5.296 open_atleast

DESCRIPTION LINKS GRAPH

Origin Derived from `atleast` and `open_global_cardinality`.

Constraint `open_atleast(S, N, VARIABLES, VALUE)`

Arguments

`S`	:	`svar`
`N`	:	`int`
`VARIABLES`	:	`collection(var−dvar)`
`VALUE`	:	`int`

Restrictions

$\mathtt{S} \geq 1$
$\mathtt{S} \leq |\mathtt{VARIABLES}|$
$\mathtt{N} \geq 0$
$\mathtt{N} \leq |\mathtt{VARIABLES}|$
`required(VARIABLES, var)`

Purpose Let $\mathcal{V}$ be the variables of the collection `VARIABLES` for which the corresponding position belongs to the set `S`. Positions are numbered from 1. At least `N` variables of $\mathcal{V}$ are assigned value `VALUE`.

Example $(\{2, 3, 4\}, 2, \langle 4, 2, 4, 4\rangle, 4)$

The `open_atleast` constraint holds since, within the last three (i.e., $\mathtt{S} = \{2, 3, 4\}$) values of the collection $\langle 4, 2, 4, 4\rangle$, at least $\mathtt{N} = 2$ values are equal to value $\mathtt{VALUE} = 4$.

Typical

$\mathtt{N} > 0$
$\mathtt{N} < |\mathtt{VARIABLES}|$
$|\mathtt{VARIABLES}| > 1$

Symmetries

- `N` can be decreased to any value ≥ 0.
- An occurrence of a value of `VARIABLES.var` that is different from `VALUE` can be replaced by any other value.

Arg. properties Suffix-extensible wrt. `VARIABLES`.

See also

common keyword: `open_among`, `open_global_cardinality` *(open constraint,value constraint)*.

comparison swapped: `open_atmost`.

hard version: `atleast`.

used in graph description: `in_set`.

Keywords

constraint arguments: constraint involving set variables.

constraint type: open constraint, value constraint.

modelling: at least.

Arc input(s) VARIABLES

Arc generator $SELF \mapsto$ collection(variables)

Arc arity 1

Arc constraint(s)

- variables.var $=$ VALUE
- in_set(variables.key, S)

Graph property(ies) **NARC** $\geq$ N

Graph model Since each arc constraint involves only one vertex (VALUE is fixed), we employ the $SELF$ arc generator in order to produce a graph with a single loop on each vertex. Variables for which the corresponding position does not belong to the set S are removed from the final graph by the second condition of the arc-constraint.

Parts (A) and (B) of Figure 5.613 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NARC** graph property, the loops of the final graph are stressed in bold.

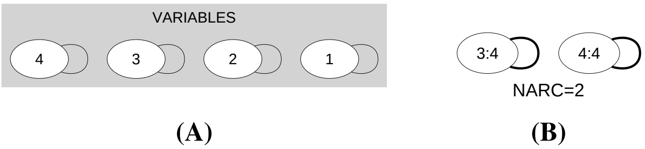

Figure 5.613: Initial and final graph of the open_atleast constraint