5.283 not_all_equal

DESCRIPTION LINKS GRAPH AUTOMATON

Origin CHIP

Constraint not_all_equal(VARIABLES)

Argument VARIABLES : collection(var−dvar)

Restrictions required(VARIABLES, var)
|VARIABLES| > 1

Purpose The variables of the collection VARIABLES should take more than a single value.

Example (⟨3, 1, 3, 3, 3⟩)

The not_all_equal constraint holds since the collection ⟨3, 1, 3, 3, 3⟩ involves more than one value (i.e., values 1 and 3).

Typical |VARIABLES| > 2
nval(VARIABLES.var) > 2

Symmetries

- Items of VARIABLES are permutable.
- All occurrences of two distinct values of VARIABLES.var can be swapped; all occurrences of a value of VARIABLES.var can be renamed to any unused value.

Arg. properties Extensible wrt. VARIABLES.

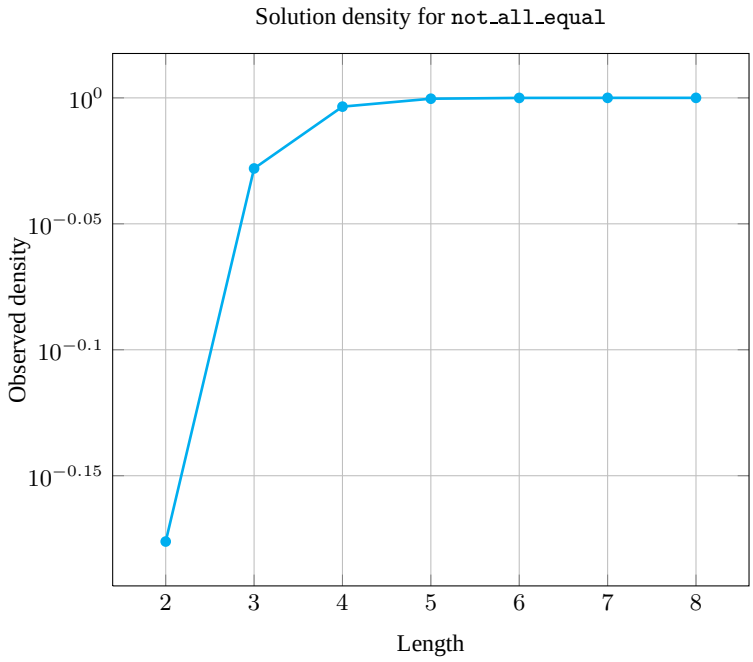
Algorithm If the intersection of the domains of the variables of the VARIABLES collection is empty the not_all_equal constraint is entailed. Otherwise, when only a single variable V remains not fixed, remove the unique value (unique since the constraint is not entailed) taken by the other variables from the domain of V.

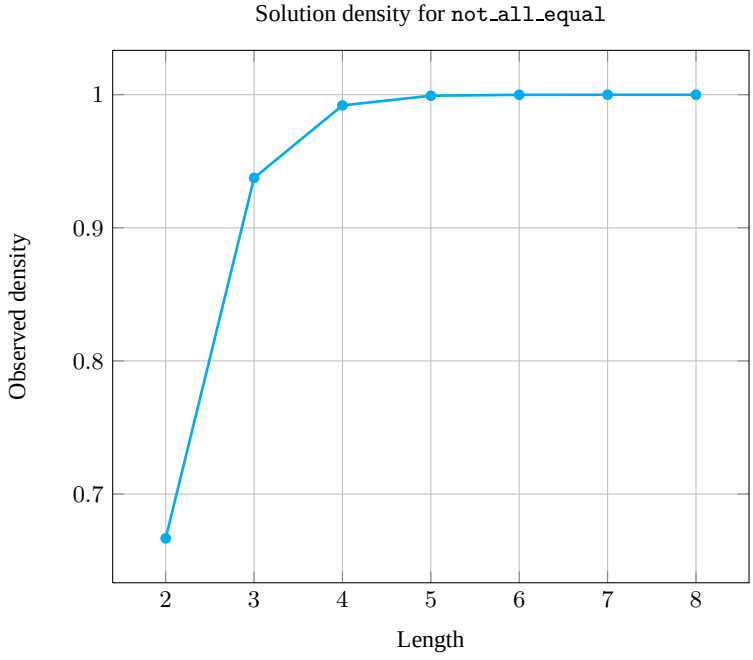
Reformulation The not_all_equal(VARIABLES) constraint can be expressed as atleast_nvalue(2, VARIABLES).

Counting

Length (n)	2	3	4	5	6	7	8
Solutions	6	60	620	7770	117642	2097144	43046712

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





Systems `rel` in **Gecode**.

See also **generalisation:** `nvalue` *(introduce a variable for counting the number of distinct values).*

implied by: alldifferent.

negation: all_equal.

specialisation: neq *(when go down to two variables)*.

used in reformulation: atleast_nvalue.

Keywords

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

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

constraint type: value constraint.

filtering: arc-consistency.

final graph structure: equivalence.

Arc input(s)	VARIABLES
Arc generator	$CLIQUE \mapsto$ collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var = variables2.var
Graph property(ies)	NSCC> 1

Graph model Parts (A) and (B) of Figure 5.608 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NSCC** graph property we show the different strongly connected components of the final graph. Each strongly connected component corresponds to a value that is assigned to some variables of the VARIABLES collection. The not_all_equal holds since the final graph contains more than one strongly connected component.

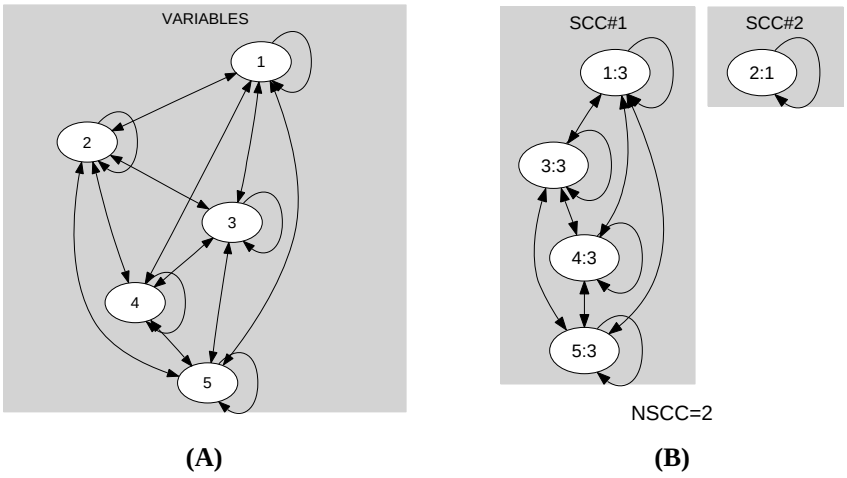


Figure 5.608: Initial and final graph of the not_all_equal constraint

Automaton

Figure 5.609 depicts the automaton associated with the not_all_equal constraint. To each pair of consecutive variables $(\texttt{VAR}_i, \texttt{VAR}_{i+1})$ of the collection VARIABLES corresponds a signature variable S_i. The following signature constraint links $\texttt{VAR}_i$, $\texttt{VAR}_{i+1}$ and S_i: $\texttt{VAR}_i = \texttt{VAR}_{i+1} \Leftrightarrow S_i$.

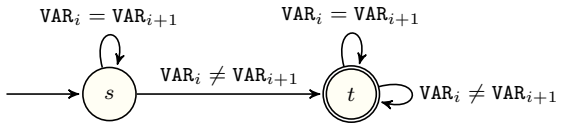


Figure 5.609: Automaton of the not_all_equal constraint

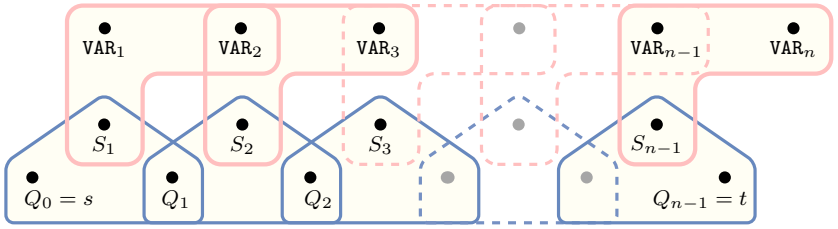


Figure 5.610: Hypergraph of the reformulation corresponding to the automaton of the not_all_equal constraint