

## 5.286 scalar\_product

	DESCRIPTION	LINKS
<b>Origin</b>	Arithmetic constraint.	
<b>Constraint</b>	<code>scalar_product(LINEARTERM, CTR, VAL)</code>	
<b>Synonyms</b>	<code>equation</code> , <code>linear</code> , <code>sum_weight</code> , <code>weightedSum</code> .	
<b>Arguments</b>	LINEARTERM : <code>collection</code> ( <code>coeff-int</code> , <code>var-dvar</code> ) CTR : <code>atom</code> VAL : <code>dvar</code>	
<b>Restrictions</b>	<code>required</code> (LINEARTERM, [ <code>coeff</code> , <code>var</code> ]) CTR ∈ [=, ≠, <, ≥, >, ≤]	
<b>Purpose</b>	Constraint a linear term defined as the sum of products of coefficients and variables. More precisely, let S denote the sum of the product between a coefficient and its variable of the different items of the LINEARTERM collection. Enforce the following constraint to hold: S CTR VAL.	
<b>Example</b>	$\left( \left\langle \begin{array}{ll} \text{coeff} - 1 & \text{var} - 1, \\ \text{coeff} - 3 & \text{var} - 1, \\ \text{coeff} - 1 & \text{var} - 4 \end{array} \right\rangle, =, 8 \right)$ <p>The <code>scalar_product</code> constraint holds since the condition <math>1 \cdot 1 + 3 \cdot 1 + 1 \cdot 4 = 8</math> is satisfied.</p>	
<b>Symmetries</b>	<ul style="list-style-type: none"> <li>Items of LINEARTERM are <a href="#">permutable</a>.</li> <li>Attributes of LINEARTERM are <a href="#">permutable</a> w.r.t. permutation (<code>coeff</code>, <code>var</code>) (<i>permutation not necessarily applied to all items</i>).</li> </ul>	
<b>Remark</b>	The <code>scalar_product</code> constraint is called <code>linear</code> in <b>Gecode</b> ( <a href="http://www.gecode.org/">http://www.gecode.org/</a> ). It is called <code>sum_weight</code> in <b>JaCoP</b> ( <a href="http://www.jacop.eu/">http://www.jacop.eu/</a> ). In the 2008 CSP solver competition the <code>scalar_product</code> constraint was called <code>weightedSum</code> and required VAL to be fixed.	
<b>Algorithm</b>	Most filtering algorithms first merge multiple occurrences of identical variables in order to potentially make more deductions. When CTR corresponds to the <i>less than or equal to</i> constraint, a filtering algorithm achieving <a href="#">bound-consistency</a> for the <code>scalar_product</code> constraint with large numbers of variables is described in [181].	
<b>Systems</b>	<code>equation</code> in <b>Choco</b> , <code>sumweight</code> in <b>JaCoP</b> , <code>scalar_product</code> in <b>SICStus</b> .	
<b>See also</b>	<a href="#">specialisation</a> : <code>sum_ctr</code> ( <i>arithmetic constraint where all coefficients are equal to 1</i> ).	
<b>Keywords</b>	<a href="#">characteristic of a constraint</a> : <code>sum</code> . <a href="#">constraint type</a> : predefined constraint, arithmetic constraint. <a href="#">filtering</a> : duplicated variables.	

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