

## 5.251 open\_minimum

	DESCRIPTION	LINKS	AUTOMATON
<b>Origin</b>	Derived from <a href="#">minimum</a>		
<b>Constraint</b>	open_minimum(MIN, VARIABLES)		
<b>Arguments</b>	MIN : <a href="#">dvar</a> VARIABLES : <a href="#">collection</a> (var-dvar, bool-dvar)		
<b>Restrictions</b>	$ VARIABLES  > 0$ <a href="#">required</a> (VARIABLES, [var, bool]) $VARIABLES.bool \geq 0$ $VARIABLES.bool \leq 1$		
<b>Purpose</b>	MIN is the minimum value of the variables $VARIABLES[i].var$ , ( $1 \leq i \leq  VARIABLES $ ) for which $VARIABLES[i].bool = 1$ (at least one of the Boolean variables is set to 1).		
<b>Example</b>	$\left( 3, \left\langle \begin{array}{cc} \text{var} - 3 & \text{bool} - 1, \\ \text{var} - 1 & \text{bool} - 0, \\ \text{var} - 7 & \text{bool} - 0, \\ \text{var} - 5 & \text{bool} - 1, \\ \text{var} - 5 & \text{bool} - 1 \end{array} \right\rangle \right)$		
	The open_minimum constraint holds since its first argument $MIN = 3$ is set to the minimum value of values 3, 1, 7, 5, 5 for which the corresponding Boolean 1, 0, 0, 1, 1 is set to 1 (i.e., values 3, 5, 5).		
<b>Symmetries</b>	<ul style="list-style-type: none"> <li>• Items of VARIABLES are <a href="#">permutable</a>.</li> <li>• One and the same constant can be <a href="#">added</a> to MIN as well as to the var attribute of all items of VARIABLES.</li> </ul>		
<b>Remark</b>	The open_minimum constraint is used in the reformulation of the <a href="#">tree_range</a> constraint.		
<b>See also</b>	<a href="#">comparison swapped</a> : <a href="#">open_maximum</a> . <a href="#">hard version</a> : <a href="#">minimum</a> . <a href="#">used in graph description</a> : <a href="#">in_set</a> . <a href="#">uses in its reformulation</a> : <a href="#">tree_range</a> .		
<b>Keywords</b>	<a href="#">characteristic of a constraint</a> : <a href="#">minimum</a> , <a href="#">automaton</a> , <a href="#">automaton without counters</a> , <a href="#">reified automaton constraint</a> . <a href="#">constraint network structure</a> : <a href="#">centered cyclic(1) constraint network(1)</a> . <a href="#">constraint type</a> : <a href="#">order constraint</a> , <a href="#">open constraint</a> , <a href="#">open automaton constraint</a> .		

**Automaton**

Figure 5.470 depicts the automaton associated with the `open_minimum` constraint. Let  $VAR_i, B_i$  be the  $i^{th}$  item of the `VARIABLES` collection. To each triple  $(MIN, VAR_i, B_i)$  corresponds a signature variable  $S_i$  as well as the following signature constraint:  $(B_i = 1 \wedge MIN < VAR_i \Leftrightarrow S_i = 0) \wedge (B_i = 1 \wedge MIN = VAR_i \Leftrightarrow S_i = 1) \wedge (B_i = 1 \wedge MIN > VAR_i \Leftrightarrow S_i = 2) \wedge (B_i = 0 \wedge MIN < VAR_i \Leftrightarrow S_i = 3) \wedge (B_i = 0 \wedge MIN = VAR_i \Leftrightarrow S_i = 4) \wedge (B_i = 0 \wedge MIN > VAR_i \Leftrightarrow S_i = 5)$ .

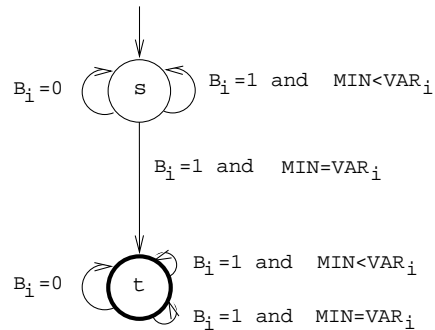


Figure 5.470: Automaton of the `open_minimum` constraint

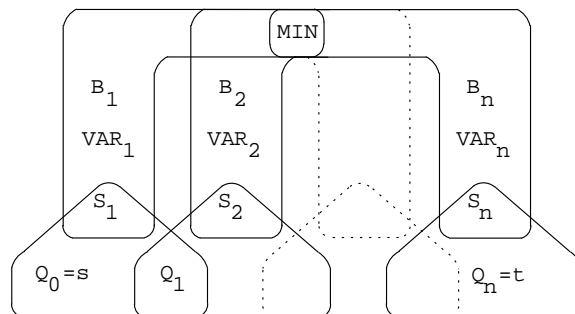


Figure 5.471: Hypergraph of the reformulation corresponding to the automaton of the `open_minimum` constraint