

5.14 alldifferent_same_value

	DESCRIPTION	LINKS	GRAPH	AUTOMATON
Origin	Derived from alldifferent .			
Constraint	<code>alldifferent_same_value(NSAME, VARIABLES1, VARIABLES2)</code>			
Synonyms	<code>alldiff_same_value</code> , <code>alldistinct_same_value</code> .			
Arguments	NSAME : <code>dvar</code> VARIABLES1 : <code>collection(var-dvar)</code> VARIABLES2 : <code>collection(var-dvar)</code>			
Restrictions	$NSAME \geq 0$ $NSAME \leq VARIABLES1 $ $ VARIABLES1 = VARIABLES2 $ <code>required(VARIABLES1, var)</code> <code>required(VARIABLES2, var)</code>			
Purpose	<div style="border: 1px solid pink; padding: 5px;"> All the values assigned to the variables of the collection <code>VARIABLES1</code> are pairwise distinct. <code>NSAME</code> is equal to number of constraints of the form <code>VARIABLES1[i].var = VARIABLES2[i].var</code> ($1 \leq i \leq VARIABLES1$) that hold. </div>			
Example	<div style="border: 1px solid blue; padding: 5px; display: inline-block;"> $\left(\begin{array}{l} 2, \langle 7, 3, 1, 5 \rangle, \\ \langle 1, 3, 1, 7 \rangle \end{array} \right)$ </div> <p>The <code>alldifferent_same_value</code> constraint holds since:</p> <ul style="list-style-type: none"> • All the values 7, 3, 1 and 3 are distinct, • Among the four expressions $7 = 1$, $3 = 3$, $1 = 1$ and $5 = 7$ exactly 2 conditions hold. 			
Typical	$NSAME < VARIABLES1 $ $ VARIABLES1 > 2$			
Symmetries	<ul style="list-style-type: none"> • Items of <code>VARIABLES1</code> and <code>VARIABLES2</code> are permutable (<i>same permutation used</i>). • All occurrences of two distinct values in <code>VARIABLES1.var</code> or <code>VARIABLES2.var</code> can be swapped; all occurrences of a value in <code>VARIABLES1.var</code> or <code>VARIABLES2.var</code> can be renamed to any unused value. 			
Usage	When all variables of the second collection are initially bound to distinct values the <code>alldifferent_same_value</code> constraint can be explained in the following way: <ul style="list-style-type: none"> • We interpret the variables of the second collection as the previous solution of a problem where all variables have to be distinct. 			

- We interpret the variables of the first collection as the current solution to find, where all variables should again be pairwise distinct.

The variable NSAME measures the `distance` of the current solution from the previous solution. This corresponds to the number of variables of VARIABLES2 that are not assigned to the same previous value.

See also

root concept: [alldifferent](#).

Keywords

characteristic of a constraint: [automaton](#), [automaton with array of counters](#).

constraint type: [proximity constraint](#).

Arc input(s)	VARIABLES1 VARIABLES2
Arc generator	$PRODUCT(CLIQUE, LOOP, =) \mapsto collection(variables1, variables2)$
Arc arity	2
Arc constraint(s)	variables1.var = variables2.var
Graph property(ies)	<ul style="list-style-type: none"> • $MAX_NSCC \leq 1$ • $NARC_NO_LOOP = NSAME$

Graph model

The arc generator $PRODUCT(CLIQUE, LOOP, =)$ is used in order to generate all the arcs of the initial graph:

- The arc generator $CLIQUE$ creates all links between the items of the first collection VARIABLES1,
- The arc generator $LOOP$ creates a loop for each item of the second collection VARIABLES2,
- Finally the arc generator $PRODUCT(=)$ creates an arc between items located at the same position in the collections VARIABLES1 and VARIABLES2.

Part (A) of Figure 5.19 gives the initial graph associated with the **Example** slot. Variables of collection VARIABLES1 are coloured, while variables of collection VARIABLES2 are kept in white. Part (B) represents the final graph associated with the **Example** slot. In this graph each vertex constitutes a strongly connected component and the number of arcs that do not correspond to a loop is equal to 2 (i.e., NSAME).

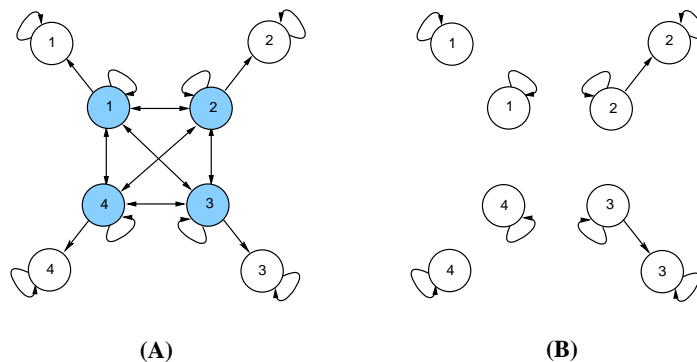


Figure 5.19: Initial and final graph of the `alldifferent_same_value` constraint

Automaton

Figure 5.20 depicts the automaton associated with the `alldifferent_same_value` constraint. Let $VAR1_i$ and $VAR2_i$ respectively denote the i^{th} variables of the `VARIABLES1` and `VARIABLES2` collections. To each pair of variables $(VAR1_i, VAR2_i)$ corresponds a signature variable S_i . The following signature constraint links $VAR1_i$, $VAR2_i$ and S_i : $VAR1_i = VAR2_i \Leftrightarrow S_i$.

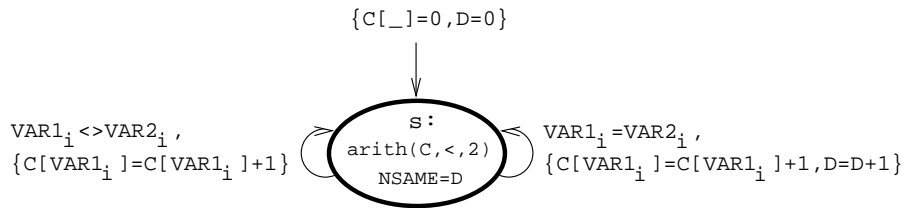


Figure 5.20: Automaton of the `alldifferent_same_value` constraint