

## 5.247 max\_occ\_of\_tuples\_of\_values

	DESCRIPTION	LINKS
<b>Origin</b>	Design.	
<b>Constraint</b>	<code>max_occ_of_tuples_of_values(MAX, K, VECTORS)</code>	
<b>Type</b>	<code>VECTOR</code> : <code>collection</code> ( <code>var-dvar</code> )	
<b>Arguments</b>	<code>MAX</code> : <code>int</code> <code>K</code> : <code>int</code> <code>VECTORS</code> : <code>collection</code> ( <code>vec</code> – <code>VECTOR</code> )	
<b>Restrictions</b>	<code>required</code> ( <code>VECTOR</code> , <code>var</code> ) $ \text{VECTOR}  \geq 2$ <code>strictly_increasing</code> ( <code>VECTOR</code> ) $\text{MAX} \geq 1$ $\text{K} \geq 2$ $\text{K} <  \text{VECTOR} $ <code>required</code> ( <code>VECTORS</code> , <code>vec</code> ) $ \text{VECTORS}  \geq 1$ <code>same_size</code> ( <code>VECTORS</code> , <code>vec</code> )	
<b>Purpose</b>	<p><code>MAX</code> is equal to the maximum number of occurrences of identical vectors derived from the vectors <code>VECTORS</code> in the following way. To each vector <math>\langle v_1, v_2, \dots, v_m \rangle</math> (with <math>v_1 &lt; v_2 \wedge \dots \wedge v_{m-1} &lt; v_m</math>) of <code>VECTORS</code> we generate all vectors <math>\langle u_1, u_2, \dots, u_K \rangle</math> such that <math>u_1 = v_{i_1}, u_2 = v_{i_2}, \dots, u_K = v_{i_K}</math> (with <math>1 \leq i_1 &lt; i_2 &lt; \dots &lt; i_K \leq m</math>).</p>	
<b>Example</b>	$\left( \begin{array}{c} \text{vec} - \langle 1, 2, 4 \rangle, \\ \text{vec} - \langle 2, 3, 5 \rangle, \\ \text{vec} - \langle 3, 4, 6 \rangle, \\ 1, 2, \left\langle \begin{array}{c} \text{vec} - \langle 4, 5, 7 \rangle, \\ \text{vec} - \langle 1, 5, 6 \rangle, \\ \text{vec} - \langle 2, 6, 7 \rangle, \\ \text{vec} - \langle 1, 3, 7 \rangle \end{array} \right\rangle \end{array} \right)$	
	<p>Given the seven vectors of the example we respectively generate:</p> <ul style="list-style-type: none"> <li>• the pairs <math>\langle 1, 2 \rangle</math>, <math>\langle 1, 4 \rangle</math> and <math>\langle 2, 4 \rangle</math> from the triple <math>\langle 1, 2, 4 \rangle</math>,</li> <li>• the pairs <math>\langle 2, 3 \rangle</math>, <math>\langle 2, 5 \rangle</math> and <math>\langle 3, 5 \rangle</math> from the triple <math>\langle 2, 3, 5 \rangle</math>,</li> <li>• the pairs <math>\langle 3, 4 \rangle</math>, <math>\langle 3, 6 \rangle</math> and <math>\langle 4, 6 \rangle</math> from the triple <math>\langle 3, 4, 6 \rangle</math>,</li> <li>• the pairs <math>\langle 4, 5 \rangle</math>, <math>\langle 4, 7 \rangle</math> and <math>\langle 5, 7 \rangle</math> from the triple <math>\langle 4, 5, 7 \rangle</math>,</li> <li>• the pairs <math>\langle 1, 5 \rangle</math>, <math>\langle 1, 6 \rangle</math> and <math>\langle 5, 6 \rangle</math> from the triple <math>\langle 1, 5, 6 \rangle</math>,</li> <li>• the pairs <math>\langle 2, 6 \rangle</math>, <math>\langle 2, 7 \rangle</math> and <math>\langle 6, 7 \rangle</math> from the triple <math>\langle 2, 6, 7 \rangle</math>,</li> </ul>	

- the pairs  $\langle 1, 3 \rangle$ ,  $\langle 1, 7 \rangle$  and  $\langle 3, 7 \rangle$  from the triple  $\langle 1, 3, 7 \rangle$ .

Putting these pairs together, we get the set of pairs  $\{\langle 1, 2 \rangle, \langle 1, 3 \rangle, \langle 1, 4 \rangle, \langle 1, 5 \rangle, \langle 1, 6 \rangle, \langle 1, 7 \rangle, \langle 2, 3 \rangle, \langle 2, 4 \rangle, \langle 2, 5 \rangle, \langle 2, 6 \rangle, \langle 2, 7 \rangle, \langle 3, 4 \rangle, \langle 3, 5 \rangle, \langle 3, 6 \rangle, \langle 3, 7 \rangle, \langle 4, 5 \rangle, \langle 4, 6 \rangle, \langle 4, 7 \rangle, \langle 5, 6 \rangle, \langle 5, 7 \rangle, \langle 6, 7 \rangle\}$ . The `max_occ_of_tuples_of_values` constraint holds since the components of the original seven vectors are strictly increasing, and since `MAX` is set to one and all the generated pairs are distinct.

### Typical

```
MAX ≤ 2
|VECTOR| < K + 5
K = 2 ∨ K + 1 = |VECTOR|
|VECTORS| > 2
```

### Arg. properties

- **Functional dependency:** `MAX` determined by `K` and `VECTORS`.
- **Contractible** wrt. `VECTORS` when `MAX = 1`.

### Usage

This constraint occurs in balanced block design problems [207, 262] such as Steiner or Kirkman triples.

### See also

**common keyword:** `max_occ_of_consecutive_tuples_of_values`, `max_occ_of_sorted_tuples_of_values` (*vector*).

**implies:** `max_occ_of_sorted_tuples_of_values`.

### Keywords

**characteristic of a constraint:** `vector`.

**modelling:** functional dependency.