5.310 ordered_nvector

DESCRIPTION LINKS GRAPH

Origin Derived from nvector.

Constraint ordered_nvector(NVEC, VECTORS)

Synonyms ordered_nvectors, ordered_npoint, ordered_npoints.

Type
```
VECTOR : collection(var−dvar)
```

Arguments
```
NVEC    : dvar
VECTORS : collection(vec − VECTOR)
```

Restrictions
```
|VECTOR| ≥ 1
NVEC ≥ min(1, |VECTORS|)
NVEC ≤ |VECTORS|
required(VECTORS, vec)
same_size(VECTORS, vec)
```

Purpose

Enforces the following two conditions:

1. NVEC is the number of distinct tuples of values assigned to the vectors of the collection VECTORS. Two tuples of values $\langle A_1, A_2, \ldots, A_m \rangle$ and $\langle B_1, B_2, \ldots, B_m \rangle$ are *distinct* if and only if there exist an integer $i \in [1, m]$ such that $A_i \neq B_i$.
2. For each pair of consecutive vectors $\texttt{VECTOR}_i$ and $\texttt{VECTOR}_{i+1}$ of the VECTORS collection we have that $\texttt{VECTOR}_i$ is lexicographically less than or equal to $\texttt{VECTOR}_{i+1}$. Given two vectors, $\vec{X}$ and $\vec{Y}$ of n components, $\langle X_0, \ldots, X_{n-1} \rangle$ and $\langle Y_0, \ldots, Y_{n-1} \rangle$, $\vec{X}$ is *lexicographically less than or equal to* $\vec{Y}$ if and only if $n = 0$ or $X_0 < Y_0$ or $X_0 = Y_0$ and $\langle X_1, \ldots, X_{n-1} \rangle$ is lexicographically less than or equal to $\langle Y_1, \ldots, Y_{n-1} \rangle$.

Example

$$\left(\begin{array}{c} \texttt{vec} - \langle 5, 6 \rangle, \\ 2, \left\langle \begin{array}{c} \texttt{vec} - \langle 5, 6 \rangle, \\ \texttt{vec} - \langle 5, 6 \rangle, \\ \texttt{vec} - \langle 9, 3 \rangle, \end{array} \right\rangle \\ \texttt{vec} - \langle 9, 3 \rangle \end{array} \right)$$

The ordered_nvector constraint holds since:

1. Its first argument NVEC $= 2$ is set to the number of distinct tuples of values (i.e., tuples $\langle 5, 6 \rangle$ and $\langle 9, 3 \rangle$) occurring within the collection VECTORS.
2. The vectors of the collection VECTORS are sorted in increasing lexicographical order.

Typical

$|\texttt{VECTOR}| > 1$
$\texttt{NVEC} > 1$
$\texttt{NVEC} < |\texttt{VECTORS}|$
$|\texttt{VECTORS}| > 1$

Arg. properties

- Functional dependency: NVEC determined by VECTORS.
- Contractible wrt. VECTORS when $\texttt{NVEC} = 1$ and $|\texttt{VECTORS}| > 0$.
- Contractible wrt. VECTORS when $\texttt{NVEC} = |\texttt{VECTORS}|$.

Reformulation

The ordered_nvector constraint can be reformulated as a conjunction of a nvector and a lex_chain_lesseq constraints.

See also

implies: lex_chain_lesseq *(*NVEC *of constraint* ordered_nvector *removed)*, nvector, ordered_atleast_nvector *(*$=$ NVEC *replaced by* $\geq$ NVEC*)*, ordered_atmost_nvector *(*$=$ NVEC *replaced by* $\leq$ NVEC*)*.

related: increasing_nvalue_chain.

root concept: increasing_nvalue.

used in graph description: lex_less, lex_lesseq.

Keywords

characteristic of a constraint: vector.

constraint type: counting constraint, order constraint.

modelling: functional dependency.

symmetry: symmetry.

Arc input(s)	VECTORS
Arc generator	$PATH \mapsto$ collection(vectors1, vectors2)
Arc arity	2
Arc constraint(s)	lex_lesseq(vectors1.vec, vectors2.vec)
Graph property(ies)	$\mathbf{NARC} = \lvert$VECTORS$\rvert - 1$

Arc input(s)	VECTORS
Arc generator	$PATH \mapsto$ collection(vectors1, vectors2)
Arc arity	2
Arc constraint(s)	lex_less(vectors1.vec, vectors2.vec)
Graph property(ies)	$\mathbf{NCC} =$ NVEC

Graph model Parts (A) and (B) of Figure 5.649 respectively show the initial and final graph of the second graph constraint associated with the **Example** slot. Since we use the **NCC** graph property in this second graph constraint, we show the different connected components of the final graph. Each strongly connected component corresponds to a tuple of values that is assigned to some vectors of the VECTORS collection. The 2 following tuple of values $\langle 5, 6\rangle$ and $\langle 9, 3\rangle$ are used by the vectors of the VECTORS collection.

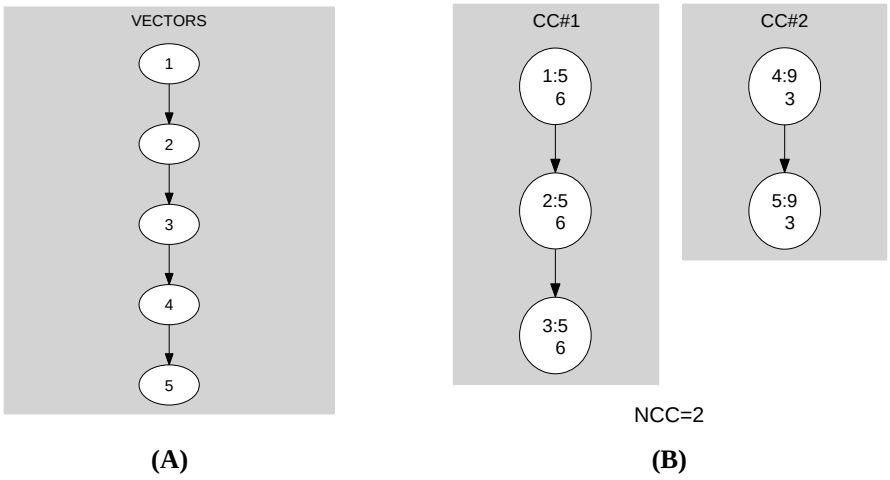

Figure 5.649: Initial and final graph of the ordered_nvector constraint