

5.171 `inverse_offset`

	DESCRIPTION	LINKS	GRAPH
Origin	Gecode		
Constraint	<code>inverse_offset(SOFFSET,POFFSET,NODES)</code>		
Synonym	<code>channel.</code>		
Arguments	SOFFSET : <code>int</code> POFFSET : <code>int</code> NODES : <code>collection(index-int, succ-dvar, pred-dvar)</code>		
Restrictions	<code>required(NODES, [index, succ, pred])</code> <code>NODES.index ≥ 1</code> <code>NODES.index ≤ NODES </code> <code>distinct(NODES, index)</code> <code>NODES.succ ≥ 1 + SOFFSET</code> <code>NODES.succ ≤ NODES + SOFFSET</code> <code>NODES.pred ≥ 1 + POFFSET</code> <code>NODES.pred ≤ NODES + POFFSET</code>		
Purpose	Enforce each vertex of a digraph to have exactly one predecessor and one successor. In addition the following two statements are equivalent: <ol style="list-style-type: none"> 1. The successor of the i^{th} node minus SOFFSET is equal to j. 2. The predecessor of the j^{th} node minus POFFSET is equal to i. I.e., $\text{NODES}[i].\text{succ} - \text{SOFFSET} = j \Leftrightarrow \text{NODES}[j].\text{pred} - \text{POFFSET} = i$.		

Example

$$\left(-1, 0, \left\langle \begin{array}{l} \text{index} - 1 \quad \text{succ} - 4 \quad \text{pred} - 3, \\ \text{index} - 2 \quad \text{succ} - 2 \quad \text{pred} - 5, \\ \text{index} - 3 \quad \text{succ} - 0 \quad \text{pred} - 2, \\ \text{index} - 4 \quad \text{succ} - 6 \quad \text{pred} - 8, \\ \text{index} - 5 \quad \text{succ} - 1 \quad \text{pred} - 1, \\ \text{index} - 6 \quad \text{succ} - 7 \quad \text{pred} - 7, \\ \text{index} - 7 \quad \text{succ} - 5 \quad \text{pred} - 4, \\ \text{index} - 8 \quad \text{succ} - 3 \quad \text{pred} - 6 \end{array} \right\rangle \right)$$

The `inverse_offset` constraint holds since:

- $\text{NODES}[1].\text{succ} - (-1) = 5 \Leftrightarrow \text{NODES}[5].\text{pred} - 0 = 1$,
- $\text{NODES}[2].\text{succ} - (-1) = 3 \Leftrightarrow \text{NODES}[3].\text{pred} - 0 = 2$,
- $\text{NODES}[3].\text{succ} - (-1) = 1 \Leftrightarrow \text{NODES}[1].\text{pred} - 0 = 3$,
- $\text{NODES}[4].\text{succ} - (-1) = 7 \Leftrightarrow \text{NODES}[7].\text{pred} - 0 = 4$,
- $\text{NODES}[5].\text{succ} - (-1) = 2 \Leftrightarrow \text{NODES}[2].\text{pred} - 0 = 5$.

- $\text{NODES}[6].\text{succ} - (-1) = 8 \Leftrightarrow \text{NODES}[8].\text{pred} - 0 = 6.$
- $\text{NODES}[7].\text{succ} - (-1) = 6 \Leftrightarrow \text{NODES}[6].\text{pred} - 0 = 7.$
- $\text{NODES}[8].\text{succ} - (-1) = 4 \Leftrightarrow \text{NODES}[4].\text{pred} - 0 = 8.$

Figure 5.347 shows the board that can be associated with this example.

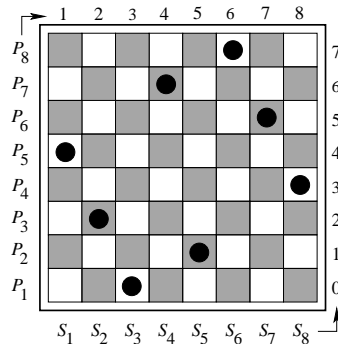


Figure 5.347: Board associated with the example of the **Example** slot

Typical

```
SOFFSET ≥ -1
SOFFSET ≤ 1
POFFSET ≥ -1
POFFSET ≤ 1
|NODES| > 1
```

Symmetry

Items of NODES are [permutable](#).

Remark

The `inverse_offset` constraint is called `channel` in **Gecode** (<http://www.gecode.org/>). Having two offsets was motivated by the fact that it is possible to declare arrays at any position in the MiniZinc modelling language.

Systems

`inverseChanneling` in **Choco**, `channel` in **Gecode**.

See also

[specialisation](#): `inverse` (assume that SOFFSET and POFFSET are both equal to 0).

Keywords

constraint type: graph constraint.
filtering: arc-consistency.
heuristics: heuristics.
modelling: channelling constraint, dual model.

Arc input(s)	NODES
Arc generator	<i>CLIQUE</i> \mapsto <code>collection(nodes1, nodes2)</code>
Arc arity	2
Arc constraint(s)	<ul style="list-style-type: none"> • <code>nodes1.succ - SOFFSET = nodes2.index</code> • <code>nodes2.pred - POFFSET = nodes1.index</code>
Graph property(ies)	NARC = NODES

Graph model

In order to express the binary constraint that links two vertices one has to make explicit the identifier of the vertices. This is why the `inverse_offset` constraint considers objects that have three attributes:

- One fixed attribute `index` that is the identifier of the vertex,
- One variable attribute `succ` that is the successor of the vertex,
- One variable attribute `pred` that is the predecessor of the vertex.

Parts (A) and (B) of Figure 5.348 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.

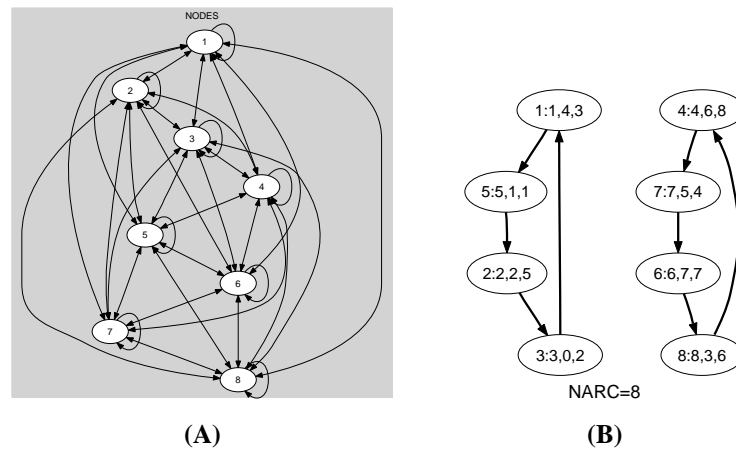


Figure 5.348: Initial and final graph of the `inverse_offset` constraint

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