5.121 element_product

DESCRIPTION LINKS GRAPH

Origin [270]

Constraint element_product(Y, TABLE, X, Z)

Synonym element.

Arguments

Y	:	dvar
TABLE	:	collection(value−int)
X	:	dvar
Z	:	dvar

Restrictions

$\texttt{Y} \geq 1$
$\texttt{Y} \leq |\texttt{TABLE}|$
$\texttt{X} \geq 0$
$\texttt{Z} \geq 0$
required(TABLE, value)
$\texttt{TABLE.value} \geq 0$

Purpose Z is equal to the $\texttt{Y}^{th}$ item of TABLE multiplied by X.

Example $(3, \langle 6, 9, 2, 9\rangle, 5, 10)$

The element_product constraint holds since its fourth argument $\texttt{Z} = 10$ is equal to the 3^{th} ($\texttt{Y} = 3$) item of the collection $\langle 6, 9, 2, 9\rangle$ multiplied by $\texttt{X} = 5$.

Typical

$\texttt{X} > 0$
$\texttt{Z} > 0$
$|\texttt{TABLE}| > 1$
$\texttt{range}(\texttt{TABLE.value}) > 1$
$\texttt{TABLE.value} > 0$

Usage The element_product constraint was originally used in configuration problems [270]. In this context, Z denotes the cost of buying X units of type Y at cost TABLE[Y].value.

Reformulation By introducing an extra variable VAL, the element_product(Y, TABLE, X, Z) constraint can be expressed in term of an element(Y, TABLE, VAL) constraint and of a product constraint $\texttt{Z} = \texttt{VAL} \cdot \texttt{X}$.

See also **common keyword:** elem, element, element_greatereq, element_lesseq (*array constraint*).

Keywords **application area:** configuration problem.

constraint type: data constraint.

modelling: array constraint, table, functional dependency, variable subscript.

Derived Collection

col(ITEM−collection(y−dvar, x−dvar, z−dvar), [item(y − Y, x − X, z − Z)])

Arc input(s) ITEM TABLE

Arc generator $PRODUCT \mapsto$ collection(item, table)

Arc arity 2

Arc constraint(s)
- item.y = table.key
- item.z = item.x ∗ table.value

Graph property(ies) **NARC**= 1

Graph model We use the derived collection ITEM for putting together the Y, the X and Z parameters of the element_product constraint. Within the arc constraint we use the implicit attribute key that associates to each item of a collection its position within the collection.

Parts (A) and (B) of Figure 5.249 respectively show the initial and final graph associated with the **Example** slot. Since we use the **NARC** graph property, the unique arc of the final graph is stressed in bold.

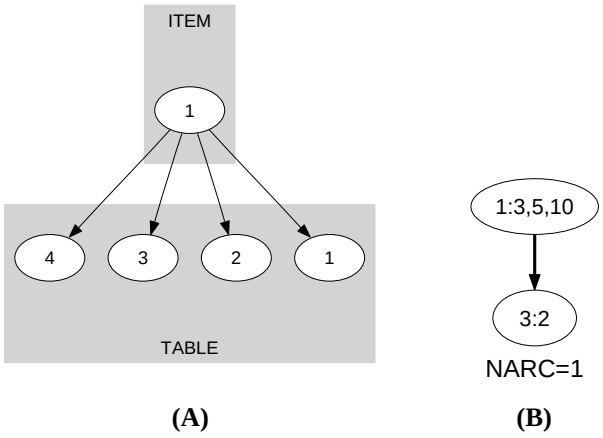

Figure 5.249: Initial and final graph of the element_product constraint

Signature Because of the first condition of the arc constraint the final graph cannot have more than one arc. Therefore we can rewrite **NARC** = 1 to **NARC** ≥ 1 and simplify $\underline{\mathbf{NARC}}$ to $\overline{\mathbf{NARC}}$.