5.301   open_maximum

Origin   Derived from maximum

Constraint   open_maximum(MAX, VARIABLES)

Arguments   MAX   : dvar
                    VARIABLES : collection(var−dvar, bool−dvar)

Restrictions $|\texttt{VARIABLES}| > 0$
                    required(VARIABLES, [var, bool])
                    VARIABLES.bool ≥ 0
                    VARIABLES.bool ≤ 1

Purpose   MAX is the maximum value of the variables VARIABLES$[i]$.var, $(1 \leq i \leq |\texttt{VARIABLES}|)$ for which VARIABLES$[i]$.bool $= 1$ (at least one of the Boolean variables is set to 1).

Example
$$\left(5, \left\langle \begin{array}{ll} \texttt{var} - 3 & \texttt{bool} - 1, \\ \texttt{var} - 1 & \texttt{bool} - 0, \\ \texttt{var} - 7 & \texttt{bool} - 0, \\ \texttt{var} - 5 & \texttt{bool} - 1, \\ \texttt{var} - 5 & \texttt{bool} - 1 \end{array} \right\rangle \right)$$

The open_maximum constraint holds since its first argument MAX $= 5$ is set to the maximum 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 $3, 5, 5$).

Typical $|\texttt{VARIABLES}| > 1$
                    range(VARIABLES.var) > 1

Symmetries   • Items of VARIABLES are permutable.
                    • One and the same constant can be added to MAX as well as to the var attribute of all items of VARIABLES.

See also   **comparison swapped:** open_minimum.
                    hard version: maximum.
                    used in graph description: in_set.

Keywords   **characteristic of a constraint:**   maximum,   automaton,   automaton without counters, reified automaton constraint.
                    constraint network structure: centered cyclic(1) constraint network(1).
                    constraint type: order constraint, open constraint, open automaton constraint.

Automaton   Figure 5.636 depicts the automaton associated with the open_maximum constraint. Let
VAR_i, B_i be the ith item of the VARIABLES collection. To each triple (MAX, VAR_i, B_i)
corresponds a signature variable S_i as well as the following signature constraint: $(B_i = 1 \land MAX < VAR_i \Leftrightarrow S_i = 0) \land (B_i = 1 \land MAX = VAR_i \Leftrightarrow S_i = 1) \land (B_i = 1 \land MAX > VAR_i \Leftrightarrow S_i = 2) \land (B_i = 0 \land MAX < VAR_i \Leftrightarrow S_i = 3) \land (B_i = 0 \land MAX = VAR_i \Leftrightarrow S_i = 4) \land (B_i = 0 \land MAX > VAR_i \Leftrightarrow S_i = 5)$.
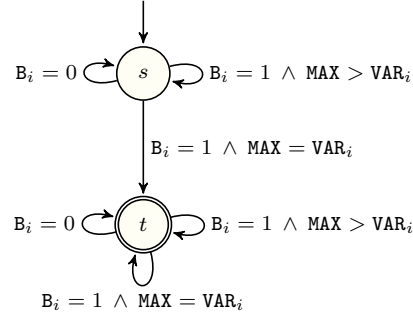
Figure 5.636: Automaton of the open_maximum constraint
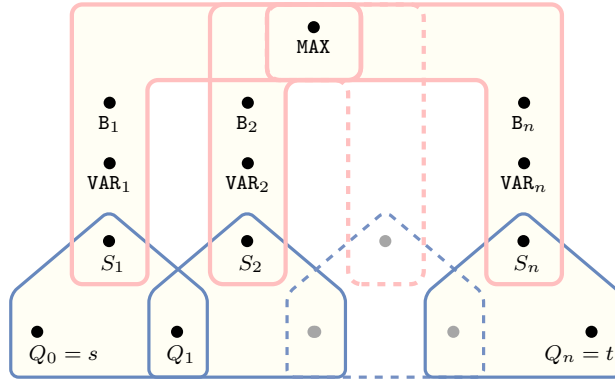
Figure 5.637: Hypergraph of the reformulation corresponding to the automaton of the
open_maximum constraint