

5.45 balance_interval

	DESCRIPTION	LINKS	GRAPH	AUTOMATON
Origin	Derived from balance .			
Constraint	<code>balance_interval(BALANCE, VARIABLES, SIZE_INTERVAL)</code>			
Arguments	BALANCE : dvar VARIABLES : collection (var — dvar) SIZE_INTERVAL : int			
Restrictions	$BALANCE \geq 0$ $BALANCE \leq \max(0, VARIABLES - 2)$ required (VARIABLES, var) $SIZE_INTERVAL > 0$			
Purpose	Consider the largest set S_1 (respectively the smallest set S_2) of variables of the collection VARIABLES that take their value in a same interval $[SIZE_INTERVAL \cdot k, SIZE_INTERVAL \cdot k + SIZE_INTERVAL - 1]$, where k is an integer. BALANCE is equal to the difference between the cardinality of S_2 and the cardinality of S_1 .			
Example	<div><code>(3, (6, 4, 3, 3, 4), 3)</code></div> <p>In the example, the third argument <code>SIZE_INTERVAL = 3</code> defines the following family of intervals $[3 \cdot k, 3 \cdot k + 2]$, where k is an integer. Values 6,4,3,3 and 4 are respectively located within intervals $[6, 8]$, $[3, 5]$, $[3, 5]$, $[3, 5]$ and $[3, 5]$. Therefore intervals $[6, 8]$ and $[3, 5]$ are respectively used 1 and 4 times. The <code>balance_interval</code> constraint holds since its first argument BALANCE is assigned to the difference between the maximum and minimum number of the previous occurrences (i.e., $4 - 1$).</p>			
Typical	$ VARIABLES > 2$ $SIZE_INTERVAL > 1$ $SIZE_INTERVAL < \text{range}(VARIABLES.\text{var})$			
Symmetries	<ul style="list-style-type: none"> Items of VARIABLES are permutable. An occurrence of a value of VARIABLES.var that belongs to the k-th interval, of size SIZE_INTERVAL, can be replaced by any other value of the same interval. 			
Arg. properties	Functional dependency : BALANCE determined by VARIABLES and SIZE_INTERVAL.			
Usage	An application of the <code>balance_interval</code> constraint is to enforce a <i>balanced assignment</i> of interval of values, no matter how many distinct interval of values will be used. In this case one will <i>push down</i> the maximum value of the first argument of the <code>balance_interval</code> constraint.			
See also	specialisation : balance (variable/constant replaced by variable).			

Keywords

application area: assignment.

characteristic of a constraint: automaton, automaton with array of counters.

constraint arguments: pure functional dependency.

constraint type: value constraint.

final graph structure: equivalence.

modelling: interval, balanced assignment, functional dependency.

Arc input(s)	VARIABLES
Arc generator	<i>CLIQUE</i> \mapsto collection(variables1, variables2)
Arc arity	2
Arc constraint(s)	variables1.var / SIZE_INTERVAL = variables2.var / SIZE_INTERVAL
Graph property(ies)	<i>RANGE_NSCC</i> = BALANCE
Graph class	<i>EQUIVALENCE</i>

Graph model The graph property *RANGE_NSCC* constraints the difference between the sizes of the largest and smallest strongly connected components.

Parts (A) and (B) of Figure 5.120 respectively show the initial and final graph associated with the **Example** slot. Since we use the *RANGE_NSCC* graph property, we show the largest and smallest strongly connected components of the final graph.

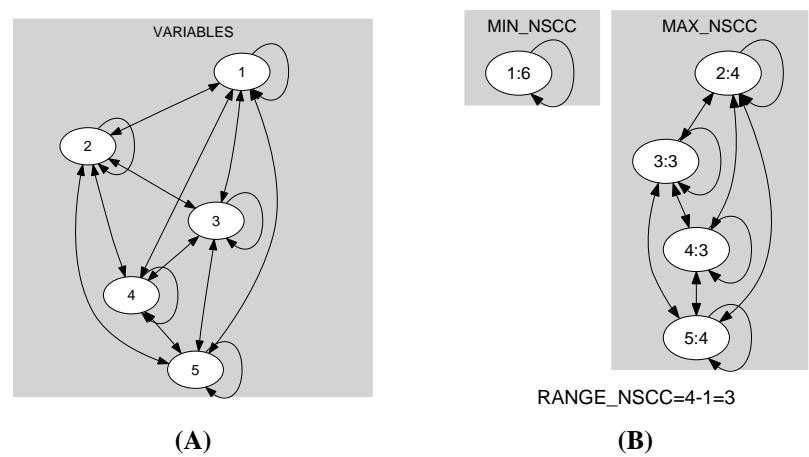


Figure 5.120: Initial and final graph of the *balance_interval* constraint

Automaton

Figure 5.121 depicts the automaton associated with the `balance_interval` constraint. To each item of the collection `VARIABLES` corresponds a signature variable S_i that is equal to 1.

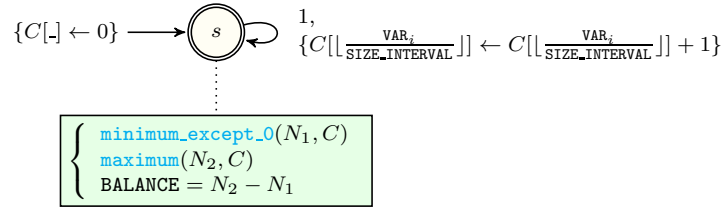


Figure 5.121: Automaton of the `balance_interval` constraint