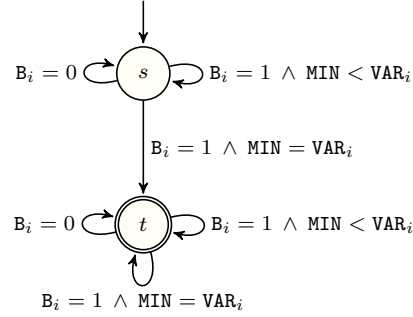
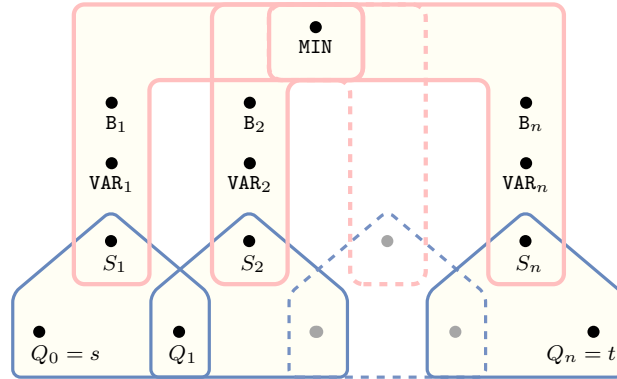


## 5.302 open\_minimum

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

**Automaton**

Figure 5.638 depicts the automaton associated with the `open_minimum` constraint. Let  $\text{VAR}_i, B_i$  be the  $i^{\text{th}}$  item of the `VARIABLES` collection. To each triple  $(\text{MIN}, \text{VAR}_i, B_i)$  corresponds a signature variable  $S_i$  as well as the following signature constraint:  $(B_i = 1 \wedge \text{MIN} < \text{VAR}_i \Leftrightarrow S_i = 0) \wedge (B_i = 1 \wedge \text{MIN} = \text{VAR}_i \Leftrightarrow S_i = 1) \wedge (B_i = 1 \wedge \text{MIN} > \text{VAR}_i \Leftrightarrow S_i = 2) \wedge (B_i = 0 \wedge \text{MIN} < \text{VAR}_i \Leftrightarrow S_i = 3) \wedge (B_i = 0 \wedge \text{MIN} = \text{VAR}_i \Leftrightarrow S_i = 4) \wedge (B_i = 0 \wedge \text{MIN} > \text{VAR}_i \Leftrightarrow S_i = 5)$ .

Figure 5.638: Automaton of the `open_minimum` constraintFigure 5.639: Hypergraph of the reformulation corresponding to the automaton of the `open_minimum` constraint