5.156 first_value_diff_0

DESCRIPTION LINKS AUTOMATON

Origin Paparazzi puzzle

Constraint first_value_diff_0(VAR, VARIABLES)

Synonyms first_value_diff_from_0, first_value_different_from_0.

Arguments

VAR	:	dvar
VARIABLES	:	collection(var−dvar)

Restrictions

$\texttt{VAR} \neq 0$
$|\texttt{VARIABLES}| \geq 1$
required(VARIABLES, var)

Purpose VAR is equal to the first non-zero variable of the collection VARIABLES.

Example

$(8, \langle 0, 0, 8, 0, 5 \rangle)$
$(4, \langle 4, 0, 8, 0, 5 \rangle)$

Typical

$|\texttt{VARIABLES}| > 1$
$\texttt{minval}(\texttt{VARIABLES.var}) < 0 \vee \texttt{maxval}(\texttt{VARIABLES.var}) > 1$
$|\texttt{VARIABLES}| - \texttt{among\_diff\_0}(0, \texttt{VARIABLES.var}) \geq 1$
$\bigvee \left(\begin{array}{l} |\texttt{VARIABLES}| \leq 4, \\ |\texttt{VARIABLES}| - \texttt{among\_diff\_0}(0, \texttt{VARIABLES.var}) > 1 \end{array} \right)$

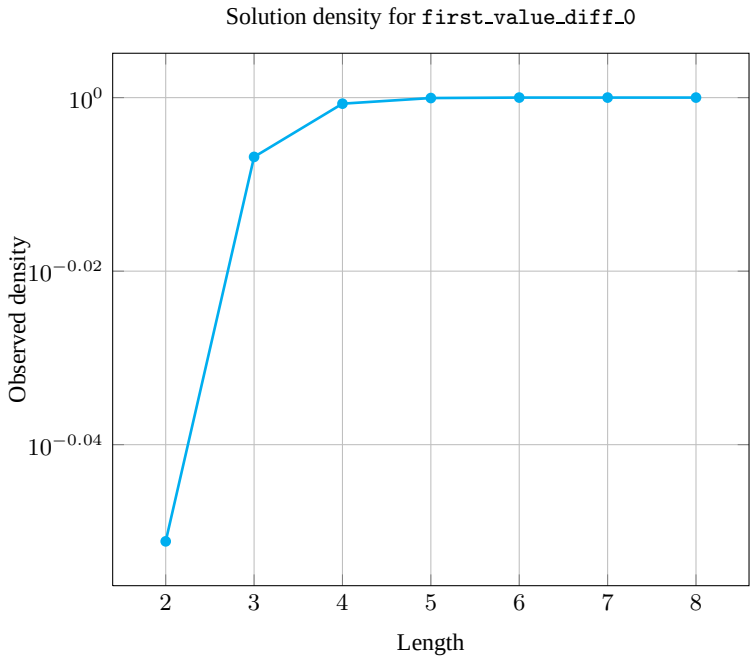
Arg. properties

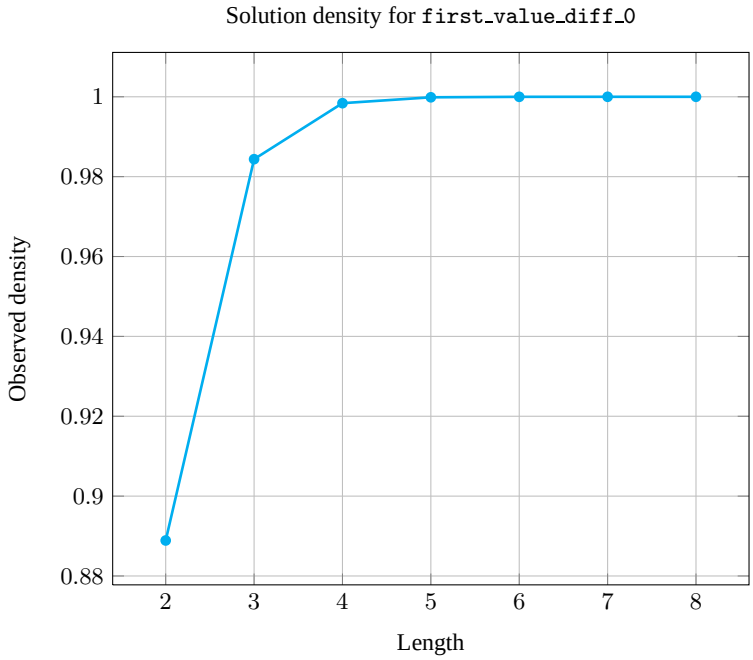
Functional dependency: VAR determined by VARIABLES.

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	8	63	624	7775	117648	2097151	43046720

Number of solutions for first_value_diff_0: domains $0..n$

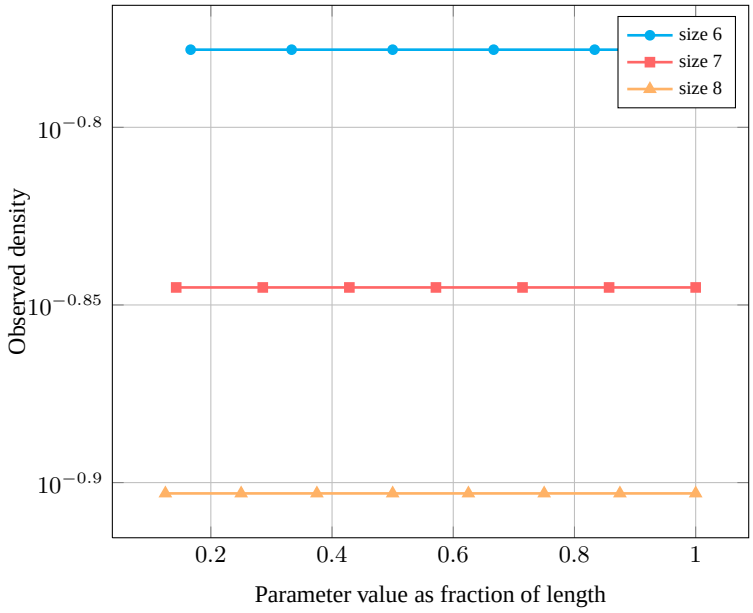

Solution density for first_value_diff_0
Observed density
10^{0}
$10^{-0.02}$
$10^{-0.04}$
2
3
4
5
6
7
8
Length

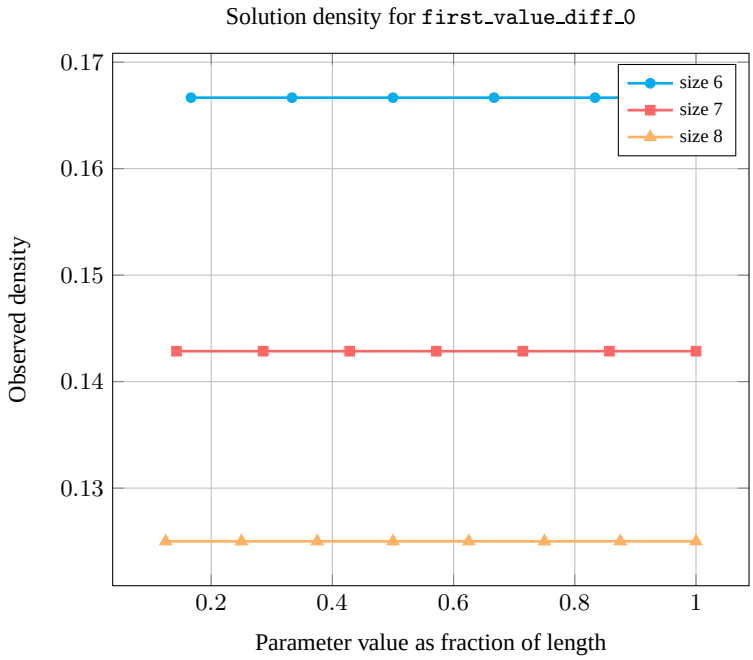

Solution density for first_value_diff_0
Observed density
1
0.98
0.96
0.94
0.92
0.9
0.88
2
3
4
5
6
7
8
Length

Length (n)		2	3	4	5	6	7	8
Total		8	63	624	7775	117648	2097151	43046720
Parameter value	1	4	21	156	1555	19608	299593	5380840
	2	4	21	156	1555	19608	299593	5380840
	3	-	21	156	1555	19608	299593	5380840
	4	-	-	156	1555	19608	299593	5380840
	5	-	-	-	1555	19608	299593	5380840
	6	-	-	-	-	19608	299593	5380840
	7	-	-	-	-	-	299593	5380840
	8	-	-	-	-	-	-	5380840

Solution count for `first_value_diff_0`: domains $0..n$

Solution density for `first_value_diff_0`





See also **implies:** `between_min_max`.

Keywords **characteristic of a constraint:** joker value, automaton, automaton with counters.
modelling: functional dependency.

Automaton

Figure 5.352 depicts an automaton that only accepts all the solutions to the `first_value_diff_0` constraint. This automaton uses a counter in order to record the value of the first non-zero variable $\texttt{VAR}_i$ already encountered. To each variable $\texttt{VAR}_i$ of the collection `VARIABLES` corresponds a 0-1 signature variable S_i. The following signature constraint links $\texttt{VAR}_i$ and S_i: $\texttt{VAR}_i \neq 0 \Leftrightarrow S_i$.

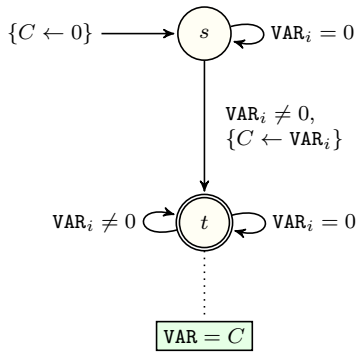


Figure 5.352: Automaton (with one counter) of the `first_value_diff_0` constraint

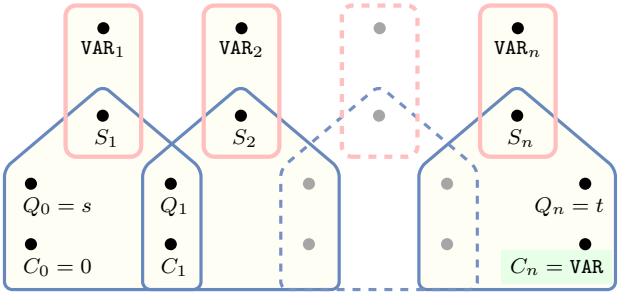


Figure 5.353: Hypergraph of the reformulation corresponding to the automaton (with one counter) of the `first_value_diff_0` constraint