5.303 or

DESCRIPTION LINKS AUTOMATON

Origin Logic

Constraint or(VAR, VARIABLES)

Synonym rel.

Arguments

VAR : dvar
VARIABLES : collection(var−dvar)

Restrictions

$\texttt{VAR} \geq 0$
$\texttt{VAR} \leq 1$
$|\texttt{VARIABLES}| \geq 2$
required(VARIABLES, var)
$\texttt{VARIABLES.var} \geq 0$
$\texttt{VARIABLES.var} \leq 1$

Purpose

Let VARIABLES be a collection of 0-1 variables $\texttt{VAR}_1, \texttt{VAR}_2, \ldots, \texttt{VAR}_n$ $(n \geq 2)$. Enforce $\texttt{VAR} = \texttt{VAR}_1 \vee \texttt{VAR}_2 \vee \cdots \vee \texttt{VAR}_n$.

Example

$(0, \langle 0, 0\rangle)$
$(1, \langle 0, 1\rangle)$
$(1, \langle 1, 0\rangle)$
$(1, \langle 1, 1\rangle)$
$(1, \langle 1, 0, 1\rangle)$

Symmetry Items of VARIABLES are permutable.

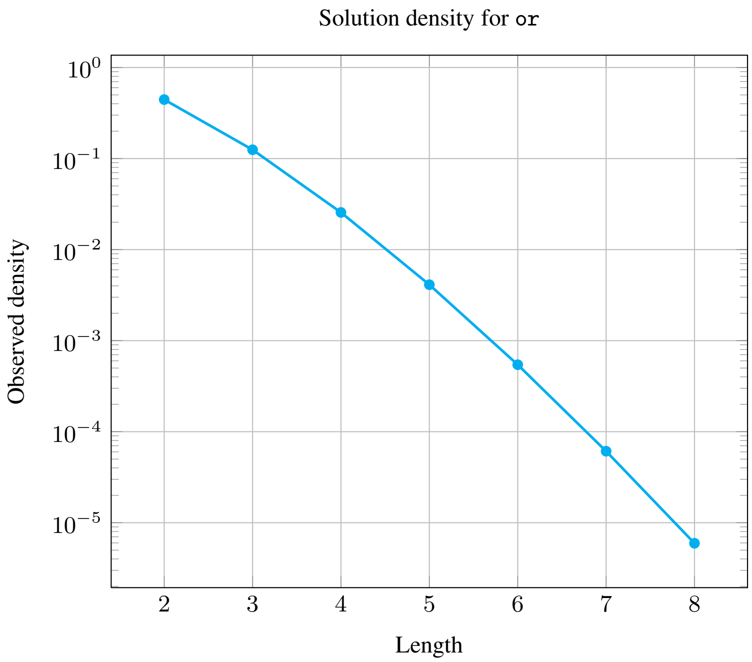
Arg. properties

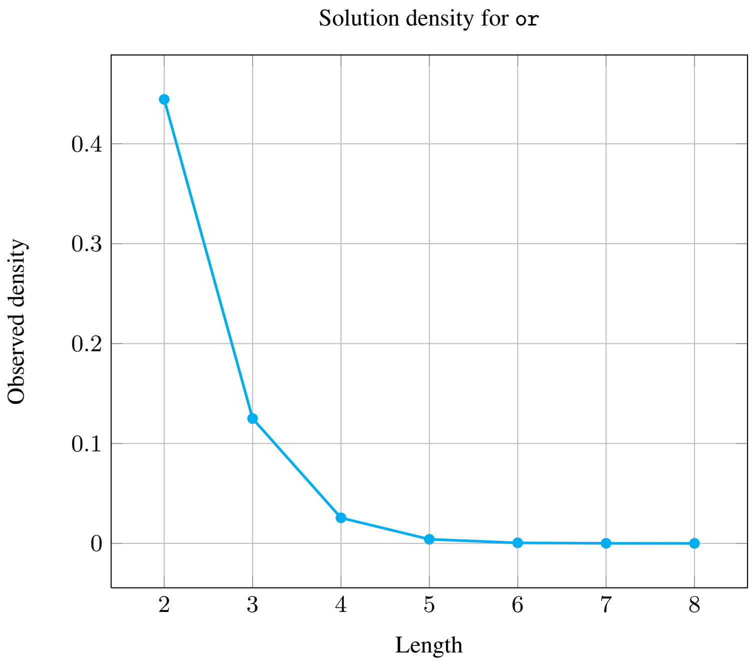
- Functional dependency: VAR determined by VARIABLES.
- Contractible wrt. VARIABLES when $\texttt{VAR} = 0$.
- Extensible wrt. VARIABLES when $\texttt{VAR} = 1$.
- Aggregate: VAR($\vee$), VARIABLES(union).

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	4	8	16	32	64	128	256

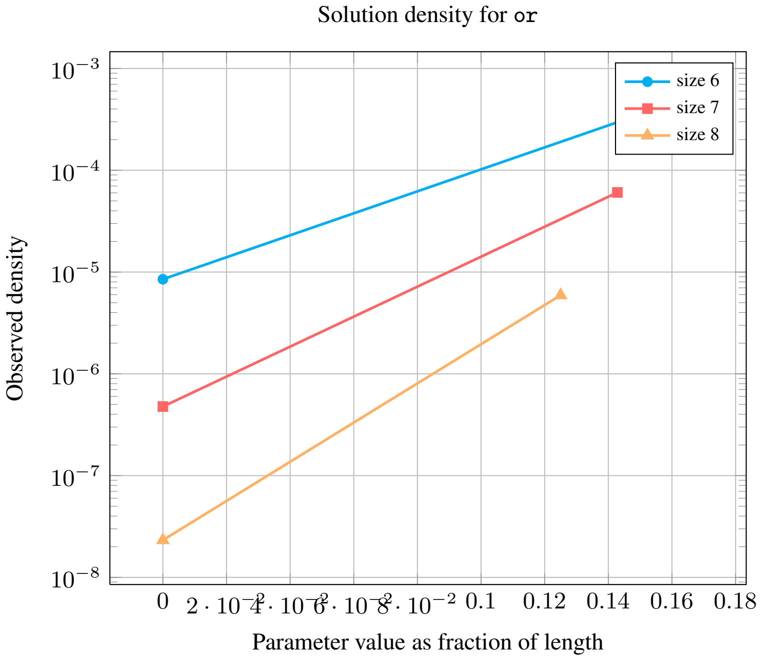
Number of solutions for or: domains $0..n$

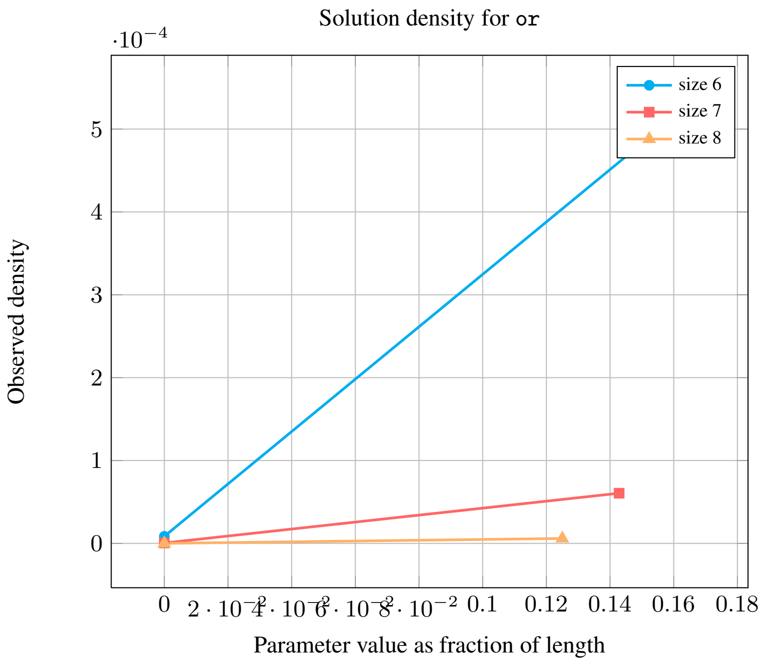

Solution density for or
Observed density
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
2
3
4
5
6
7
8
Length


Solution density for or
Observed density
0.4
0.3
0.2
0.1
0
2
3
4
5
6
7
8
Length

Length (n)		2	3	4	5	6	7	8
Total		4	8	16	32	64	128	256
Parameter value	0	1	1	1	1	1	1	1
	1	3	7	15	31	63	127	255

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


Solution density for `or`



Systems reifiedOr in **Choco**, rel in **Gecode**, orbool in **JaCoP**, #“/ in **SICStus**.

See also **common keyword:** `and`, `clause_or`, `equivalent`, `imply`, `nand`, `nor`, `xor` *(Boolean constraint)*.

implies: `atleast_nvalue`, `maximum`.

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

constraint arguments: pure functional dependency.

constraint network structure: Berge-acyclic constraint network.

constraint type: Boolean constraint.

filtering: arc-consistency.

modelling: disjunction, functional dependency.

Cond. implications

- `or`($\mathtt{VAR}, \mathtt{VARIABLES}$)
  with $|\mathtt{VARIABLES}| > 2$
  implies `some_equal`($\mathtt{VARIABLES}$).

- `or`($\mathtt{VAR}, \mathtt{VARIABLES}$)
  with $\mathtt{VAR} = 0$
  implies `nor`($\mathtt{VAR}, \mathtt{VARIABLES}$)
  when $\mathtt{VAR} = 1$.

- `or`($\mathtt{VAR}, \mathtt{VARIABLES}$)
  with $\mathtt{VAR} = 1$
  implies `nor`($\mathtt{VAR}, \mathtt{VARIABLES}$)
  when $\mathtt{VAR} = 0$.

Automaton Figure 5.621 depicts a first deterministic automaton without counter associated with the `or` constraint. To the first argument `VAR` of the `or` constraint corresponds the first signature variable. To each variable $\texttt{VAR}_i$ of the second argument `VARIABLES` of the `or` constraint corresponds the next signature variable. There is no signature constraint.

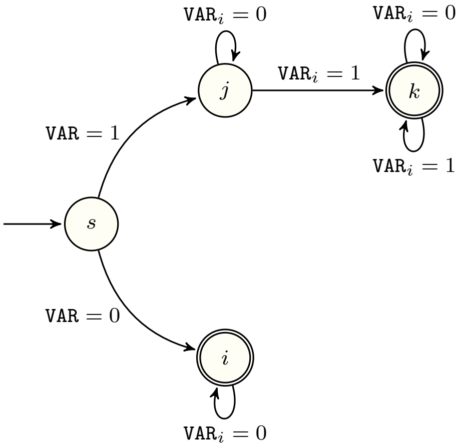


Figure 5.621: Counter free automaton of the `or` constraint

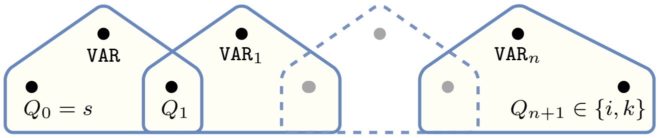


Figure 5.622: Hypergraph of the reformulation corresponding to the automaton of the `or` constraint

Figure 5.623 depicts a second deterministic automaton with one counter associated with the `or` constraint, where the argument `VAR` is unified to the final value of the counter.

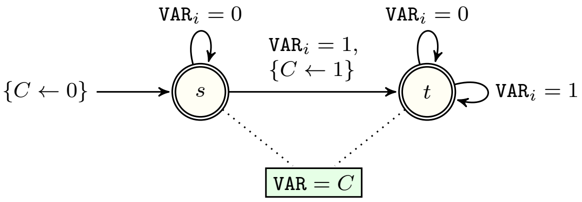


Figure 5.623: Automaton (with one counter) of the `or` constraint

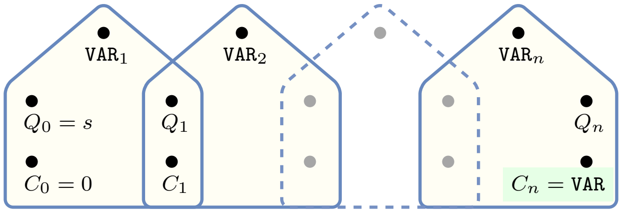


Figure 5.624: Hypergraph of the reformulation corresponding to the automaton (with one counter) of the `or` constraint (since all states of the automaton are accepting there is no restriction on the last variable Q_n)