

### 5.101 `diffn_column`

	DESCRIPTION	LINKS	GRAPH
<b>Origin</b>	CHIP: option guillotine cut (column) of <code>diffn</code> .		
<b>Constraint</b>	<code>diffn_column(ORTHOTOPE, DIM)</code>		
<b>Type</b>	ORTHOTOPE : <code>collection(ori-dvar, siz-dvar, end-dvar)</code>		
<b>Arguments</b>	ORTHOTOPE : <code>collection(orth - ORTHOTOPE)</code> DIM : <code>int</code>		
<b>Restrictions</b>	$ \text{ORTHOTOPE}  > 0$ <code>require_at_least(2, ORTHOTOPE, [ori, siz, end])</code> $\text{ORTHOTOPE.siz} \geq 0$ $\text{ORTHOTOPE.ori} \leq \text{ORTHOTOPE.end}$ <code>required(ORTHOTOPE, orth)</code> <code>same_size(ORTHOTOPE, orth)</code> $\text{DIM} > 0$ $\text{DIM} \leq  \text{ORTHOTOPE} $ <code>diffn(ORTHOTOPE)</code>		

Extension of the generalised multi-dimensional non-overlapping `diffn` constraint. Holds if, for each pair of `orthotopes` ( $O_1, O_2$ ) the following conditions hold:

**Purpose**

- $O_1$  and  $O_2$  do not overlap. Two `orthotopes` do not overlap if there exists at least one dimension where their projections do not overlap.
- Let  $P_1$  and  $P_2$  respectively denote the projections of  $O_1$  and  $O_2$  in dimension DIM. If  $P_1$  and  $P_2$  overlap then the size of their intersection is equal to the size of  $O_1$  in dimension DIM, as well as to the size of  $O_2$  in dimension DIM.

**Example**

$$\left( \begin{array}{l} \text{orth} - \left\langle \begin{array}{l} \text{ori} - 1 \quad \text{siz} - 3 \quad \text{end} - 4, \\ \text{ori} - 3 \quad \text{siz} - 2 \quad \text{end} - 5 \end{array} \right\rangle, \\ \text{orth} - \left\langle \begin{array}{l} \text{ori} - 9 \quad \text{siz} - 1 \quad \text{end} - 10, \\ \text{ori} - 4 \quad \text{siz} - 3 \quad \text{end} - 7 \end{array} \right\rangle, \\ \text{orth} - \left\langle \begin{array}{l} \text{ori} - 4 \quad \text{siz} - 2 \quad \text{end} - 6, \\ \text{ori} - 3 \quad \text{siz} - 4 \quad \text{end} - 7 \end{array} \right\rangle, \\ \left\langle \text{orth} - \left\langle \begin{array}{l} \text{ori} - 1 \quad \text{siz} - 3 \quad \text{end} - 4, \\ \text{ori} - 6 \quad \text{siz} - 1 \quad \text{end} - 7 \end{array} \right\rangle, \right. \\ \left. \text{orth} - \left\langle \begin{array}{l} \text{ori} - 6 \quad \text{siz} - 2 \quad \text{end} - 8, \\ \text{ori} - 1 \quad \text{siz} - 4 \quad \text{end} - 5 \end{array} \right\rangle, \right. \\ \text{orth} - \left\langle \begin{array}{l} \text{ori} - 10 \quad \text{siz} - 1 \quad \text{end} - 11, \\ \text{ori} - 1 \quad \text{siz} - 1 \quad \text{end} - 2 \end{array} \right\rangle, \\ \text{orth} - \left\langle \begin{array}{l} \text{ori} - 9 \quad \text{siz} - 1 \quad \text{end} - 10, \\ \text{ori} - 1 \quad \text{siz} - 1 \quad \text{end} - 2 \end{array} \right\rangle, \\ \text{orth} - \left\langle \begin{array}{l} \text{ori} - 6 \quad \text{siz} - 2 \quad \text{end} - 8, \\ \text{ori} - 6 \quad \text{siz} - 1 \quad \text{end} - 7 \end{array} \right\rangle \end{array} \right), 1$$

Figure 5.208 represents the respective position of the eight rectangles of the example. The coordinates of the leftmost lowest corner of each rectangle are stressed in bold. The `diffn_column` constraint holds since (1) the eight rectangles do not overlap and since (2) when their projection in dimension DIM = 1 overlap the size of their intersection is equal to the size of the corresponding rectangles in dimension DIM = 1.

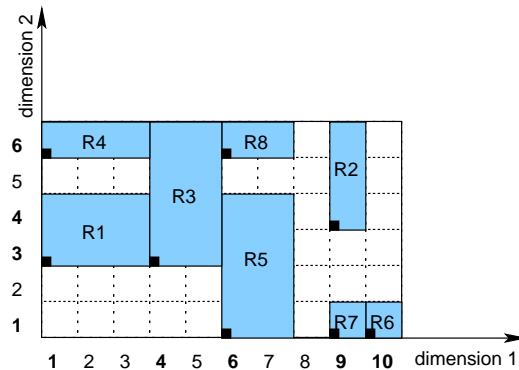


Figure 5.208: Eight non-overlapping rectangles such that, for each pair of rectangles  $R_i, R_j$  ( $1 \leq i < j \leq 12$ ), if the projections in dimension 1 of rectangles  $R_i$  and  $R_j$  intersect then the size of their intersection is equal to the size of  $R_i$  in dimension 1 and to the size of  $R_j$  in dimension 1

#### Typical

```
|ORTHOPE| > 1
ORTHOPE.siz > 0
|ORTHOPEs| > 1
```

#### Symmetries

- Items of ORTHOTOPES are [permutable](#).
- One and the same constant can be [added](#) to the `ori` and `end` attributes of all items of ORTHOTOPES.orth.

#### See also

**common keyword:** `diffn` (*geometrical constraint, orthotope*), `diffn_include` (*geometrical constraint, orthotope, positioning constraint*).  
**used in graph description:** `two_orth_column`.

#### Keywords

**constraint type:** `decomposition`.  
**geometry:** `geometrical constraint`, `positioning constraint`, `orthotope`, `guillotine cut`.

<b>Arc input(s)</b>	ORTHOTOPES
<b>Arc generator</b>	$\text{CLIQUE}(<) \mapsto \text{collection}(\text{orthotopes1}, \text{orthotopes2})$
<b>Arc arity</b>	2
<b>Arc constraint(s)</b>	$\text{two\_orth\_column}(\text{orthotopes1.orth}, \text{orthotopes2.orth}, \text{DIM})$
<b>Graph property(ies)</b>	$\text{NARC} =  \text{ORTHOTOPES}  * ( \text{ORTHOTOPES}  - 1) / 2$

**Graph model**

Since showing all items produces too big graphs, parts (A) and (B) of Figure 5.209 respectively show the initial and final graph associated with the first three items of the **Example** slot. Since we use the **NARC** graph property, the arcs of the final graph are stressed in bold.

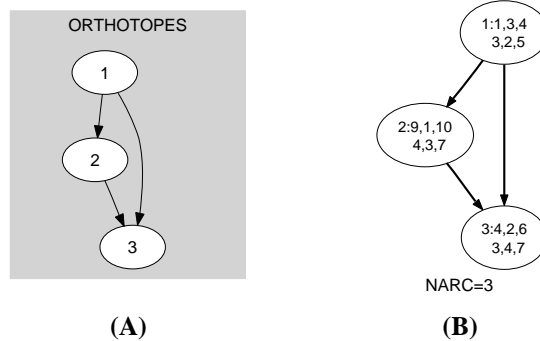


Figure 5.209: Initial and final graph of the diffn\_column constraint

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