

### 5.39 balance\_partition

	DESCRIPTION	LINKS	GRAPH
<b>Origin</b>	Derived from <a href="#">balance</a> .		
<b>Constraint</b>	<code>balance_partition(BALANCE, VARIABLES, PARTITIONS)</code>		
<b>Type</b>	VALUES : <code>collection(val-int)</code>		
<b>Arguments</b>	BALANCE : <code>dvar</code> VARIABLES : <code>collection(var-dvar)</code> PARTITIONS : <code>collection(p-VALUES)</code>		
<b>Restrictions</b>	$ VALUES  \geq 1$ <code>required(VALUES, val)</code> <code>distinct(VALUES, val)</code> $BALANCE \geq 0$ $BALANCE \leq \max(0,  VARIABLES  - 2)$ <code>required(VARIABLES, var)</code> <code>required(PARTITIONS, p)</code> $ PARTITIONS  \geq 2$		
<b>Purpose</b>	Consider the largest set $\mathcal{S}_1$ (respectively the smallest set $\mathcal{S}_2$ ) of variables of the collection VARIABLES that take their value in the same partition of the collection PARTITIONS. BALANCE is equal to the difference between the cardinality of $\mathcal{S}_2$ and the cardinality of $\mathcal{S}_1$ .		
<b>Example</b>	$\left( \begin{array}{l} 1, \langle 6, 2, 6, 4, 4 \rangle, \\ \left\langle \begin{array}{l} p - \langle 1, 3 \rangle, \\ p - \langle 4 \rangle, \\ p - \langle 2, 6 \rangle \end{array} \right\rangle \end{array} \right)$		
	In this example values 6, 2, 6, 4, 4 are respectively associated with the partitions $p - \langle 2, 6 \rangle$ and $p - \langle 4 \rangle$ . Partitions $p - \langle 4 \rangle$ and $p - \langle 2, 6 \rangle$ are respectively used 2 and 3 times. The <code>balance_partition</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., $3 - 2$ ). Note that we do not consider those partitions that are not used at all.		
<b>Typical</b>	$ VARIABLES  > 2$ $ VARIABLES  >  PARTITIONS $		
<b>Symmetries</b>	<ul style="list-style-type: none"> <li>• Items of VARIABLES are <a href="#">permutable</a>.</li> <li>• Items of PARTITIONS are <a href="#">permutable</a>.</li> <li>• Items of PARTITIONS.p are <a href="#">permutable</a>.</li> <li>• An occurrence of a value of VARIABLES.var can be replaced by any other value that also belongs to the same partition of PARTITIONS.</li> </ul>		

- Usage** An application of the `balance_partition` is to enforce a *balanced assignment* of values, no matter how many distinct partitions will be used. In this case one will *push down* the maximum value of the first argument of the `balance_partition` constraint.
- See also** [specialisation: balance](#) (variable  $\in$  partition replaced by variable).  
[used in graph description: in\\_same\\_partition](#).
- Keywords** [application area: assignment](#).  
[characteristic of a constraint: partition](#).  
[constraint type: value constraint](#).  
[final graph structure: equivalence](#).  
[modelling: balanced assignment](#).

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

**Graph model**

The graph property **RANGE\_NSCC** constrains the difference between the sizes of the largest and smallest strongly connected components.

Parts (A) and (B) of Figure 5.72 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.

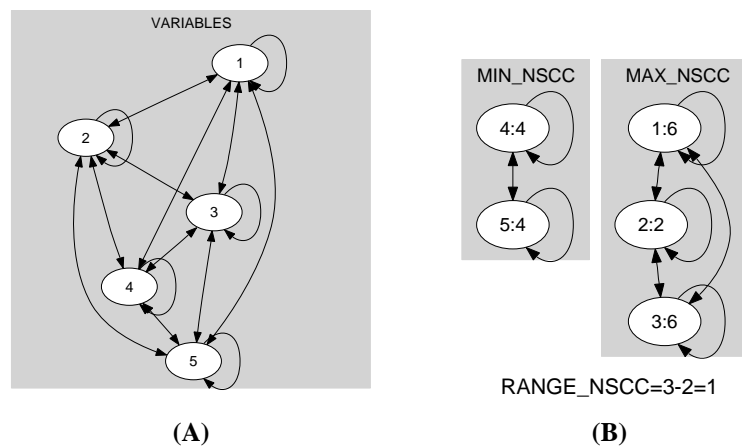


Figure 5.72: Initial and final graph of the `balance_partition` constraint

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