries of this catalog.

Constraint

in_same_partition(VAR1, VAR2, PARTITIONS)

Type

VALUES : collection(val−int)

Arguments

VAR1 : dvar
VAR2 : dvar
PARTITIONS : collection(p − VALUES)

Restrictions

|VALUES| ≥ 1
required(VALUES, val)
distinct(VALUES, val)
required(PARTITIONS, p)
|PARTITIONS| ≥ 2

Purpose

Enforce VAR1 and VAR2 to be respectively assigned to values v_1 and v_2 that both belong to a same partition of the collection PARTITIONS.

Example

(6, 2, ⟨p − ⟨1, 3⟩ , p − ⟨4⟩ , p − ⟨2, 6⟩⟩)

The in_same_partition constraint holds since its first and second arguments VAR1 = 6 and VAR2 = 2 both belong to the third partition ⟨2, 6⟩ of its third argument PARTITIONS.

Typical

VAR1 ≠ VAR2

Symmetries

- Arguments are permutable w.r.t. permutation (VAR1, VAR2) (PARTITIONS).
- Items of PARTITIONS are permutable.
- Items of PARTITIONS.p are permutable.

Arg. properties

Extensible wrt. PARTITIONS.

Used in

alldifferent_partition, balance_partition, change_partition, common_partition, nclass, same_partition, soft_same_partition_var, soft_used_by_partition_var, used_by_partition.

See also

common keyword: alldifferent_partition *(partition)*, in *(value constraint)*.

used in graph description: in.

Keywords

characteristic of a constraint: partition, automaton, automaton without counters, reified automaton constraint, derived collection.

constraint arguments: binary constraint.

constraint network structure: centered cyclic(2) constraint network(1).

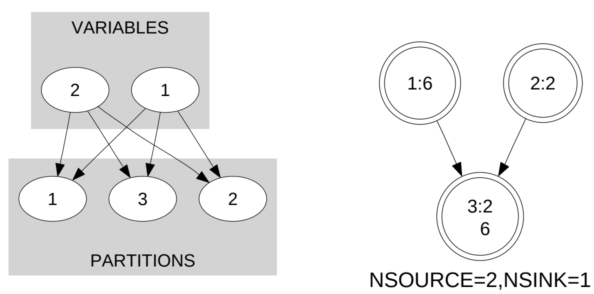
constraint type: value constraint.

filtering: arc-consistency.

Derived Collection	$\texttt{col}\left(\begin{array}{l}\texttt{VARIABLES}-\texttt{collection}(\texttt{var}-\texttt{dvar}),\\ [\texttt{item}(\texttt{var}-\texttt{VAR1}),\texttt{item}(\texttt{var}-\texttt{VAR2})]\end{array}\right)$
Arc input(s)	VARIABLES PARTITIONS
Arc generator	$PRODUCT \mapsto$ collection(variables, partitions)
Arc arity	2
Arc constraint(s)	in(variables.var, partitions.p)
Graph property(ies)	• **NSOURCE** $= 2$ • **NSINK** $= 1$

Graph model VAR1 and VAR2 are put together in the derived collection VARIABLES. Since both VAR1 and VAR2 should take their value in one of the partition depicted by the PARTITIONS collection, the final graph should have two sources corresponding respectively to VAR1 and VAR2. Since two, possibly distinct, values should be assigned to VAR1 and VAR2 and since these values belong to the same partition p the final graph should only have one sink. This sink corresponds in fact to partition p.

Parts (A) and (B) of Figure 5.407 respectively show the initial and final graph associated with the **Example** slot. Since we both use the **NSOURCE** and **NSINK** graph properties, the source and sink vertices of the final graph are shown with a double circle.



(A) **(B)**

Figure 5.407: Initial and final graph of the in_same_partition constraint

Signature Note that the sinks of the initial graph cannot become sources of the final graph since isolated vertices are eliminated from the final graph. Since the final graph contains two sources it also includes one arc between a source and a sink. Therefore the minimum number of sinks of the final graph is equal to one. So we can rewrite **NSINK** $= 1$ to **NSINK** ≥ 1 and simplify $\overline{\textbf{NSINK}}$ to $\overline{\textbf{NSINK}}$.

Automaton Figure 5.408 depicts the automaton associated with the in_same_partition constraint. Let $\texttt{VALUES}_i$ be the p attribute of the i^{th} item of the PARTITIONS collection. To each triple $(\texttt{VAR1}, \texttt{VAR2}, \texttt{VALUES}_i)$ corresponds a 0-1 signature variable S_i as well as the following signature constraint: $((\texttt{VAR1} \in \texttt{VALUES}_i) \wedge (\texttt{VAR2} \in \texttt{VALUES}_i)) \Leftrightarrow S_i$.

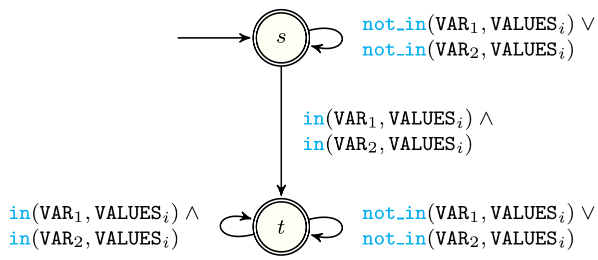


Figure 5.408: Automaton of the in_same_partition constraint

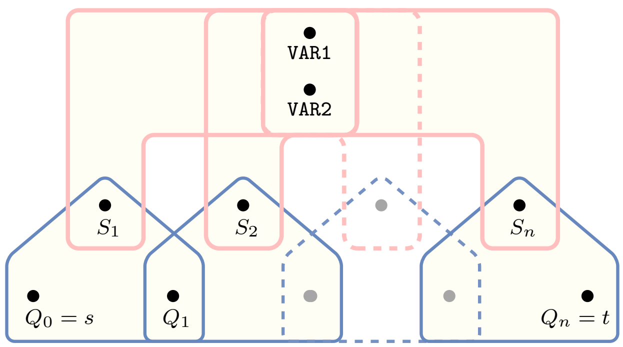


Figure 5.409: Hypergraph of the reformulation corresponding to the automaton of the in_same_partition constraint