## 5.237 longest_decreasing_sequence

DESCRIPTION LINKS AUTOMATON

**Origin** constraint on sequences

**Constraint** longest_decreasing_sequence(L, VARIABLES)

**Synonym** size_longest_decreasing_sequence.

**Arguments**

| | | |
|---|---|---|
| L | : | dvar |
| VARIABLES | : | collection(var−dvar) |

**Restrictions**

L ≥ 0
L <range(VARIABLES.var)
required(VARIABLES, var)

**Purpose** L is the largest difference between the first and the last value of the maximum decreasing sequences of the collection VARIABLES.
A sequence of consecutive variables $X_i, X_{i+1}, \ldots, X_j$ $(1 \leq i \leq j \leq |\texttt{VARIABLES}|)$ of the collection of variables VARIABLES is a *maximum decreasing sequence* if all the following conditions simultaneously apply:

- $X_i \geq X_{i+1} \geq \cdots \geq X_j$,
- $i = 1$ or $X_{i-1} < X_i$,
- $i = |\texttt{VARIABLES}|$ or $X_j < X_{j+1}$.

**Example**

$(0, \langle 0, 1, 2, 5\rangle)$
$(0, \langle 8, 8\rangle)$
$(6, \langle 10, 8, 8, 6, 4, 9, 10, 8\rangle)$

Figure 5.523 gives a graphical representation of the third example of the **Example** slot with its two maximum decreasing sequences in red of respective size 6 and 2. The corresponding longest_decreasing_sequence constraint holds since its first argument L is fixed to the maximum size 6.

**Typical**

L > 0
|VARIABLES| > 1
nval(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: L determined by VARIABLES.

**Counting**

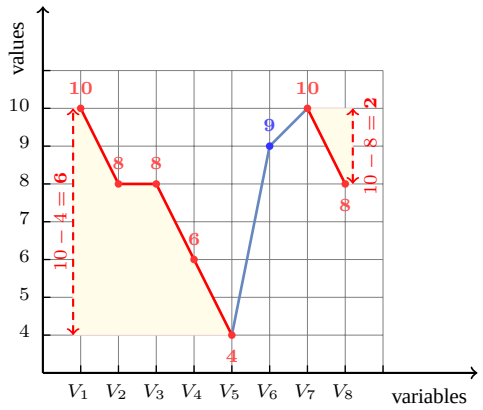
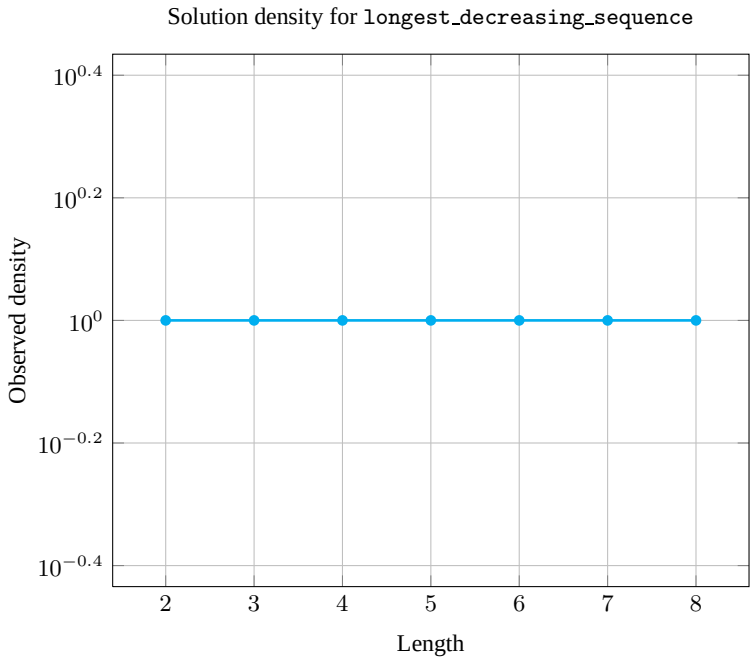
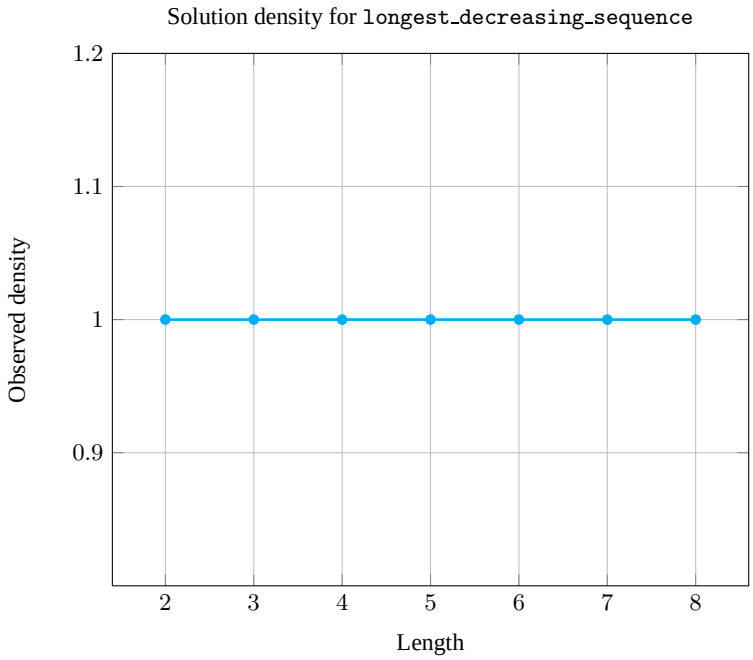



Figure 5.523: Illustration of the third example of the **Example** slot: a sequence of eight variables $V_1$, $V_2$, $V_3$, $V_4$, $V_5$, $V_6$, $V_7$, $V_8$ respectively fixed to values $10$, $8$, $8$, $6$, $4$, $9$, $10$, $8$ and its two maximum decreasing sequences in red of respective size $10 - 4 = 6$ and $10 - 8 = 2$.

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

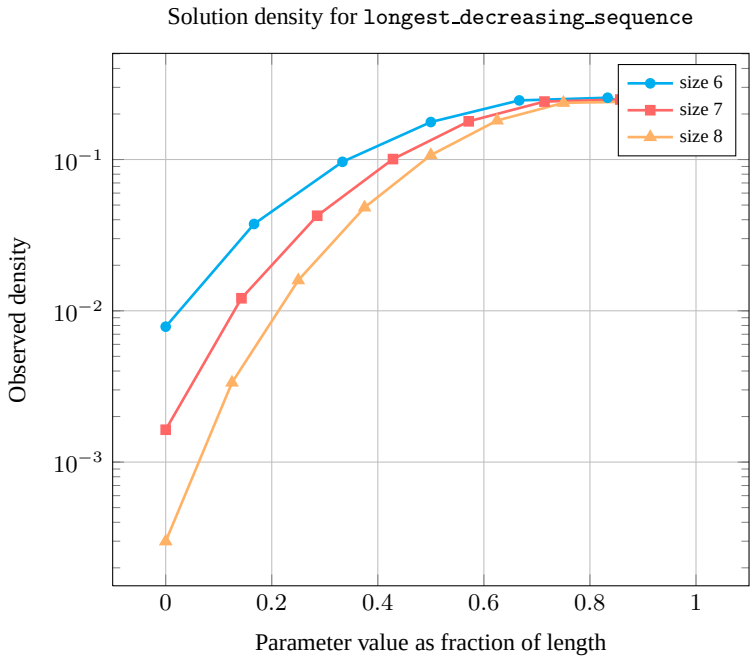
Number of solutions for `longest_decreasing_sequence`: domains $0..n$

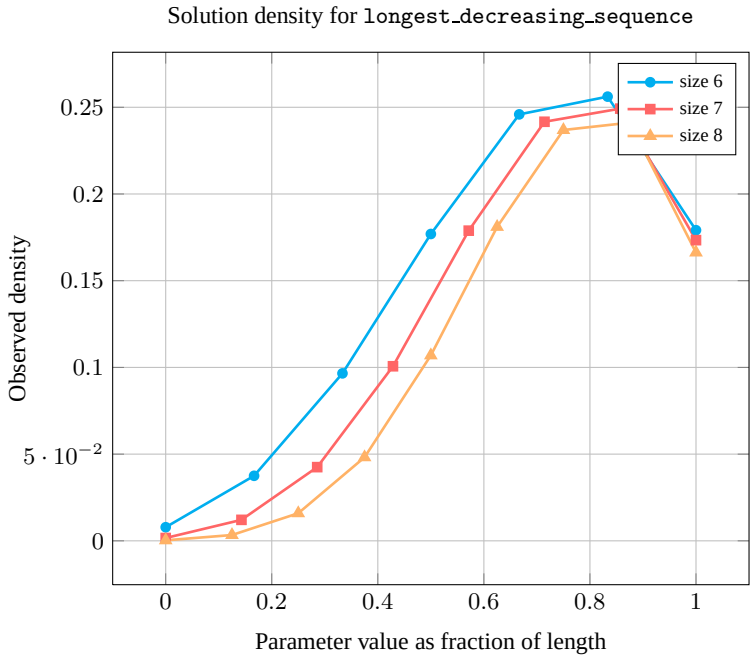





| Length ($n$) | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Total | | 9 | 64 | 625 | 7776 | 117649 | 2097152 | 43046721 |
| Parameter value | 0 | 6 | 20 | 70 | 252 | 924 | 3432 | 12870 |
| | 1 | 2 | 18 | 122 | 750 | 4412 | 25382 | 144314 |
| | 2 | 1 | 16 | 161 | 1398 | 11361 | 89132 | 685090 |
| | 3 | - | 10 | 162 | 1942 | 20816 | 211106 | 2074365 |
| | 4 | - | - | 110 | 2024 | 28930 | 375084 | 4603682 |
| | 5 | - | - | - | 1410 | 30134 | 506766 | 7792840 |
| | 6 | - | - | - | - | 21072 | 522648 | 10197174 |
| | 7 | - | - | - | - | - | 363602 | 10379696 |
| | 8 | - | - | - | - | - | - | 7156690 |

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




**See also** **common keyword:** `longest_increasing_sequence`, `min_dist_between_inflexion` (*sequence*).

**Keywords**

**characteristic of a constraint:** automaton, automaton with counters, automaton with same input symbol.

**combinatorial object:** sequence.

**constraint arguments:** reverse of a constraint, pure functional dependency.

**filtering:** glue matrix.

**modelling:** functional dependency.

**Automaton**

Figure 5.524 depicts the automaton associated with the `longest_decreasing_sequence` constraint.

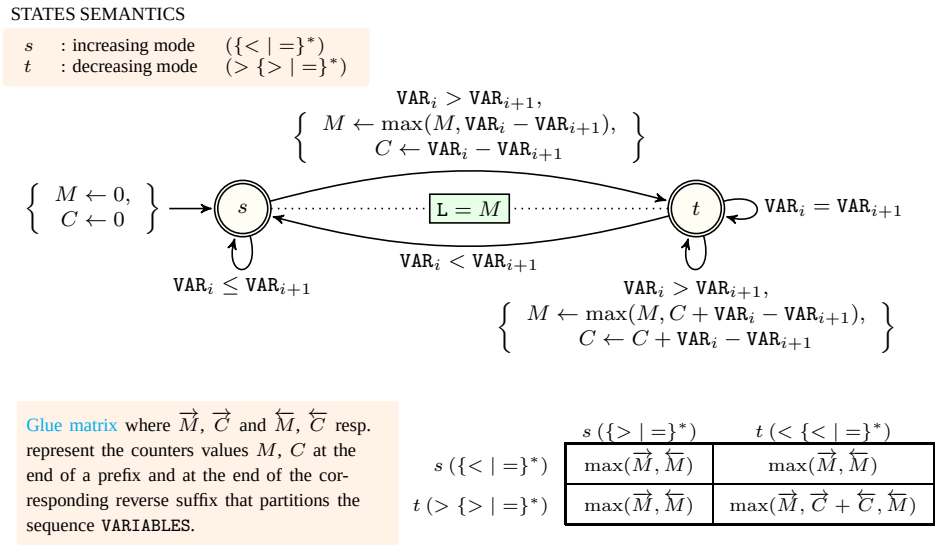



Figure 5.524: Automaton of the `longest_decreasing_sequence` constraint and its glue matrix (note that the reverse of the `longest_decreasing_sequence` constraint is the `longest_increasing_sequence` constraint)

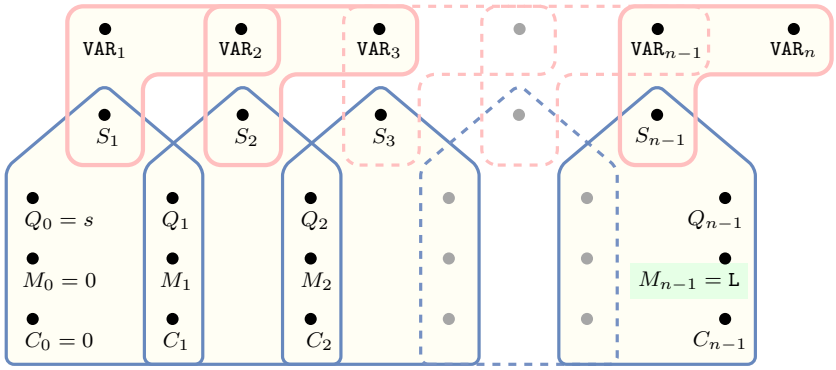



Figure 5.525: Hypergraph of the reformulation corresponding to the automaton of the `longest_decreasing_sequence` constraint