

## 5.4 all\_differ\_from\_exactly\_k\_pos

	DESCRIPTION	LINKS	GRAPH
Origin	Inspired by <a href="#">all_differ_from_at_least_k_pos</a> .		
Constraint	<code>all_differ_from_exactly_k_pos(K, VECTORS)</code>		
Type	VECTOR : <code>collection(var-dvar)</code>		
Arguments	K : <code>int</code> VECTORS : <code>collection(vec - VECTOR)</code>		
Restrictions	<code>required(VECTOR, var)</code> $ \text{VECTOR}  \geq 1$ $ \text{VECTOR}  \geq K$ $K \geq 0$ <code>required(VECTORS, vec)</code> <code>same_size(VECTORS, vec)</code>		
Purpose	Enforce all pairs of distinct vectors of the VECTORS collection to differ from exactly K positions. Enforce $K = 0$ when $ \text{VECTORS}  < 2$ .		
Example	$(2, \langle \text{vec} - \langle 0, 3, 0, 6 \rangle, \text{vec} - \langle 0, 3, 4, 1 \rangle, \text{vec} - \langle 9, 3, 4, 6 \rangle \rangle)$		
	The <code>all_differ_from_exactly_k_pos</code> constraint holds since: <ul style="list-style-type: none"> <li>• The first and second vectors differ from 2 positions, which is equal to <math>K = 2</math>.</li> <li>• The first and third vectors differ from 2 positions, which is equal to <math>K = 2</math>.</li> <li>• The second and third vectors differ from 2 positions, which is equal to <math>K = 2</math>.</li> </ul>		
Typical	$K > 0$ $K <  \text{VECTOR} $ $ \text{VECTORS}  > 1$		
Symmetries	<ul style="list-style-type: none"> <li>• Items of VECTORS are <a href="#">permutable</a>.</li> <li>• Items of VECTORS.vec are <a href="#">permutable</a> (<i>same permutation used</i>).</li> </ul>		
Arg. properties	<a href="#">Contractible</a> wrt. VECTORS.		
See also	<b>implies:</b> <code>all_differ_from_at_least_k_pos</code> ( $= K$ replaced by $\geq K$ ), <code>all_differ_from_at_most_k_pos</code> ( $= K$ replaced by $\leq K$ ). <b>part of system of constraints:</b> <code>differ_from_exactly_k_pos</code> . <b>used in graph description:</b> <code>differ_from_exactly_k_pos</code> .		

Keywords	<p><b>characteristic of a constraint:</b> disequality, vector.</p> <p><b>constraint type:</b> system of constraints, decomposition.</p> <p><b>final graph structure:</b> no loop, symmetric.</p>
Cond. implications	<p>all_differ_from_exactly_k_pos(K, VECTORS) with <math>K \leq  \text{VECTORS} </math> implies atleast_nvector(NVEC, VECTORS).</p>

<b>Arc input(s)</b>	VECTORS
<b>Arc generator</b>	$\text{CLIQUE}(\neq) \mapsto \text{collection}(\text{vectors1}, \text{vectors2})$
<b>Arc arity</b>	2
<b>Arc constraint(s)</b>	$\text{differ\_from\_exactly\_k\_pos}(K, \text{vectors1.vec}, \text{vectors2.vec})$
<b>Graph property(ies)</b>	$\text{NARC} =  \text{VECTORS}  *  \text{VECTORS}  -  \text{VECTORS} $
<b>Graph class</b>	<ul style="list-style-type: none"> <li>• NO_LOOP</li> <li>• SYMMETRIC</li> </ul>

**Graph model**

The **Arc constraint(s)** slot uses the `differ_from_exactly_k_pos` constraint defined in this catalogue.

Parts (A) and (B) of Figure 5.4 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NARC** graph property, the arcs of the final graph are stressed in bold. The previous constraint holds since exactly  $3 \cdot (3 - 1) = 6$  arc constraints hold.

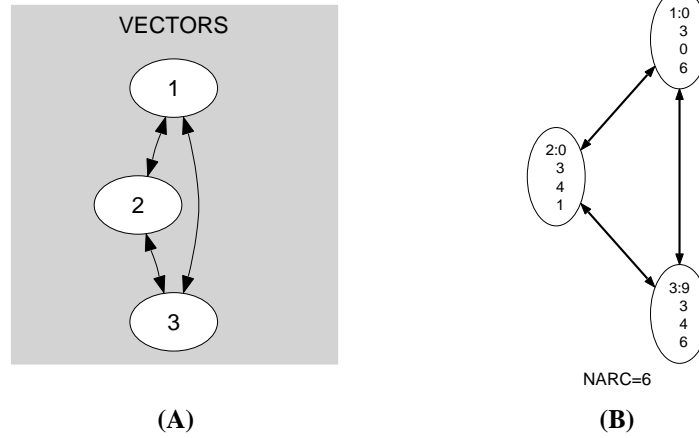


Figure 5.4: Initial and final graph of the `all_differ_from_exactly_k_pos` constraint

**Signature**

Since we use the  $\text{CLIQUE}(\neq)$  arc generator on the items of the **VECTORS** collection, the expression  $|\text{VECTORS}| \cdot |\text{VECTORS}| - |\text{VECTORS}|$  corresponds to the maximum number of arcs of the final graph. Therefore we can rewrite the graph property  $\text{NARC} = |\text{VECTORS}| \cdot |\text{VECTORS}| - |\text{VECTORS}|$  to  $\text{NARC} \geq |\text{VECTORS}| \cdot |\text{VECTORS}| - |\text{VECTORS}|$ . This leads to simplify  $\text{NARC}$  to  $\text{NARC}$ .

