5.194 inside_sboxes

DESCRIPTION LINKS LOGIC

Origin Geometry, derived from [338]

Constraint inside_sboxes(K, DIMS, OBJECTS, SBOXES)

Synonym inside.

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

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

Purpose

Holds if, for each pair of objects (O_i, O_j), $i < j$, O_i is inside O_j 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.
An object O_i *is inside* an object O_j with respect to a set of dimensions depicted by DIMS if and only if, for all shifted boxes s_i associated with O_i, there exists a shifted box s_j of O_j such that s_j is inside s_i. A shifted box s_j *is inside* a shifted box s_i if and only if, for all dimensions $d \in$ DIMS, (1) the start of s_j in dimension d is strictly less than the start of s_i in dimension d, and (2) the end of s_i in dimension d is strictly less than the end of s_j in dimension d.

Example

$$\left(\begin{array}{l} 2, \{0,1\}, \\ \left\langle\begin{array}{lll} \texttt{oid}-1 & \texttt{sid}-1 & \texttt{x}-\langle 3,3\rangle, \\ \texttt{oid}-2 & \texttt{sid}-2 & \texttt{x}-\langle 2,2\rangle, \\ \texttt{oid}-3 & \texttt{sid}-3 & \texttt{x}-\langle 1,1\rangle \end{array}\right\rangle, \\ \left\langle\begin{array}{lll} \texttt{sid}-1 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 1,1\rangle, \\ \texttt{sid}-2 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 3,3\rangle, \\ \texttt{sid}-3 & \texttt{t}-\langle 0,0\rangle & \texttt{l}-\langle 5,5\rangle \end{array}\right\rangle \end{array}\right)$$

Figure 5.451 shows the objects of the example. Since O_1 is inside O_2 and O_3, and since O_2 is also inside O_3, the inside_sboxes constraint holds.

Typical

$|\texttt{OBJECTS}| > 1$

Symmetries

- 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 inside_sboxes is a restriction of the original relation since it requires that each box of an object is contained by one box of the other object.

See also

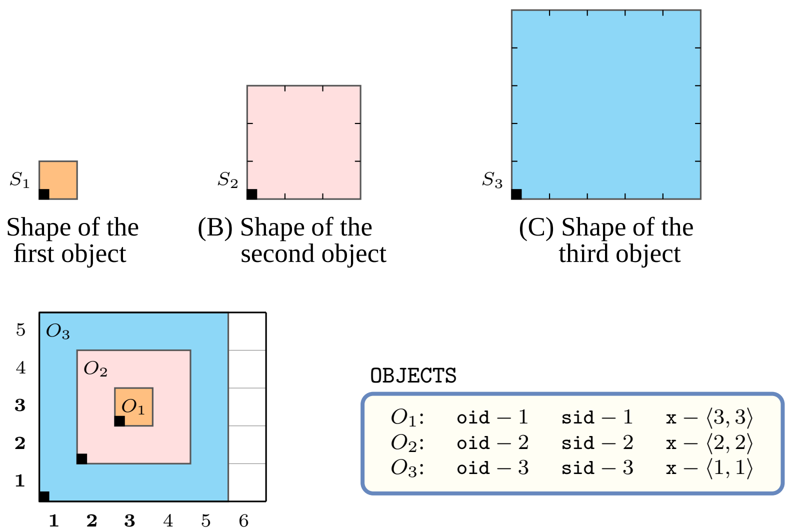
common keyword: contains_sboxes, coveredby_sboxes, covers_sboxes, disjoint_sboxes, equal_sboxes, meet_sboxes *(rcc8)*, non_overlap_sboxes *(geometrical constraint,logic)*, overlap_sboxes *(rcc8)*.

Keywords

constraint type: logic.

geometry: geometrical constraint, rcc8.

miscellaneous: obscure.



(A) Shape of the first object

(B) Shape of the second object

(C) Shape of the third object

(D) Three objects O_1, O_2, O_3, where O_1 is inside O_2 and O_3, and where O_2 is inside O_3

Figure 5.451: (D) the three nested objects O_3, O_2, O_1 of the **Example** slot respectively assigned shapes S_3, S_2, S_1; (A), (B), (C) shapes S_1, S_2 and S_3 are made up from a single shifted box.

Logic

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