

5.194 `inside_sboxes`

	DESCRIPTION	LINKS	LOGIC
Origin	Geometry, derived from [338]		
Constraint	<code>inside_sboxes(K, DIMS, OBJECTS, SBOXES)</code>		
Synonym	<code>inside.</code>		
Types	VARIABLES : <code>collection(v-dvar)</code> INTEGERS : <code>collection(v-int)</code> POSITIVES : <code>collection(v-int)</code>		
Arguments	K : <code>int</code> DIMS : <code>sint</code> OBJECTS : <code>collection(oid-int, sid-dvar, x - VARIABLES)</code> SBOXES : <code>collection(sid-int, t - INTEGERS, l - POSITIVES)</code>		
Restrictions	$ VARIABLES \geq 1$ $ INTEGERS \geq 1$ $ POSITIVES \geq 1$ <code>required(VARIABLES, v)</code> $ VARIABLES = K$ <code>required(INTEGERS, v)</code> $ INTEGERS = K$ <code>required(POSITIVES, v)</code> $ POSITIVES = K$ $POSITIVES.v > 0$ $K > 0$ $DIMS \geq 0$ $DIMS < K$ <code>increasing-seq(OBJECTS, [oid])</code> <code>required(OBJECTS, [oid, sid, x])</code> $OBJECTS.oid \geq 1$ $OBJECTS.oid \leq OBJECTS $ $OBJECTS.sid \geq 1$ $OBJECTS.sid \leq SBOXES $ $ SBOXES \geq 1$ <code>required(SBOXES, [sid, t, l])</code> $SBOXES.sid \geq 1$ $SBOXES.sid \leq SBOXES $ <code>do_not_overlap(SBOXES)</code>		

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 $d \in \text{DIMS}$, (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

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

Figure 5.434 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

`|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](#).

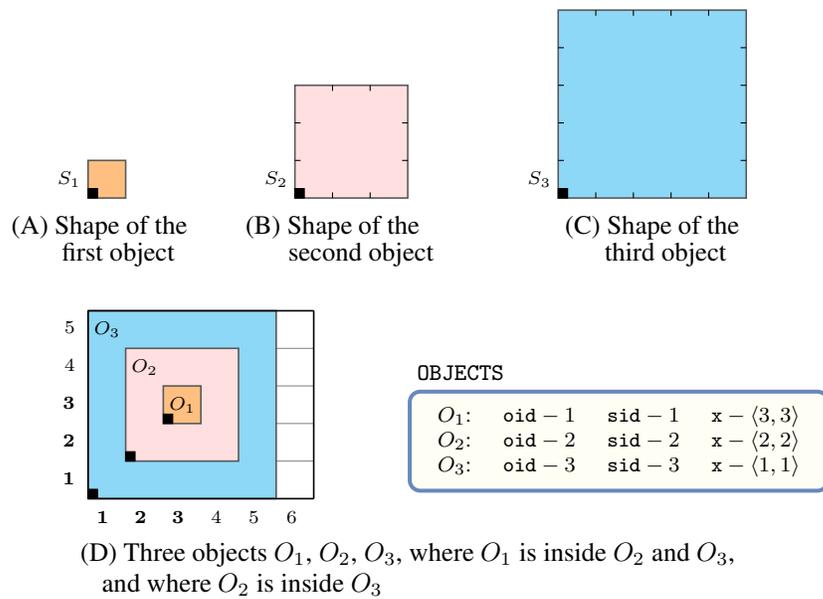


Figure 5.434: (D) the three nested objects O_3, O_2, O_1 of the **Example** slot respectively assigned shapes S_3, S_2, S_1 ; (A), (B), (C) shapes S_1, S_2 and S_3 are made up from a single shifted box.

Logic

- $\text{origin}(O1, S1, D) \stackrel{\text{def}}{=} O1.x(D) + S1.t(D)$
- $\text{end}(O1, S1, D) \stackrel{\text{def}}{=} O1.x(D) + S1.t(D) + S1.l(D)$
- $\text{inside_sboxes}(\text{Dims}, O1, S1, O2, S2) \stackrel{\text{def}}{=} \forall D \in \text{Dims} \wedge \left(\begin{array}{l} \text{origin}(O2, S2, D) < \\ \text{origin}(O1, S1, D) \\ \text{end}(O1, S1, D) < \\ \text{end}(O2, S2, D) \end{array} \right)$
- $\text{inside_objects}(\text{Dims}, O1, O2) \stackrel{\text{def}}{=} \forall S1 \in \text{sboxes}([O1.\text{sid}]) \exists S2 \in \text{sboxes}([O2.\text{sid}]) \text{inside_sboxes} \left(\begin{array}{l} \text{Dims}, \\ O1, \\ S1, \\ O2, \\ S2 \end{array} \right)$
- $\text{all_inside}(\text{Dims}, \text{OIDS}) \stackrel{\text{def}}{=} \forall O1 \in \text{objects}(\text{OIDS}) \forall O2 \in \text{objects}(\text{OIDS}) O1.\text{oid} < \Rightarrow O2.\text{oid} \text{inside_objects} \left(\begin{array}{l} \text{Dims}, \\ O1, \\ O2 \end{array} \right)$
- $\text{all_inside}(\text{DIMENSIONS}, \text{OIDS})$