5.2 all_differ_from_at_least_k_pos

DESCRIPTION LINKS GRAPH

Origin Inspired by [177].

Constraint all_differ_from_at_least_k_pos(K, VECTORS)

Type

VECTOR	:	collection(var−dvar)

Arguments

K	:	int
VECTORS	:	collection(vec − VECTOR)

Restrictions

required(VECTOR, var)
$|\text{VECTOR}| \geq 1$
$|\text{VECTOR}| \geq \text{K}$
$\text{K} \geq 0$
required(VECTORS, vec)
same_size(VECTORS, vec)

Purpose Enforce all pairs of distinct vectors of the VECTORS collection to differ from at least K positions.

Example $\langle 2, \langle \text{vec} - \langle 2, 5, 2, 0\rangle, \text{vec} - \langle 3, 6, 2, 1\rangle, \text{vec} - \langle 3, 6, 1, 0\rangle\rangle\rangle$

The all_differ_from_at_least_k_pos constraint holds since:

- The first and second vectors differ from 3 positions, which is greater than or equal to $\text{K} = 2$.
- The first and third vectors differ from 3 positions, which is greater than or equal to $\text{K} = 2$.
- The second and third vectors differ from 2 positions, which is greater than or equal to $\text{K} = 2$.

Typical
$\text{K} > 0$
$|\text{VECTORS}| > 1$

Symmetries

- Items of VECTORS are permutable.
- Items of VECTORS.vec are permutable (*same permutation used*).

Arg. properties

- Contractible wrt. VECTORS.
- Extensible wrt. VECTORS.vec (*add items at same position*).

See also

implied by: all_differ_from_exactly_k_pos ($\geq$ K *replaced by* $=$ K).

part of system of constraints: differ_from_at_least_k_pos.

used in graph description: differ_from_at_least_k_pos.

Keywords **application area:** bioinformatics.

characteristic of a constraint: disequality, vector.

constraint type: system of constraints, decomposition.

final graph structure: no loop, symmetric.

Cond. implications `all_differ_from_at_least_k_pos`(`K`, `VECTORS`)
with $\texttt{K} \leq |\texttt{VECTORS}|$
implies `atleast_nvector`(`NVEC`, `VECTORS`).

Arc input(s)	VECTORS
Arc generator	$CLIQUE(\neq) \mapsto$ collection(vectors1, vectors2)
Arc arity	2
Arc constraint(s)	differ_from_at_least_k_pos(K, vectors1.vec, vectors2.vec)
Graph property(ies)	NARC= |VECTORS| * |VECTORS| − |VECTORS|
Graph class	• NO_LOOP • SYMMETRIC

Graph model

The **Arc constraint(s)** slot uses the differ_from_at_least_k_pos constraint defined in this catalogue.

Parts (A) and (B) of Figure 5.2 respectively show the initial and final graph associated with the **Example** slot. Since we use the NARC graph property, the arcs of the final graph are stressed in bold. The previous constraint holds since exactly $3 \cdot (3-1) = 6$ arc constraints hold.

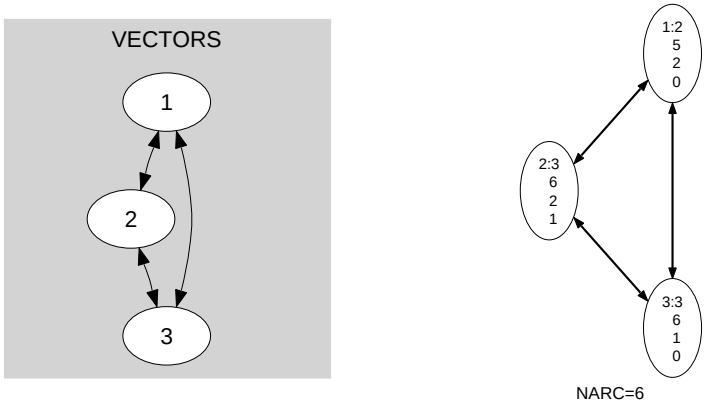

Figure 5.2: Initial and final graph of the all_differ_from_at_least_k_pos constraint

Signature

Since we use the $CLIQUE(\neq)$ arc generator on the items of the VECTORS collection, the expression |VECTORS| · |VECTORS| − |VECTORS| corresponds to the maximum number of arcs of the final graph. Therefore we can rewrite the graph property NARC = |VECTORS| · |VECTORS| − |VECTORS| to NARC ≥ |VECTORS| · |VECTORS| − |VECTORS|. This leads to simplify NARC to NARC.