5.130 distance_between

DESCRIPTION LINKS GRAPH

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Constraint distance_between(DIST, VARIABLES1, VARIABLES2, CTR)

Synonym distance.

Arguments

DIST	:	dvar
VARIABLES1	:	collection(var−dvar)
VARIABLES2	:	collection(var−dvar)
CTR	:	atom

Restrictions

$\texttt{DIST} \geq 0$
$\texttt{DIST} \leq |\texttt{VARIABLES1}| * |\texttt{VARIABLES2}| - |\texttt{VARIABLES1}|$
required(VARIABLES1, var)
required(VARIABLES2, var)
$|\texttt{VARIABLES1}| = |\texttt{VARIABLES2}|$
$\texttt{CTR} \in [=, \neq, <, \geq, >, \leq]$

Purpose Let U_i and V_i be respectively the i^{th} and j^{th} variables $(i \neq j)$ of the collection VARIABLES1. In a similar way, let X_i and Y_i be respectively the i^{th} and j^{th} variables $(i \neq j)$ of the collection VARIABLES2. DIST is equal to the number of times one of the following mutually incompatible conditions are true:

- U_i CTR V_i holds and X_i CTR Y_i does not hold,
- X_i CTR Y_i holds and U_i CTR V_i does not hold.

Example $(2, \langle 3, 4, 6, 2, 4\rangle, \langle 2, 6, 9, 3, 6\rangle, <)$

The distance_between constraint holds since the following DIST $=$ 2 conditions are verified:

- $\texttt{VARIABLES1}[4].\texttt{var} = 2 < \texttt{VARIABLES1}[1].\texttt{var} = 3 \wedge$
  $\texttt{VARIABLES2}[4].\texttt{var} = 3 \geq \texttt{VARIABLES2}[1].\texttt{var} = 2$
- $\texttt{VARIABLES2}[1].\texttt{var} = 2 < \texttt{VARIABLES2}[4].\texttt{var} = 3 \wedge$
  $\texttt{VARIABLES1}[1].\texttt{var} = 3 \geq \texttt{VARIABLES1}[4].\texttt{var} = 2$

Typical

$\texttt{DIST} > 0$
$\texttt{DIST} < |\texttt{VARIABLES1}| * |\texttt{VARIABLES2}| - |\texttt{VARIABLES1}|$
$|\texttt{VARIABLES1}| > 1$
$\texttt{CTR} \in [=, \neq]$

Symmetries

- Arguments are permutable w.r.t. permutation (DIST) (VARIABLES1, VARIABLES2) (CTR).
- Items of VARIABLES1 and VARIABLES2 are permutable (*same permutation used*).
- One and the same constant can be added to the var attribute of all items of VARIABLES1.
- One and the same constant can be added to the var attribute of all items of VARIABLES2.

Arg. properties

Functional dependency: DIST determined by VARIABLES1, VARIABLES2 and CTR.

Usage

Measure the distance between two sequences in term of the number of constraint changes. This should be put in contrast to the number of value changes that is sometimes superficial.

See also

common keyword: distance_change *(proximity constraint)*.

Keywords

constraint arguments: pure functional dependency.

constraint type: proximity constraint.

modelling: functional dependency.

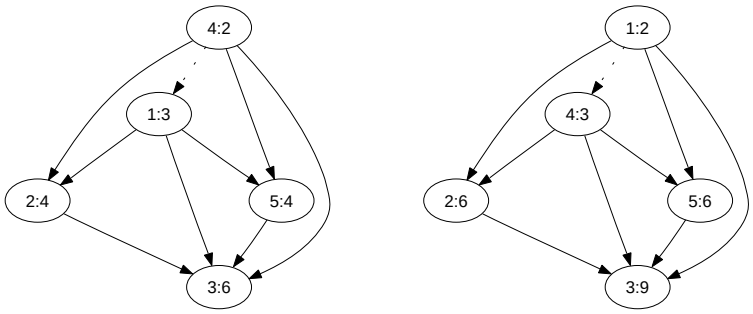
Arc input(s)	VARIABLES1/ VARIABLES2
Arc generator	$CLIQUE(\neq) \mapsto$ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var CTR variables2.var
Graph property(ies)	DISTANCE= DIST

Graph model Within the **Arc input(s)** slot, the character **/** indicates that we generate two distinct graphs. The graph property DISTANCE measures the distance between two digraphs G_1 and G_2. This distance is defined as the sum of the following quantities:

- The number of arcs of G_1 that do not belong to G_2,
- The number of arcs of G_2 that do not belong to G_1.

Part (A) of Figure 5.286 gives the final graph associated with the sequence var-3,var-4,var-6,var-2,var-4 (i.e., the second argument of the constraint of the **Example** slot), while part (B) shows the final graph corresponding to var-2,var-6,var-9,var-3,var-6 (i.e., the third argument of the constraint of the **Example** slot). The two arc constraints that differ from one graph to the other are marked by a dotted line. The distance_between constraint holds since between sequence var-3,var-4,var-6,var-2,var-4 and sequence var-2,var-6,var-9,var-3,var-6 there are DIST $= 2$ changes that respectively correspond to:

- Within the final graph associated with sequence var-3,var-4,var-6,var-2,var-4 the arc $4 \rightarrow 1$ (i.e., values $2 \rightarrow 3$) does not occur in the final graph associated with var-2,var-6,var-9,var-3,var-6,
- Within the final graph associated with sequence var-2,var-6,var-9,var-3,var-6 the arc $1 \rightarrow 4$ (i.e., values $2 \rightarrow 3$) does not occur in the final graph associated with var-3,var-4,var-6,var-2,var-4.



(A) **(B)**

Figure 5.286: Final graphs of the distance_between constraint