5.252 meet_sboxes

DESCRIPTION LINKS LOGIC

Origin Geometry, derived from [338]

Constraint meet_sboxes(K, DIMS, OBJECTS, SBOXES)

Synonym meet.

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

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

Purpose

Holds if, for each pair of objects (O_i, O_j), $i \neq j$, O_i and O_j meet with respect to a set of dimensions depicted by `DIMS`. 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 *meet* with respect to a set of dimensions depicted by `DIMS` if and only if the two following conditions hold:

- For all shifted box s_i associated with O_i and for all shifted box s_j associated with O_j there exists a dimension $d \in$ `DIMS` such that (1) the start of s_i in dimension d is greater than or equal to the end of s_j in dimension d, or (2) the start of s_j in dimension d is greater than or equal to the end of s_i in dimension d (i.e., there is no overlap between the shifted box of O_i and the shifted box of O_j).
- There exists a shifted box s_i of O_i and there exists a shifted box s_j of O_j such that for all dimensions d (1) the end of s_i in dimension d is greater than or equal to the start of s_j in dimension d, and (2) the end of s_j in dimension d is greater than or equal to the start of s_i in dimension d (i.e., at least two shifted box of O_i and O_j are in contact).

Example

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

Figure 5.547 shows the objects of the example. Since all the pairs of objects meet the `meet_sboxes` constraint holds.

Typical

$|\texttt{OBJECTS}| > 1$

Symmetries

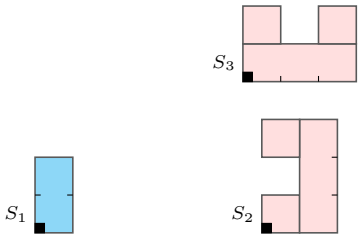
- Items of `OBJECTS` are permutable.
- Items of `SBOXES` are permutable.
- Items of `OBJECTS.x`, `SBOXES.t` and `SBOXES.l` are permutable (*same permutation used*).

Arg. properties

Suffix-contractible wrt. `OBJECTS`.

Remark

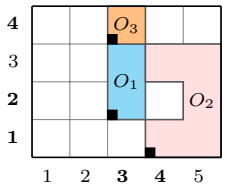
One of the eight relations of the *Region Connection Calculus* [338].



(A) Shape of the first object

(B) Shapes of the second object

(C) Shape of the third object



OBJECTS

O_1:	oid − 1	sid − 1	x − ⟨3, 2⟩
O_2:	oid − 2	sid − 2	x − ⟨4, 1⟩
O_3:	oid − 3	sid − 4	x − ⟨3, 4⟩

(D) Three objects for which each pair of objects meet

Figure 5.547: (D) the three pairwise meeting objects O_1, O_2, O_3 of the **Example** slot respectively assigned shapes S_1, S_2, S_4; (A), (B), (C) shapes S_1, S_2, S_3 and S_4 are respectively made up from 1, 3, 3 and 1 disjoint shifted box.

See also

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

Keywords

constraint type: logic.

geometry: geometrical constraint, rcc8.

Logic

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