5.152 equal_sboxes

DESCRIPTION LINKS LOGIC

Origin Geometry, derived from [338]

Constraint equal_sboxes(K, DIMS, OBJECTS, SBOXES)

Synonym equal.

Types

VARIABLES	:	collection(v−dvar)
INTEGERS	:	collection(v−int)
POSITIVES	:	collection(v−int)

Arguments

K	:	int
DIMS	:	sint
OBJECTS	:	collection(oid−int, sid−dvar, x − VARIABLES)
SBOXES	:	collection(sid−int, t − INTEGERS, l − POSITIVES)

Restrictions

$|\mathtt{VARIABLES}| \geq 1$
$|\mathtt{INTEGERS}| \geq 1$
$|\mathtt{POSITIVES}| \geq 1$
required(VARIABLES, v)
$|\mathtt{VARIABLES}| = \mathtt{K}$
required(INTEGERS, v)
$|\mathtt{INTEGERS}| = \mathtt{K}$
required(POSITIVES, v)
$|\mathtt{POSITIVES}| = \mathtt{K}$
$\mathtt{POSITIVES.v} > 0$
$\mathtt{K} > 0$
$\mathtt{DIMS} \geq 0$
$\mathtt{DIMS} < \mathtt{K}$
increasing_seq(OBJECTS, [oid])
required(OBJECTS, [oid, sid, x])
$\mathtt{OBJECTS.oid} \geq 1$
$\mathtt{OBJECTS.oid} \leq |\mathtt{OBJECTS}|$
$\mathtt{OBJECTS.sid} \geq 1$
$\mathtt{OBJECTS.sid} \leq |\mathtt{SBOXES}|$
$|\mathtt{SBOXES}| \geq 1$
required(SBOXES, [sid, t, l])
$\mathtt{SBOXES.sid} \geq 1$
$\mathtt{SBOXES.sid} \leq |\mathtt{SBOXES}|$
do_not_overlap(SBOXES)

Purpose

Holds if, for each pair of objects (O_i, O_j), $i \neq j$, O_i and O_j coincide exactly with respect to a set of dimensions depicted by DIMS. O_i and O_j are objects that take a shape among a set of shapes. Each *shape* is defined as a finite set of shifted boxes, where each shifted box is described by a box in a K-dimensional space at a given offset (from the origin of the shape) with given sizes. More precisely, a *shifted box* is an entity defined by its shape id `sid`, shift offset `t`, and sizes `l`. Then, a shape is defined as the union of shifted boxes sharing the same shape id. An *object* is an entity defined by its unique object identifier `oid`, shape id `sid` and origin `x`.

Two objects O_i and object O_j are *equal* with respect to a set of dimensions depicted by DIMS if and only if, for all shifted box s_i associated with O_i there exists a shifted box s_j such that, for all dimensions $d \in$ DIMS, (1) the origins of s_i and s_j coincide and, (2) the ends of s_i and s_j also coincide.

Example

$$\left(\begin{array}{l} 2, \{0,1\}, \\ \left\langle \begin{array}{lll} \texttt{oid}-1 & \texttt{sid}-2 & \texttt{x}-\langle 4,1\rangle, \\ \texttt{oid}-2 & \texttt{sid}-2 & \texttt{x}-\langle 4,1\rangle, \\ \texttt{oid}-3 & \texttt{sid}-2 & \texttt{x}-\langle 4,1\rangle \end{array} \right\rangle, \\ \left\langle \begin{array}{lll} \texttt{sid}-1 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 1,2\rangle, \\ \texttt{sid}-2 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 1,1\rangle, \\ \texttt{sid}-2 & \texttt{t}-\langle 1,0\rangle & \texttt{l}-\langle 1,3\rangle, \\ \texttt{sid}-2 & \texttt{t}-\langle 0,2\rangle & \texttt{l}-\langle 1,1\rangle, \\ \texttt{sid}-3 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 3,1\rangle, \\ \texttt{sid}-3 & \texttt{t}-\langle 0,1\rangle & \texttt{l}-\langle 1,1\rangle, \\ \texttt{sid}-3 & \texttt{t}-\langle 2,1\rangle & \texttt{l}-\langle 1,1\rangle, \\ \texttt{sid}-4 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 1,1\rangle \end{array} \right\rangle \end{array}\right)$$

Figure 5.342 shows the objects of the example. Since these objects coincide exactly the `equal_sboxes` constraint holds.

Typical

$|\texttt{OBJECTS}| > 1$

Symmetries

- Items of OBJECTS are permutable.
- Items of SBOXES are permutable.
- Items of OBJECTS.x, SBOXES.t and SBOXES.l are permutable (*same permutation used*).

Arg. properties

Suffix-contractible wrt. OBJECTS.

Remark

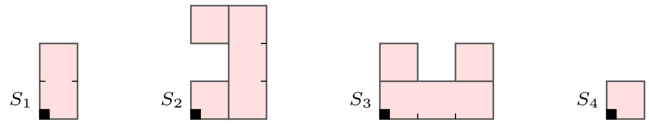
One of the eight relations of the *Region Connection Calculus* [338]. The constraint `equal_sboxes` is a restriction of the original relation since it requires to have exactly the same partition between the different objects.

See also

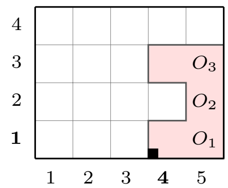
common keyword: `contains_sboxes`, `coveredby_sboxes`, `covers_sboxes`, `disjoint_sboxes`, `inside_sboxes`, `meet_sboxes` (*rcc8*), `non_overlap_sboxes` (*geometrical constraint*,*logic*), `overlap_sboxes` (*rcc8*).

Keywords

constraint type: logic.



(A) Possible shapes S_1, S_2, S_3 and S_4



OBJECTS

O_1:	oid $-$ 1	sid $-$ 2	x $-$ $\langle 4, 1 \rangle$
O_2:	oid $-$ 2	sid $-$ 2	x $-$ $\langle 4, 1 \rangle$
O_3:	oid $-$ 3	sid $-$ 2	x $-$ $\langle 4, 1 \rangle$

(B) Three objects which exactly coincide

Figure 5.342: (B) The three mutually coinciding objects O_1, O_2, O_3 of the **Example** slot respectively assigned shape S_2; (A) shapes S_1, S_2, S_3 and S_4 are respectively made up from 1, 3, 3 and 1 disjoint shifted box.

geometry: geometrical constraint, rcc8.

miscellaneous: obscure.

Logic

- $\texttt{origin}(\texttt{O1},\texttt{S1},\texttt{D}) \stackrel{\text{def}}{=} \texttt{O1.x}(\texttt{D}) + \texttt{S1.t}(\texttt{D})$
- $\texttt{end}(\texttt{O1},\texttt{S1},\texttt{D}) \stackrel{\text{def}}{=} \texttt{O1.x}(\texttt{D}) + \texttt{S1.t}(\texttt{D}) + \texttt{S1.l}(\texttt{D})$
- $\texttt{equal\_sboxes}(\texttt{Dims},\texttt{O1},\texttt{S1},\texttt{O2},\texttt{S2}) \stackrel{\text{def}}{=}$
  $$\forall \texttt{D} \in \texttt{Dims} \quad \bigwedge \left(\begin{array}{l} \texttt{origin}(\texttt{O1},\texttt{S1},\texttt{D}) = \\ \texttt{origin}(\texttt{O2},\texttt{S2},\texttt{D}) \end{array} , \begin{array}{l} \texttt{end}(\texttt{O1},\texttt{S1},\texttt{D}) = \\ \texttt{end}(\texttt{O2},\texttt{S2},\texttt{D}) \end{array} \right)$$
- $\texttt{equal\_objects}(\texttt{Dims},\texttt{O1},\texttt{O2}) \stackrel{\text{def}}{=}$
  $$\forall \texttt{S1} \in \texttt{sboxes}([\texttt{O1.sid}]) \quad \exists \texttt{S2} \in \texttt{sboxes}\left(\left[\texttt{O2.sid} \right] \right) \quad \texttt{equal\_sboxes}\left(\begin{array}{l} \texttt{Dims}, \\ \texttt{O1}, \\ \texttt{S1}, \\ \texttt{O2}, \\ \texttt{S2} \end{array} \right)$$
- $\texttt{all\_equal}(\texttt{Dims},\texttt{OIDS}) \stackrel{\text{def}}{=}$
  $$\forall \texttt{O1} \in \texttt{objects}(\texttt{OIDS}) \quad \forall \texttt{O2} \in \texttt{objects}(\texttt{OIDS}) \quad \begin{array}{l} \texttt{O1.oid} = \\ \texttt{O2.oid} - 1 \end{array} \Rightarrow \texttt{equal\_objects}\left(\begin{array}{l} \texttt{Dims}, \\ \texttt{O1}, \\ \texttt{O2} \end{array} \right)$$
- $\texttt{all\_equal}(\texttt{DIMENSIONS},\texttt{OIDS})$