5.206 k_cut

DESCRIPTION LINKS GRAPH

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Constraint k_cut(K, NODES)

Arguments

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

Restrictions

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

Purpose Select some arcs of a digraph in order to have at least K connected components (an isolated vertex, i.e. a vertex without any ingoing or outgoing arc, is counted as one connected component).

Example

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

The k_cut constraint holds since the graph corresponding to the NODES collection contains 3 connected components (i.e., two connected components respectively involving vertices 1 and 4 and a third connected component containing the remaining vertices 2, 3 and 5), and since the first argument K enforces to have at least 3 connected components.

Typical |NODES| > 1

Symmetries

- K can be decreased to any value ≥ 1.
- Items of NODES are permutable.

See also **common keyword:** link_set_to_booleans *(constraint involving set variables)*.

used in graph description: in_set.

Keywords **constraint arguments:** constraint involving set variables.

constraint type: graph constraint.

filtering: linear programming.

final graph structure: connected component.

Arc input(s)	NODES
Arc generator	$CLIQUE \mapsto$ collection(nodes1, nodes2)
Arc arity	2
Arc constraint(s)	$\bigvee \left(\begin{array}{l} \texttt{nodes1.index} = \texttt{nodes2.index}, \\ \texttt{in\_set}(\texttt{nodes2.index}, \texttt{nodes1.succ}) \end{array} \right)$
Graph property(ies)	NCC$\geq$ K

Graph model nodes1.index = nodes2.index holds if nodes1 and nodes2 correspond to the same vertex. It is used in order to enforce keeping all the vertices of the initial graph. This is because an isolated vertex counts always as one connected component. Within the context of the **Example** slot, part (A) of Figure 5.478 shows the initial graph from which we have chosen to 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 5.478 gives the final graph associated with the example of the **Example** slot. The k_cut constraint holds since we have at least K = 3 connected components in the final graph.

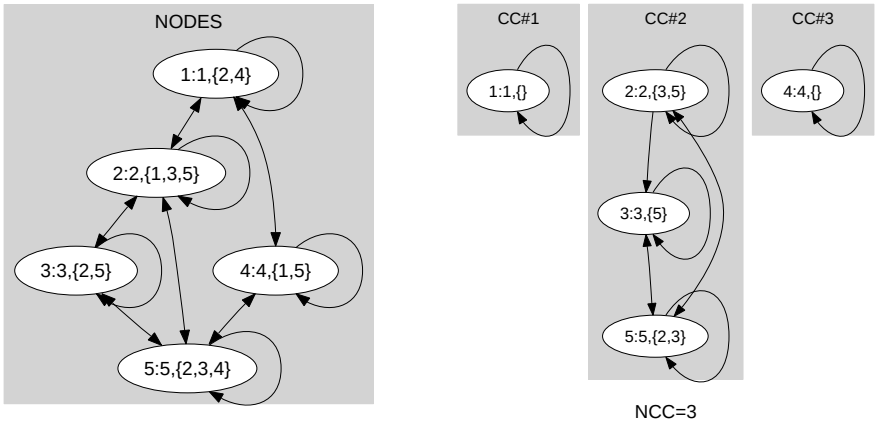

Figure 5.478: Initial and final graph of the k_cut set constraint