5.72 colored_matrix

DESCRIPTION LINKS

Origin KOALOG

Constraint colored_matrix(C, L, K, MATRIX, CPROJ, LPROJ)

Synonyms coloured_matrix, cardinality_matrix, card_matrix.

Arguments

C : int
L : int
K : int
MATRIX : collection(column−int, line−int, var−dvar)
CPROJ : collection(column−int, val−int, nocc−dvar)
LPROJ : collection(line−int, val−int, nocc−dvar)

Restrictions

C ≥ 0
L ≥ 0
K ≥ 0
required(MATRIX, [column, line, var])
increasing_seq(MATRIX, [column, line])
|MATRIX| = C ∗ L + C + L + 1
MATRIX.column ≥ 0
MATRIX.column ≤ C
MATRIX.line ≥ 0
MATRIX.line ≤ L
MATRIX.var ≥ 0
MATRIX.var ≤ K
required(CPROJ, [column, val, nocc])
increasing_seq(CPROJ, [column, val])
|CPROJ| = C ∗ K + C + K + 1
CPROJ.column ≥ 0
CPROJ.column ≤ C
CPROJ.val ≥ 0
CPROJ.val ≤ K
required(LPROJ, [line, val, nocc])
increasing_seq(LPROJ, [line, val])
|LPROJ| = L ∗ K + L + K + 1
LPROJ.line ≥ 0
LPROJ.line ≤ L
LPROJ.val ≥ 0
LPROJ.val ≤ K

Purpose Given a matrix of domain variables, imposes a global_cardinality constraint involving cardinality variables on each column and each row of the matrix.

Example

$$\left(\begin{array}{l} 1,2,4,\left\langle\begin{array}{lll} \texttt{column}-0 & \texttt{line}-0 & \texttt{var}-3, \\ \texttt{column}-0 & \texttt{line}-1 & \texttt{var}-1, \\ \texttt{column}-0 & \texttt{line}-2 & \texttt{var}-3, \\ \texttt{column}-1 & \texttt{line}-0 & \texttt{var}-4, \\ \texttt{column}-1 & \texttt{line}-1 & \texttt{var}-4, \\ \texttt{column}-1 & \texttt{line}-2 & \texttt{var}-3 \end{array}\right\rangle, \\ \left\langle\begin{array}{lll} \texttt{column}-0 & \texttt{val}-0 & \texttt{nocc}-0, \\ \texttt{column}-0 & \texttt{val}-1 & \texttt{nocc}-1, \\ \texttt{column}-0 & \texttt{val}-2 & \texttt{nocc}-0, \\ \texttt{column}-0 & \texttt{val}-3 & \texttt{nocc}-2, \\ \texttt{column}-0 & \texttt{val}-4 & \texttt{nocc}-0, \\ \texttt{column}-1 & \texttt{val}-0 & \texttt{nocc}-0, \\ \texttt{column}-1 & \texttt{val}-1 & \texttt{nocc}-0, \\ \texttt{column}-1 & \texttt{val}-2 & \texttt{nocc}-0, \\ \texttt{column}-1 & \texttt{val}-3 & \texttt{nocc}-1, \\ \texttt{column}-1 & \texttt{val}-4 & \texttt{nocc}-2 \end{array}\right\rangle, \\ \left\langle\begin{array}{lll} \texttt{line}-0 & \texttt{val}-0 & \texttt{nocc}-0, \\ \texttt{line}-0 & \texttt{val}-1 & \texttt{nocc}-0, \\ \texttt{line}-0 & \texttt{val}-2 & \texttt{nocc}-0, \\ \texttt{line}-0 & \texttt{val}-3 & \texttt{nocc}-1, \\ \texttt{line}-0 & \texttt{val}-4 & \texttt{nocc}-1, \\ \texttt{line}-1 & \texttt{val}-0 & \texttt{nocc}-0, \\ \texttt{line}-1 & \texttt{val}-1 & \texttt{nocc}-1, \\ \texttt{line}-1 & \texttt{val}-2 & \texttt{nocc}-0, \\ \texttt{line}-1 & \texttt{val}-3 & \texttt{nocc}-0, \\ \texttt{line}-1 & \texttt{val}-4 & \texttt{nocc}-1, \\ \texttt{line}-2 & \texttt{val}-0 & \texttt{nocc}-0, \\ \texttt{line}-2 & \texttt{val}-1 & \texttt{nocc}-0, \\ \texttt{line}-2 & \texttt{val}-2 & \texttt{nocc}-0, \\ \texttt{line}-2 & \texttt{val}-3 & \texttt{nocc}-2, \\ \texttt{line}-2 & \texttt{val}-4 & \texttt{nocc}-0 \end{array}\right\rangle \end{array}\right)$$

Typical

$\texttt{C} \geq 1$
$\texttt{L} \geq 1$
$\texttt{K} \geq 1$
$\texttt{range}(\texttt{MATRIX.var}) > 1$

Arg. properties

- Functional dependency: CPROJ.nocc determined by C, L and K.
- Functional dependency: LPROJ.nocc determined by C, L and K.

Remark

Within [350] the colored_matrix constraint is called cardinality_matrix.

Algorithm

The filtering algorithm described in [350] is based on network flow and does not achieve arc-consistency in general. However, when the number of values is restricted to two, the algorithm [350] achieves arc-consistency on the variables of the matrix. This corresponds in fact to a generalisation of the problem called "Matrices composed of 0's and 1's" presented by Ford and Fulkerson [227].

See also

common keyword: `k_alldifferent` *(system of constraints)*.

part of system of constraints: `global_cardinality`.

related to a common problem: `same` *(matrix reconstruction problem)*.

Keywords

constraint arguments: pure functional dependency.

constraint type: system of constraints, predefined constraint, timetabling constraint.

modelling: functional dependency, matrix, matrix model.