

## 5.248 max\_occ\_of\_tuples\_of\_values

	DESCRIPTION	LINKS
Origin	Design.	
Constraint	<code>max_occ_of_tuples_of_values(MAX, K, VECTORS)</code>	
Type	VECTOR : <code>collection</code> (var-dvar)	
Arguments	MAX : <code>int</code> K : <code>int</code> VECTORS : <code>collection</code> (vec – VECTOR)	
Restrictions	<code>required</code> (VECTOR, var) $ \text{VECTOR}  \geq 2$ <code>strictly_increasing</code> (VECTOR) $\text{MAX} \geq 1$ $K \geq 2$ $K <  \text{VECTOR} $ <code>required</code> (VECTORS, vec) $ \text{VECTORS}  \geq 1$ <code>same_size</code> (VECTORS, vec)	

### Purpose

MAX is equal to the maximum number of occurrences of identical vectors derived from the vectors VECTORS in the following way. To each vector  $\langle v_1, v_2, \dots, v_m \rangle$  (with  $v_1 < v_2 \wedge \dots \wedge v_{m-1} < v_m$ ) of VECTORS we generate all vectors  $\langle u_1, u_2, \dots, u_K \rangle$  such that  $u_1 = v_{i_1}, u_2 = v_{i_2}, \dots, u_K = v_{i_K}$  (with  $1 \leq i_1 < i_2 < \dots < i_K \leq m$ ).

### Example

$$\left( \begin{array}{c} \text{vec} - \langle 1, 2, 4 \rangle, \\ \text{vec} - \langle 2, 3, 5 \rangle, \\ \text{vec} - \langle 3, 4, 6 \rangle, \\ \text{vec} - \langle 4, 5, 7 \rangle, \\ \text{vec} - \langle 1, 5, 6 \rangle, \\ \text{vec} - \langle 2, 6, 7 \rangle, \\ \text{vec} - \langle 1, 3, 7 \rangle \end{array} \right)$$

Given the seven vectors of the example we respectively generate:

- the pairs  $\langle 1, 2 \rangle$ ,  $\langle 1, 4 \rangle$  and  $\langle 2, 4 \rangle$  from the triple  $\langle 1, 2, 4 \rangle$ ,
- the pairs  $\langle 2, 3 \rangle$ ,  $\langle 2, 5 \rangle$  and  $\langle 3, 5 \rangle$  from the triple  $\langle 2, 3, 5 \rangle$ ,
- the pairs  $\langle 3, 4 \rangle$ ,  $\langle 3, 6 \rangle$  and  $\langle 4, 6 \rangle$  from the triple  $\langle 3, 4, 6 \rangle$ ,
- the pairs  $\langle 4, 5 \rangle$ ,  $\langle 4, 7 \rangle$  and  $\langle 5, 7 \rangle$  from the triple  $\langle 4, 5, 7 \rangle$ ,
- the pairs  $\langle 1, 5 \rangle$ ,  $\langle 1, 6 \rangle$  and  $\langle 5, 6 \rangle$  from the triple  $\langle 1, 5, 6 \rangle$ ,
- the pairs  $\langle 2, 6 \rangle$ ,  $\langle 2, 7 \rangle$  and  $\langle 6, 7 \rangle$  from the triple  $\langle 2, 6, 7 \rangle$ ,

- 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.