5.201 inverse_set

DESCRIPTION LINKS GRAPH

Origin Derived from inverse.

Constraint inverse_set(X, Y)

Arguments

X : collection(index−int, set−svar)
Y : collection(index−int, set−svar)

Restrictions

required(X, [index, set])
required(Y, [index, set])
increasing_seq(X, index)
increasing_seq(Y, index)
$\texttt{X.index} \geq 1$
$\texttt{X.index} \leq |\texttt{X}|$
$\texttt{Y.index} \geq 1$
$\texttt{Y.index} \leq |\texttt{Y}|$
$\texttt{X.set} \geq 1$
$\texttt{X.set} \leq |\texttt{Y}|$
$\texttt{Y.set} \geq 1$
$\texttt{Y.set} \leq |\texttt{X}|$

Purpose

The following two statements are equivalent:

1. Value j belongs to the set variable of the i^{th} item of the X collection.
2. Value i belongs to the set variable of the j^{th} item of the Y collection.

I.e., $j \in \texttt{X}[i] \Leftrightarrow i \in \texttt{Y}[j]$.

Example

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

The inverse_set constraint holds since:

$$\left\{\begin{array}{l} 2 \in \texttt{X}[1].\texttt{set} \Leftrightarrow 1 \in \texttt{Y}[2].\texttt{set}, \quad 4 \in \texttt{X}[1].\texttt{set} \Leftrightarrow 1 \in \texttt{Y}[4].\texttt{set}, \\ 4 \in \texttt{X}[2].\texttt{set} \Leftrightarrow 2 \in \texttt{Y}[4].\texttt{set}, \\ 1 \in \texttt{X}[3].\texttt{set} \Leftrightarrow 3 \in \texttt{Y}[1].\texttt{set}, \\ 4 \in \texttt{X}[4].\texttt{set} \Leftrightarrow 4 \in \texttt{Y}[4].\texttt{set}. \end{array}\right.$$

Typical

$|\texttt{X}| > 1$
$|\texttt{Y}| > 1$

Symmetries

- Arguments are permutable w.r.t. permutation (X, Y).
- Items of X are permutable.
- Items of Y are permutable.

Usage

The `inverse_set` constraint can for instance be used in order to model problems where one has to place items on a rectangular board in such a way that a column or a row can have more than one item. We have one set variable for each row of the board; Its values are the column indexes corresponding to the positions where an item is placed. Similarly we have also one set variable for each column of the board; Its values are the row indexes corresponding to the positions where an item is placed. The `inverse_set` constraint maintains the link between the rows and the columns variables. Figure 5.450 shows the board that can be associated with the example of the **Example** slot.

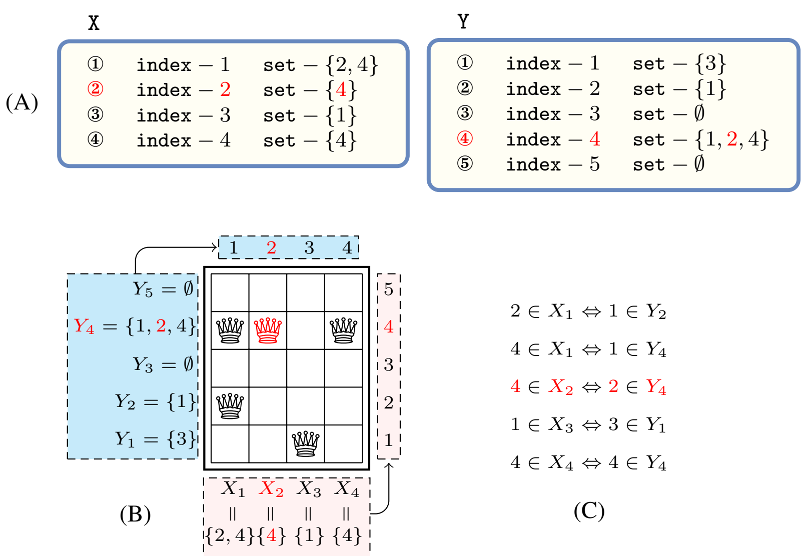


Figure 5.450: Illustration of the **Example** slot where we highlight in red the second item of the X collection and the fourth item of the Y collection showing the relation between X_2 and Y_4, where X_i (with $1 \leq i \leq 4$) and Y_j (with $1 \leq j \leq 5$) respectively stands for the set attribute of the i^{th} item of the X collection and of the j^{th} item of the Y collection (A) Collections X and Y passed to the `inverse_set` constraint, (B) Corresponding board, (C) Conditions linking the items of X and the items of Y.

Systems

inverseSet in **Choco**, inverse_set in **MiniZinc**.

See also

common keyword: `inverse_within_range` *(channelling constraint)*.

specialisation: `inverse` *(*`set variable` *replaced by* `domain variable`*)*.

used in graph description: `in_set`.

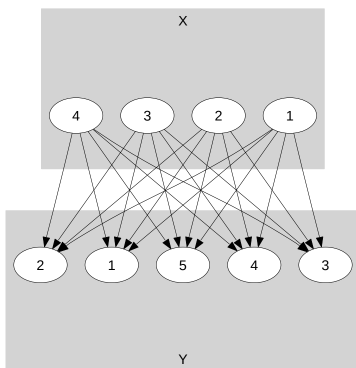
Keywords

constraint arguments: constraint involving set variables.

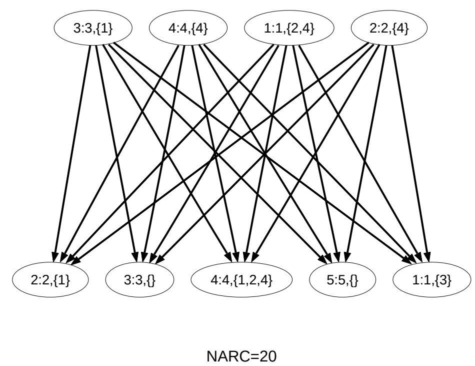
modelling: channelling constraint, set channel, dual model.

Arc input(s)	X Y
Arc generator	*PRODUCT* ↦ collection(x, y)
Arc arity	2
Arc constraint(s)	in_set(y.index, x.set) ⇔ in_set(x.index, y.set)
Graph property(ies)	**NARC** = |X| ∗ |Y|

Graph model Parts (A) and (B) of Figure 5.451 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NARC** graph property, the arcs of the final graph are stressed in bold.



(A)



(B)

Figure 5.451: Initial and final graph of the inverse_set constraint