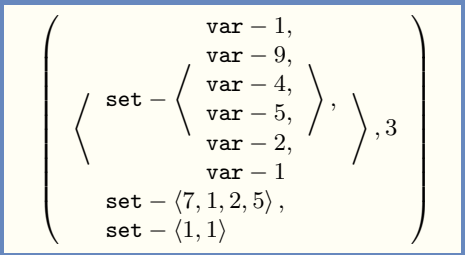


5.184 `k_used_by_modulo`

	DESCRIPTION	LINKS	GRAPH
Origin	Derived from <code>used_by_modulo</code> and from <code>k_used_by</code> .		
Constraint	<code>k_used_by_modulo(SETS, M)</code>		
Type	VARIABLES : <code>collection(var-dvar)</code>		
Arguments	SETS : <code>collection(set - VARIABLES)</code> M : <code>int</code>		
Restrictions	<code>required(VARIABLES, var)</code> $ VARIABLES > 0$ <code>required(SETS, set)</code> $ SETS > 1$ <code>non_increasing_size(SETS, set)</code> $M > 0$		
Purpose	Given $ SETS $ sets of domain variables, the <code>k_used_by_modulo</code> constraint enforces a <code>used_by_modulo</code> constraint between each pair of consecutive sets.		
Example			
	The <code>k_used_by_modulo</code> constraint holds since:		
	<ul style="list-style-type: none"> • The first collection of variables is assigned 1 value in $\{0, 3, \dots, 3 \cdot k\}$, 3 values in $\{1, 4, \dots, 1 + 3 \cdot k\}$ and 2 values in $\{2, 5, \dots, 2 + 3 \cdot k\}$, while the second collection of variables is assigned no more values in the previous three sets of values. • The second collection of variables is assigned 2 values in $\{0, 3, \dots, 3 \cdot k\}$ and 2 values in $\{2, 5, \dots, 2 + 3 \cdot k\}$, while the third collection of variables is assigned no more values in the previous three sets of values. 		
Typical	$ VARIABLES > 1$ $M > 1$		
Symmetries	<ul style="list-style-type: none"> • Items of SETS are <code>permutable</code>. • Items of SETS.set are <code>permutable</code>. • An occurrence of a value u of SETS.set.var can be <code>replaced</code> by any other value v such that v is congruent to u modulo M. 		

- See also** **common keyword:** `k_used_by` (*system of constraints*).
- part of system of constraints:** `used_by_modulo`.
- used in graph description:** `used_by_modulo`.
- Keywords** **characteristic of a constraint:** `modulo`.
- constraint type:** `system of constraints`, `decomposition`.
- modelling:** `inclusion`.

Arc input(s)	SETS
Arc generator	$\text{PATH} \mapsto \text{collection}(\text{set1}, \text{set2})$
Arc arity	2
Arc constraint(s)	$\text{used_by_modulo}(\text{set1.set}, \text{set2.set}, M)$
Graph property(ies)	$\text{NARC} = \text{SETS} - 1$

Graph model

Parts (A) and (B) of Figure 5.366 respectively show the initial and final graph associated with the **Example** slot. To each vertex corresponds a collection of variables, while to each arc corresponds a `used_by_modulo` constraint.

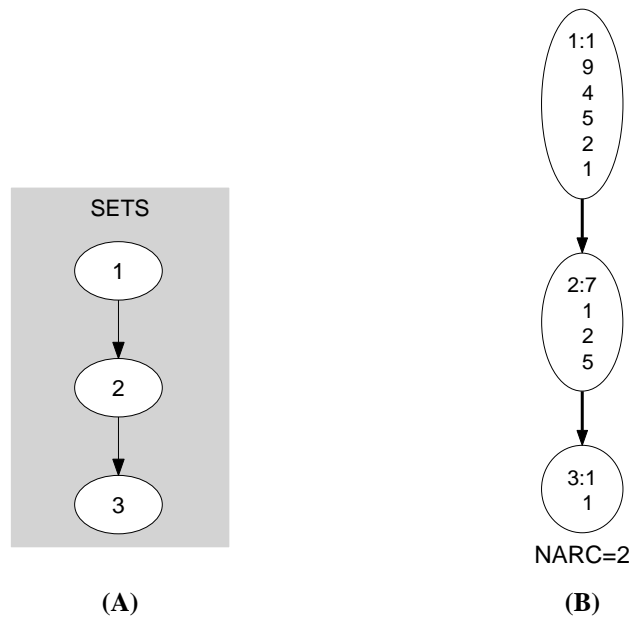


Figure 5.366: Initial and final graph of the `k_used_by_modulo` constraint

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