5.382 subgraph_isomorphism

DESCRIPTION LINKS

Origin [277]

Constraint subgraph_isomorphism(NODES_PATTERN, NODES_TARGET, FUNCTION)

Arguments

NODES_PATTERN	:	collection(index−int, succ−sint)
NODES_TARGET	:	collection(index−int, succ−svar)
FUNCTION	:	collection(image−dvar)

Restrictions

required(NODES_PATTERN, [index, succ])
NODES_PATTERN.index $\geq$ 1
NODES_PATTERN.index $\leq$ |NODES_PATTERN|
distinct(NODES_PATTERN, index)
NODES_PATTERN.succ $\geq$ 1
NODES_PATTERN.succ $\leq$ |NODES_PATTERN|
required(NODES_TARGET, [index, succ])
NODES_TARGET.index $\geq$ 1
NODES_TARGET.index $\leq$ |NODES_TARGET|
distinct(NODES_TARGET, index)
NODES_TARGET.succ $\geq$ 1
NODES_TARGET.succ $\leq$ |NODES_TARGET|
required(FUNCTION, [image])
FUNCTION.image $\geq$ 1
FUNCTION.image $\leq$ |NODES_TARGET|
distinct(FUNCTION, image)
|FUNCTION| $=$ |NODES_PATTERN|

Purpose

Given two directed graphs PATTERN and TARGET enforce a one to one correspondence, defined by the function FUNCTION, between the vertices of the graph PATTERN and the vertices of an induced subgraph of TARGET so that, if there is an arc from u to v in the graph PATTERN, then there is also an arc from the image of u to the image of v in the induced subgraph of TARGET. The vertices of both graphs are respectively defined by the two collections of vertices NODES_PATTERN and NODES_TARGET. Within collection NODES_PATTERN the set of successors of each node is fixed, while this is not the case for the collection NODES_TARGET. This stems from the fact that the TARGET graph is not fixed (i.e., the lower and upper bounds of the target graph are specified when we post the subgraph_isomorphism constraint, while the induced subgraph of a solution to the subgraph_isomorphism constraint corresponds to a graph for which the upper and lower bounds are identical).

Example

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

Figure 5.743 gives the pattern (see Part (A)) and target graph (see Part (B)) of the **Example** slot as well as the one to one correspondence (see Part (C)) between the pattern graph and the induced subgraph of the target graph. The `subgraph_isomorphism` constraint since:

- To the arc from vertex 1 to vertex 4 in the pattern graph corresponds the arc from vertex 4 to 5 in the induced subgraph of the target graph.
- To the arc from vertex 1 to vertex 2 in the pattern graph corresponds the arc from vertex 4 to 2 in the induced subgraph of the target graph.
- To the arc from vertex 2 to vertex 1 in the pattern graph corresponds the arc from vertex 2 to 4 in the induced subgraph of the target graph.
- To the arc from vertex 2 to vertex 4 in the pattern graph corresponds the arc from vertex 2 to 5 in the induced subgraph of the target graph.
- To the arc from vertex 2 to vertex 3 in the pattern graph corresponds the arc from vertex 2 to 3 in the induced subgraph of the target graph.

Typical

$|\texttt{NODES\_PATTERN}| > 1$
$|\texttt{NODES\_TARGET}| > 1$

Symmetries

- Items of `NODES_PATTERN` are permutable.
- Items of `NODES_TARGET` are permutable.

Usage

Within the context of constraint programming the constraint was used for finding symmetries [325, 327, 326].

Algorithm

[412, 341, 254, 445].

See also

related: `graph_isomorphism`.

Keywords

constraint arguments: constraint involving set variables.

constraint type: predefined constraint, graph constraint.

symmetry: symmetry.

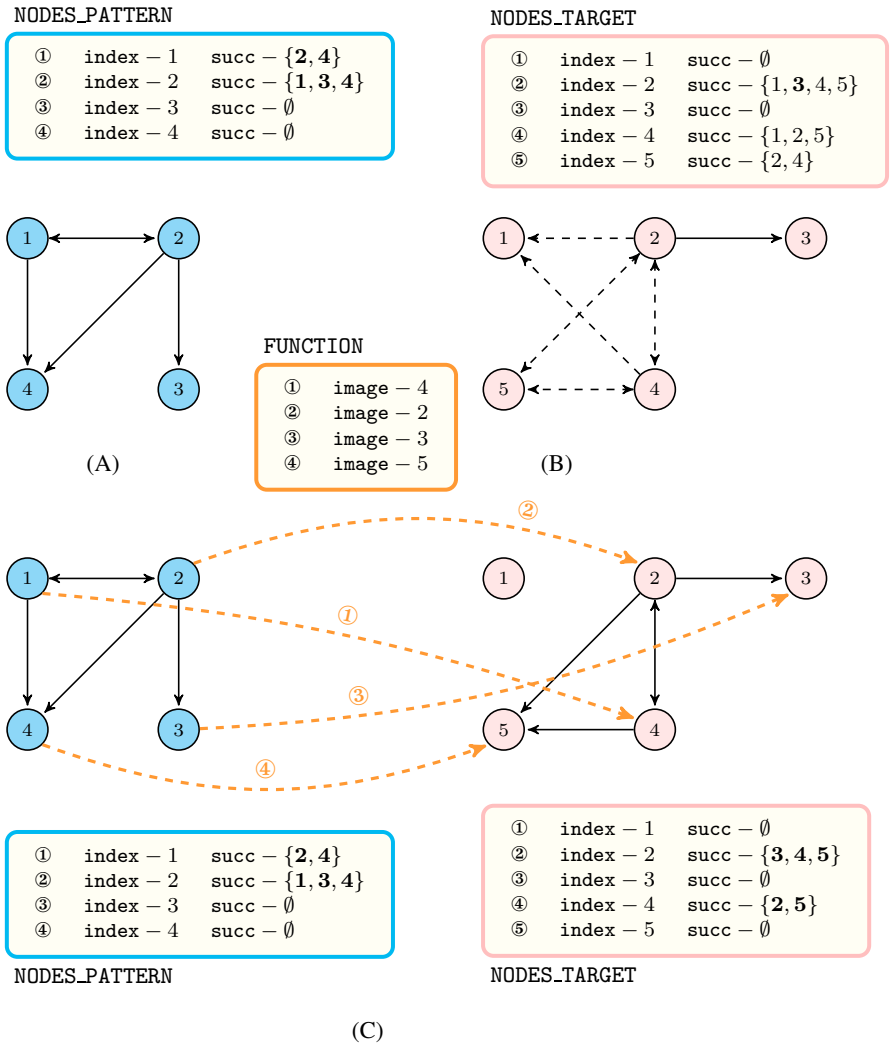

Figure 5.743: Illustration of the **Example** slot: (A) The pattern graph, (B) a possible initial target graph – plain arcs must belong to the induced subgraph, while dotted arcs may or may not belong to the induced subgraph – and (C) the correspondence, denoted by thick dashed arcs, between the vertices of the pattern graph and the vertices of the induced subgraph of the target graph. Within a set variable a bold value (respectively a plain value) represents a value that for sure belong (respectively that may belong) to the set.