5.384 sum_ctr

DESCRIPTION LINKS GRAPH

Origin Arithmetic constraint.

Constraint sum_ctr(VARIABLES, CTR, VAR)

Synonyms constant_sum, sum, linear, scalar_product.

Arguments

VARIABLES	:	collection(var−dvar)
CTR	:	atom
VAR	:	dvar

Restrictions

required(VARIABLES, var)
CTR $\in [=, \neq, <, \geq, >, \leq]$

Purpose Constraint the sum of a set of domain variables. More precisely, let S denote the sum of the variables of the VARIABLES collection (when the collection is empty the corresponding sum is equal to 0). Enforce the following constraint to hold: S CTR VAR.

Example $(\langle 1, 1, 4\rangle, =, 6)$

The sum_ctr constraint holds since the condition $1 + 1 + 4 = 6$ is satisfied.

Typical

|VARIABLES| > 1
range(VARIABLES.var) > 1
CTR $\in [=, <, \geq, >, \leq]$

Symmetry Items of VARIABLES are permutable.

Arg. properties

- Contractible wrt. VARIABLES when CTR $\in [<, \leq]$ and minval(VARIABLES.var) ≥ 0.
- Contractible wrt. VARIABLES when CTR $\in [\geq, >]$ and maxval(VARIABLES.var) ≤ 0.
- Extensible wrt. VARIABLES when CTR $\in [\geq, >]$ and minval(VARIABLES.var) ≥ 0.
- Extensible wrt. VARIABLES when CTR $\in [<, \leq]$ and maxval(VARIABLES.var) ≤ 0.
- Aggregate: VARIABLES(union), CTR(id), VAR(+).

Remark When CTR corresponds to $=$ this constraint is referenced under the names constant_sum in KOALOG (http://www.koalog.com/php/index.php) and sum in **JaCoP** (http://www.jacop.eu/).

Systems equation in **Choco**, linear in **Gecode**, scalar_product in **SICStus**.

Used in bin_packing, cumulative, cumulative_convex, cumulative_with_level_of_priority, cumulatives, indexed_sum, interval_and_sum, relaxed_sliding_sum, sliding_sum, sliding_time_window_sum.

See also **assignment dimension added:** interval_and_sum *(assignment dimension corresponding to intervals is added)*.

common keyword: arith_sliding *(arithmetic constraint)*, increasing_sum *(sum)*, product_ctr, range_ctr *(arithmetic constraint)*, sum, sum_cubes_ctr, sum_powers4_ctr, sum_powers5_ctr, sum_powers6_ctr *(sum)*, sum_set *(arithmetic constraint)*, sum_squares_ctr *(sum)*.

generalisation: scalar_product *(arithmetic constraint where all coefficients are not necessarly equal to* 1*)*.

implied by: arith_sliding.

system of constraints: sliding_sum.

Keywords **characteristic of a constraint:** sum.

constraint type: arithmetic constraint.

heuristics: regret based heuristics, regret based heuristics in matrix problems.

Cond. implications

- sum_ctr(VARIABLES, CTR, VAR)
  with VARIABLES.var ≥ 0
  and VARIABLES.var ≤ 1
  implies sum_squares_ctr(VARIABLES, CTR, VAR)
  when VARIABLES.var ≥ 0
  and VARIABLES.var ≤ 1.

- sum_ctr(VARIABLES, CTR, VAR)
  with VARIABLES.var ≥ -1
  and VARIABLES.var ≤ 1
  implies sum_cubes_ctr(VARIABLES, CTR, VAR)
  when VARIABLES.var ≥ -1
  and VARIABLES.var ≤ 1.

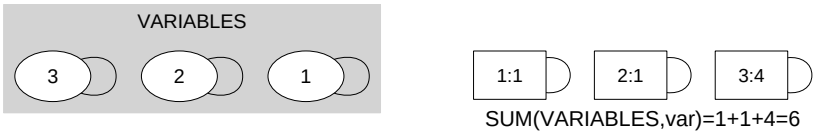
- sum_ctr(VARIABLES, CTR, VAR)
  with VARIABLES.var ≥ -1
  and VARIABLES.var ≤ 1
  implies sum_powers5_ctr(VARIABLES, CTR, VAR)
  when VARIABLES.var ≥ -1
  and VARIABLES.var ≤ 1.

- sum_ctr(VARIABLES, CTR, VAR)
  with CTR $\in [=]$
  and increasing(VARIABLES)
  implies increasing_sum(VARIABLES, VAR).

Arc input(s)	VARIABLES
Arc generator	$SELF \mapsto$ collection(variables)
Arc arity	1
Arc constraint(s)	TRUE
Graph property(ies)	**SUM**(VARIABLES, var) CTR VAR

Graph model Since we want to keep all the vertices of the initial graph we use the *SELF* arc generator together with the TRUE arc constraint. This predefined arc constraint always holds.

Parts (A) and (B) of Figure 5.746 respectively show the initial and final graph associated with the **Example** slot. Since we use the TRUE arc constraint both graphs are identical.



(A) **(B)**

Figure 5.746: Initial and final graph of the sum_ctr constraint