5.110 decreasing

DESCRIPTION LINKS GRAPH AUTOMATON

Origin Inspired by increasing.

Constraint decreasing(VARIABLES)

Argument VARIABLES : collection(var−dvar)

Restriction required(VARIABLES, var)

Purpose The variables of the collection VARIABLES are decreasing.

Example $(\langle 8, 4, 1, 1\rangle)$

The decreasing constraint holds since $8 \geq 4 \geq 1 \geq 1$.

Typical $|\text{VARIABLES}| > 2$
$\text{range}(\text{VARIABLES.var}) > 1$

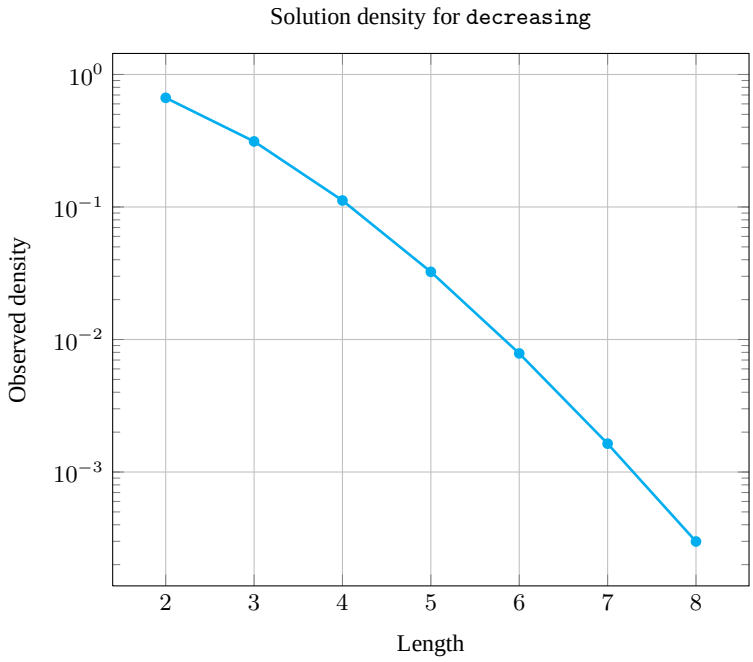
Symmetry One and the same constant can be added to the var attribute of all items of VARIABLES.

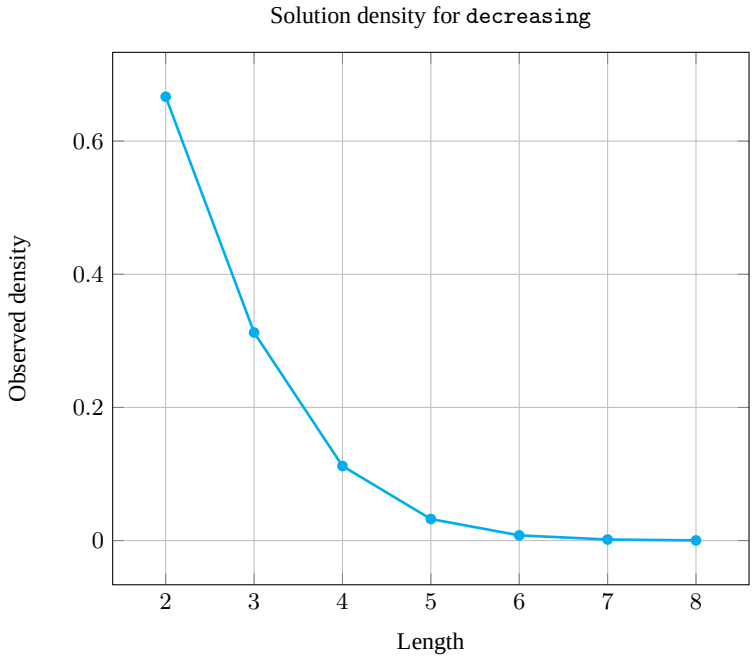
Arg. properties Contractible wrt. VARIABLES.

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	6	20	70	252	924	3432	12870

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





Systems `increasingNValue` in **Choco**, `rel` in **Gecode**, `decreasing` in **MiniZinc**.

See also **common keyword:** `strictly_increasing` (*order constraint*).

comparison swapped: increasing.

implied by: all_equal, strictly_decreasing.

implies: multi_global_contiguity, no_peak, no_valley.

Keywords

characteristic of a constraint: automaton, automaton without counters, reified automaton constraint.

constraint network structure: sliding cyclic(1) constraint network(1).

constraint type: decomposition, order constraint.

filtering: arc-consistency.

final graph structure: acyclic, bipartite, no loop.

Arc input(s)	VARIABLES
Arc generator	$PATH \mapsto$ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var $\geq$ variables2.var
Graph property(ies)	**NARC**$=$ |VARIABLES| $-$ 1
Graph class	• ACYCLIC • BIPARTITE • NO_LOOP

Graph model Parts (A) and (B) of Figure 5.259 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NARC** graph property, the arcs of the final graph are stressed in bold.

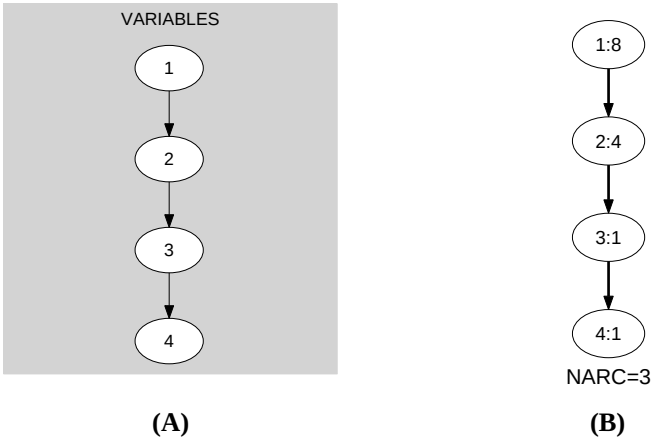


Figure 5.259: Initial and final graph of the decreasing constraint

Automaton

Figure 5.260 depicts the automaton associated with the decreasing constraint. To each pair of consecutive variables $(\mathtt{VAR}_i, \mathtt{VAR}_{i+1})$ of the collection VARIABLES corresponds a 0-1 signature variable S_i. The following signature constraint links $\mathtt{VAR}_i$, $\mathtt{VAR}_{i+1}$ and S_i: $\mathtt{VAR}_i \geq \mathtt{VAR}_{i+1} \Leftrightarrow S_i$.

Figure 5.260: Automaton of the decreasing constraint

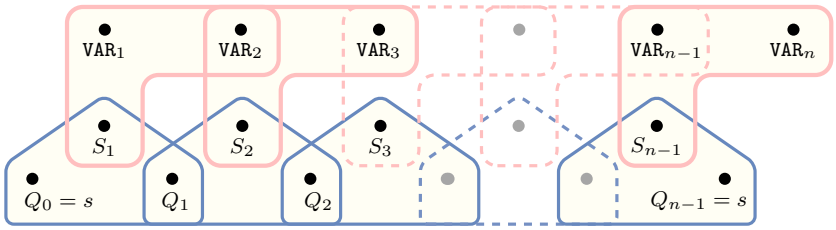


Figure 5.261: Hypergraph of the reformulation corresponding to the automaton of the decreasing constraint