## 5.292   nvisible_from_end

DESCRIPTION   **LINKS**   **AUTOMATON**

Origin   Derived from nvisible_from_start

Constraint   nvisible_from_end(N, VARIABLES)

Synonyms   nvisible, nvisible_from_right.

Arguments

    N   : dvar
    VARIABLES : collection(var−dvar)

Restrictions

    required(VARIABLES, var)
    $N \geq \min(1, |\text{VARIABLES}|)$
    $N \leq |\text{VARIABLES}|$

Purpose

The ith $(1 \leq i \leq |\text{VARIABLES}|)$ variable of the sequence VARIABLES is *visible* if and only if all variables after the ith variable are strictly smaller than the ith variable itself. N is the total number of visible variables of the sequence of variables VARIABLES.

Example

    $(2, \langle 1, 6, 2, 1, 4, 8, 2 \rangle)$
    $(1, \langle 3, 6, 2, 1, 4, 8, 8 \rangle)$
    $(7, \langle 9, 8, 7, 5, 4, 3, 2 \rangle)$

The first nvisible_from_end constraint holds since the sequence 1 6 2 1 4 8 2 contains two visible items that respectively correspond to the seventh and sixth items.

Typical

    $|\text{VARIABLES}| > 2$
    range(VARIABLES.var) > 2

Symmetry   One and the same constant can be added to the var attribute of all items of VARIABLES.

Arg. properties

Functional dependency: N determined by VARIABLES.

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	9	64	625	7776	117649	2097152	43046721

Number of solutions for nvisible_from_end: domains $0..n$

Solution density for `nvisible_from_end`

Solution density for `nvisible_from_end`
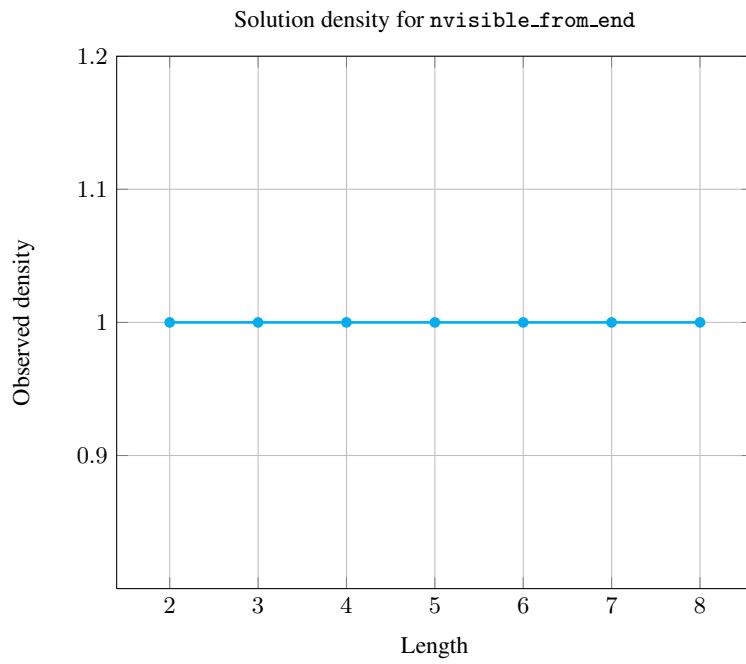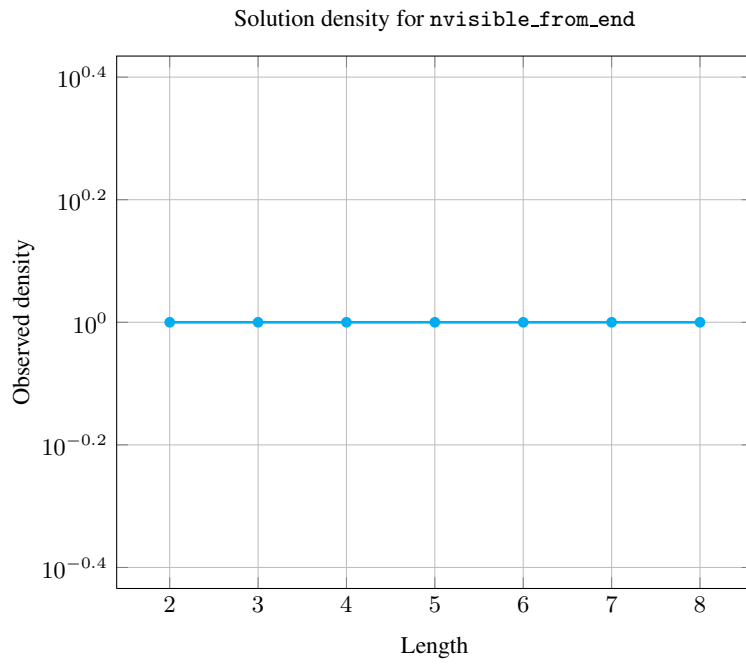
Length (n)		2	3	4	5	6	7	8
Total		9	64	625	7776	117649	2097152	43046721
Parameter value	1	6	30	225	2275	29008	446964	8080425
	2	3	30	305	3675	52794	889056	17238570
	3	-	4	90	1610	29400	583548	12780180
	4	-	-	5	210	6020	158760	4238367
	5	-	-	-	6	420	18060	661500
	6	-	-	-	-	7	756	46410
	7	-	-	-	-	-	8	1260
	8	-	-	-	-	-	-	9

Solution count for `nvisible_from_end`: domains $0..n$

Solution density for `nvisible_from_end`

Solution density for `nvisible_from_end`
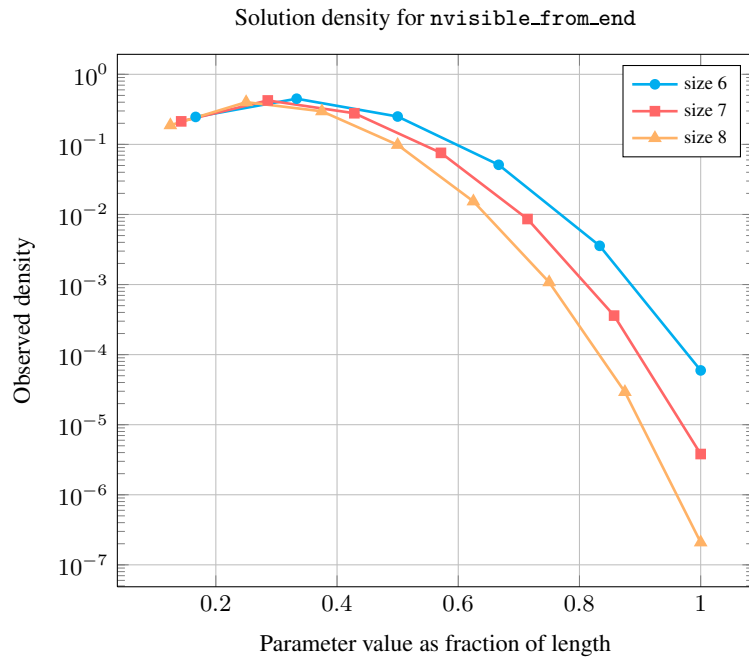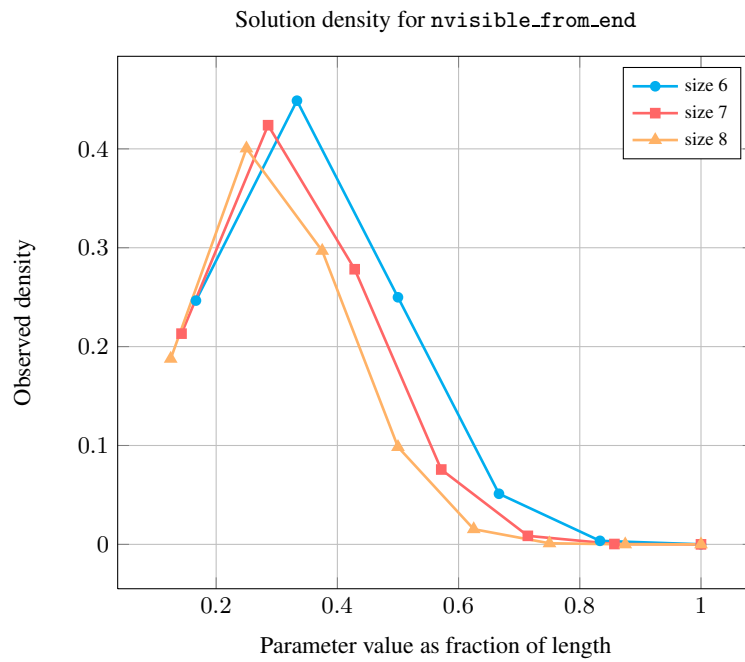
See also   **implies:** `atleast_nvalue`.

related: `nvisible_from_start` *(count from the start of the sequence rather than from the end).*

Keywords   **combinatorial object:** sequence.

constraint arguments: pure functional dependency.

modelling: functional dependency.

Automaton   Figure 5.607 depicts the automaton associated with the `nvisible_from_end` constraint.

$$0,$$
$$\left\{ \begin{array}{c} M < \texttt{VAR}_i \Rightarrow \\ M \leftarrow \texttt{VAR}_i, \\ C \leftarrow C+1 \end{array} \right\}$$

$$\left\{ \begin{array}{c} M \leftarrow 0, \\ C \leftarrow 0 \end{array} \right\} \longrightarrow \; s \qquad \begin{array}{c} 0, \\ \{M \leftarrow \texttt{VAR}_i, C \leftarrow 1\} \end{array} \longrightarrow \; t \qquad \begin{array}{c} 0, \\ \left\{ \begin{array}{c} M \geq \texttt{VAR}_i \Rightarrow \\ M \leftarrow M, \\ C \leftarrow C \end{array} \right\} \end{array}$$
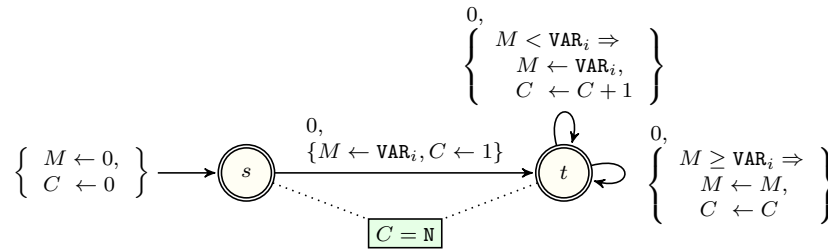
$$\boxed{C = \texttt{N}}$$

Figure 5.607: Automaton of the `nvisible_from_end` constraint with two counters M and C, where M records the largest value encountered so far, and C the number of visible values from the right hand side of the sequence $\texttt{VAR}_1, \texttt{VAR}_2, \ldots, \texttt{VAR}_n$ (i.e., the sequence $\texttt{VAR}_n, \texttt{VAR}_{n-1}, \ldots, \texttt{VAR}_1$ is passed to the automaton)

$$
\begin{array}{cccc}
\bullet & \bullet & \bullet & \bullet \\
\texttt{VAR}_n & \texttt{VAR}_{n-1} & & \texttt{VAR}_1 \\
\bullet & \bullet & \bullet & \bullet \\
Q_0 = s & Q_1 & & Q_n \in \{s, t\} \\
\bullet & \bullet & \bullet & \bullet \\
M_0 = 0 & M_1 & & M_n \\
\bullet & \bullet & \bullet & \bullet \\
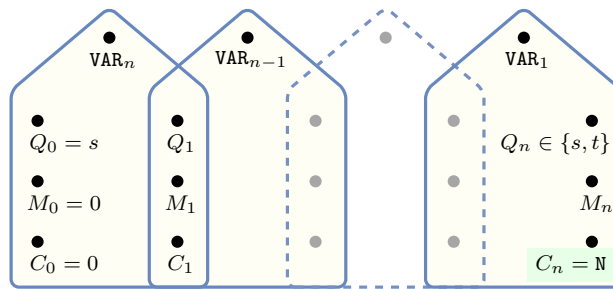C_0 = 0 & C_1 & & C_n = \texttt{N}
\end{array}
$$

Figure 5.608: Hypergraph of the reformulation corresponding to the automaton (with two counters) of the `nvisible_from_end` constraint (since all states of the automaton are accepting there is no restriction on the last variable Q_n)