5.280 no_valley

DESCRIPTION LINKS AUTOMATON

Origin

Derived from valley.

Constraint

no_valley(VARIABLES)

Argument

VARIABLES : collection(var−dvar)

Restrictions

$|$VARIABLES$| > 0$
required(VARIABLES, var)

Purpose

A variable V_k $(1 < k < m)$ of the sequence of variables VARIABLES $= V_1, \ldots, V_m$ is a *valley* if and only if there exists an i $(1 < i \leq k)$ such that $V_{i-1} > V_i$ and $V_i = V_{i+1} = \cdots = V_k$ and $V_k < V_{k+1}$. The total number of valleys of the sequence of variables VARIABLES is equal to 0.

Example

$(\langle 1, 1, 4, 8, 8, 2\rangle)$

The no_valley constraint holds since the sequence 1 1 4 8 8 2 does not contain any valley.

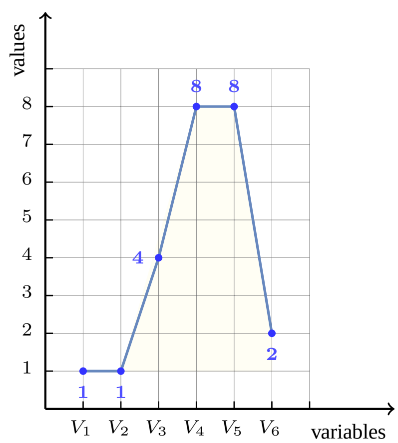


Figure 5.602: Illustration of the **Example** slot: a sequence of five variables V_1, V_2, V_3, V_4, V_5, V_6 respectively fixed to values 1, 1, 4, 8, 8, 2 without any valley

Typical

$|$VARIABLES$| > 3$
range(VARIABLES.var) > 1

Symmetries

- Items of `VARIABLES` can be reversed.
- One and the same constant can be added to the `var` attribute of all items of `VARIABLES`.

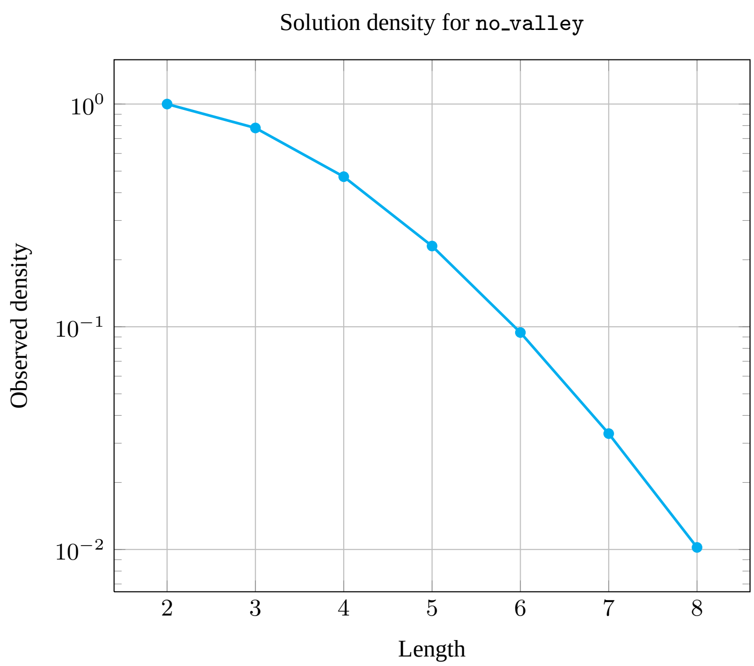
Arg. properties

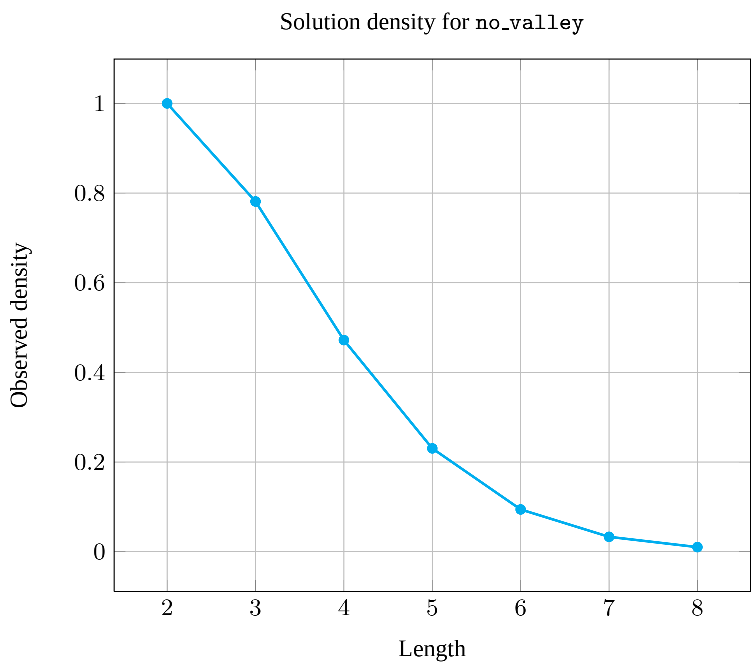
Contractible wrt. `VARIABLES`.

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	9	50	295	1792	11088	69498	439791

Number of solutions for `no_valley`: domains $0..n$





See also

comparison swapped: no_peak.

generalisation: valley *(introduce a* variable *counting the number of valleys)*.

implied by: decreasing, global_contiguity, increasing.

implies: all_equal_valley_min.

related: peak.

Keywords

characteristic of a constraint: automaton, automaton without counters, automaton with same input symbol, reified automaton constraint.

combinatorial object: sequence.

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

Automaton Figure 5.603 depicts the automaton associated with the `no_valley` constraint. To each pair of consecutive variables $(\mathtt{VAR}_i, \mathtt{VAR}_{i+1})$ of the collection `VARIABLES` corresponds a signature variable S_i. The following signature constraint links $\mathtt{VAR}_i$, $\mathtt{VAR}_{i+1}$ and S_i: $(\mathtt{VAR}_i < \mathtt{VAR}_{i+1} \Leftrightarrow S_i = 0) \wedge (\mathtt{VAR}_i = \mathtt{VAR}_{i+1} \Leftrightarrow S_i = 1) \wedge (\mathtt{VAR}_i > \mathtt{VAR}_{i+1} \Leftrightarrow S_i = 2)$.

STATES SEMANTICS

s	: stationary/increasing mode	$(\{<\mid=\}^*)$
t	: decreasing mode	$(>\{>\mid=\}^*)$

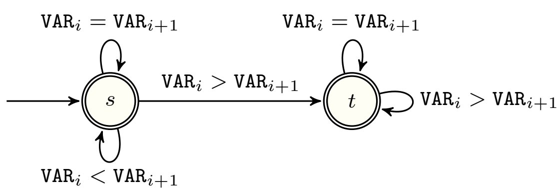


Figure 5.603: Automaton of the `no_valley` constraint

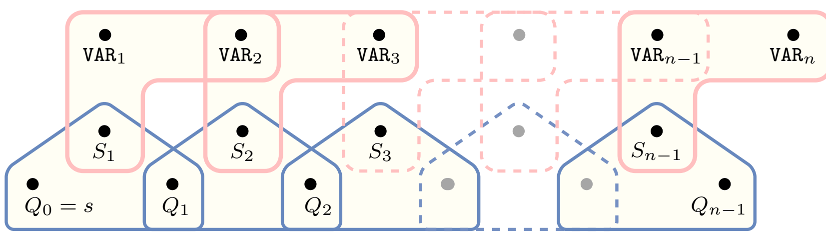


Figure 5.604: Hypergraph of the reformulation corresponding to the automaton of the `no_valley` constraint (since all states of the automaton are accepting there is no restriction on the last variable Q_{n-1})