5.86 connected

DESCRIPTION LINKS GRAPH

Origin [142]

Constraint connected(NODES)

Argument NODES : collection(index−int, succ−svar)

Restrictions
required(NODES, [index, succ])
NODES.index ≥ 1
NODES.index ≤ |NODES|
distinct(NODES, index)
NODES.succ ≥ 1
NODES.succ ≤ |NODES|

Purpose Consider a digraph G described by the NODES collection. Select a subset of arcs of G so that the corresponding graph is symmetric (i.e., if there is an arc from i to j, there is also an arc from j to i) and connected (i.e., there is a path between any pair of vertices of G).

Example

$$\left\{ \left\langle \begin{array}{ll} \texttt{index} - 1 & \texttt{succ} - \{1,2,3\}, \\ \texttt{index} - 2 & \texttt{succ} - \{1,3\}, \\ \texttt{index} - 3 & \texttt{succ} - \{1,2,4\}, \\ \texttt{index} - 4 & \texttt{succ} - \{3,5,6\}, \\ \texttt{index} - 5 & \texttt{succ} - \{4\}, \\ \texttt{index} - 6 & \texttt{succ} - \{4\} \end{array} \right\rangle \right\}$$

The connected constraint holds since the NODES collection depicts a symmetric graph involving a single connected component.

Typical |NODES| > 1

Symmetry Items of NODES are permutable.

Algorithm A filtering algorithm for the connected constraint is sketched in [142, page 88]. Beside the pruning associated with the fact that the final graph is symmetric, it is based on the fact that all bridges and cut vertices on a path between two vertices that should for sure belong to the final graph should also belong to the final graph.

See also
common keyword: symmetric (*symmetric*).
implies: strongly_connected.
used in graph description: in_set.

Keywords
constraint arguments: constraint involving set variables.
constraint type: graph constraint.
filtering: DFS-bottleneck.
final graph structure: connected component, symmetric.

Arc input(s)	NODES
Arc generator	$CLIQUE \mapsto$ collection(nodes1, nodes2)
Arc arity	2
Arc constraint(s)	in_set(nodes2.index, nodes1.succ)
Graph property(ies)	NCC= 1
Graph class	SYMMETRIC

Graph model Part (A) of Figure 5.214 shows the initial graph from which we start. It is derived from the set associated with each vertex. Each set describes the potential values of the succ attribute of a given vertex. Part (B) of Figure 5.214 gives the final graph associated with the **Example** slot.

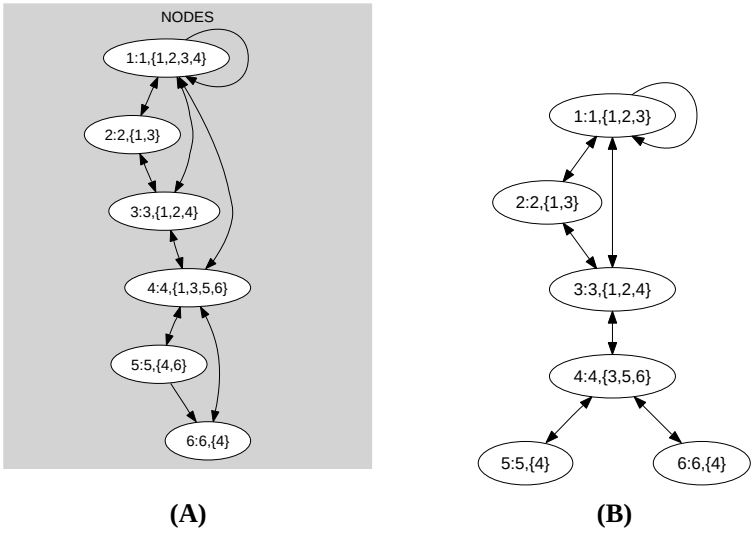

Figure 5.214: Initial and final graph of the connected set constraint