5.130 equal_sboxes

DESCRIPTION LINKS LOGIC

Origin Geometry, derived from [305]

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−int, x − VARIABLES)
SBOXES : collection(sid−int, t − INTEGERS, l − POSITIVES)

Restrictions

required(VARIABLES, v)
|VARIABLES| = K
required(INTEGERS, v)
|INTEGERS| = K
required(POSITIVES, v)
|POSITIVES| = K
POSITIVES.v > 0
K > 0
DIMS ≥ 0
DIMS < K
required(OBJECTS, [oid, sid, x])
OBJECTS.oid ≥ 1
OBJECTS.oid ≤ |OBJECTS|
OBJECTS.sid ≥ 1
OBJECTS.sid ≤ |SBOXES|
required(SBOXES, [sid, t, l])
SBOXES.sid ≥ 1
SBOXES.sid ≤ |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 5.260 shows the objects of the example. Since these objects coincide exactly the `equal_sboxes` constraint holds.

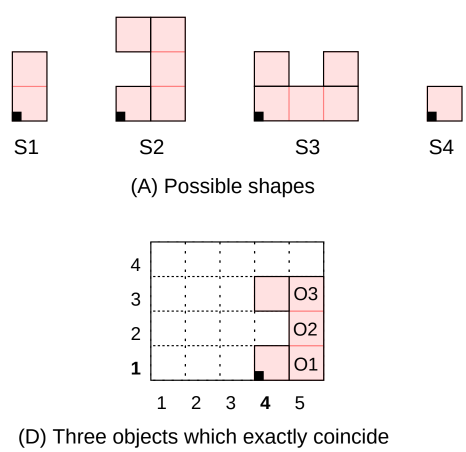

Figure 5.260: The three mutually coinciding objects of the example

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*).

Remark

One of the eight relations of the *Region Connection Calculus* [305]. 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.

geometry: geometrical constraint, rcc8.

Logic

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