5.85 connect_points

DESCRIPTION LINKS GRAPH

Origin

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Constraint

connect_points(SIZE1, SIZE2, SIZE3, NGROUP, POINTS)

Arguments

SIZE1	:	int
SIZE2	:	int
SIZE3	:	int
NGROUP	:	dvar
POINTS	:	collection(p−dvar)

Restrictions

SIZE1 > 0
SIZE2 > 0
SIZE3 > 0
NGROUP ≥ 0
NGROUP $\leq$ |POINTS|
SIZE1 $*$ SIZE2 $*$ SIZE3 $=$ |POINTS|
required(POINTS, p)

Purpose

On a 3-dimensional grid of variables, number of groups, where a group consists of a connected set of variables that all have a same value distinct from 0.

Example

$$
\left(\begin{array}{c}
8,4,2,2,\left\langle\begin{array}{c}
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-1,\mathtt{p}-1,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-1,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-1,\\
\mathtt{p}-1,\mathtt{p}-1,\\
\mathtt{p}-1,\mathtt{p}-1,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-1,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-2,\mathtt{p}-2,\\
\mathtt{p}-2,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0,\\
\mathtt{p}-0,\mathtt{p}-2,\\
\mathtt{p}-0,\mathtt{p}-0
\end{array}\right\rangle
\end{array}\right)
$$

Figure 5.195 corresponds to the solution where we describe separately each layer of the grid. The `connect_points` constraint holds since we have two groups (`NGROUP` $=2$): a first one for the variables of the `POINTS` collection assigned to value 1, and a second one for the variables assigned to value 2.

0	0	**1**	**1**	0	**2**	0	0
0	0	0	**1**	0	**2**	0	0
0	0	0	**1**	**1**	**1**	**1**	**1**
0	**2**	0	**1**	0	**2**	0	0

0	0	0	0	0	0	0	0
0	0	0	0	0	**2**	0	0
0	**2**	**2**	**2**	**2**	**2**	0	0
0	**2**	0	0	0	**2**	0	0

Figure 5.195: The two layers of the solution

Typical

SIZE1 > 1
SIZE2 > 1
NGROUP > 0
NGROUP $<$ |POINTS|
|POINTS| > 3

Symmetry

All occurrences of two distinct values of POINTS.p that are both different from 0 can be swapped; all occurrences of a value of POINTS.p that is different from 0 can be renamed to any unused value that is also different from 0.

Arg. properties

Functional dependency: NGROUP determined by SIZE1, SIZE2, SIZE3 and POINTS.

Usage

Wiring problems [382], [450].

Algorithm

Since the graph corresponding to the 3-dimensional grid is symmetric one could certainly use as a starting point the filtering algorithm associated with the *number of connected components* graph property described in [52] (see the paragraphs "*Estimating* $\underline{\mathbf{NCC}}$" and "*Estimating* $\overline{\mathbf{NCC}}$"). One may also try to take advantage of the fact that the considered initial graph is a grid in order to simplify the previous filtering algorithm.

Keywords

characteristic of a constraint: joker value.

final graph structure: strongly connected component, symmetric.

geometry: geometrical constraint.

modelling: functional dependency.

problems: channel routing.

Arc input(s)	POINTS
Arc generator	$GRID$([SIZE1, SIZE2, SIZE3]) $\mapsto$collection(points1, points2)
Arc arity	2
Arc constraint(s)	• points1.p $\neq 0$ • points1.p = points2.p
Graph property(ies)	**NSCC**= NGROUP
Graph class	SYMMETRIC

Graph model Figure 5.196 gives the initial graph constructed by the $GRID$ arc generator associated with the **Example** slot.

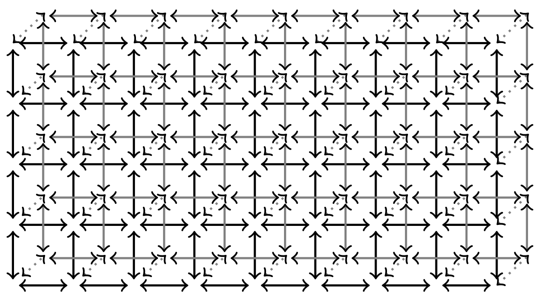

Figure 5.196: Graph generated by $GRID$([8,4,2])