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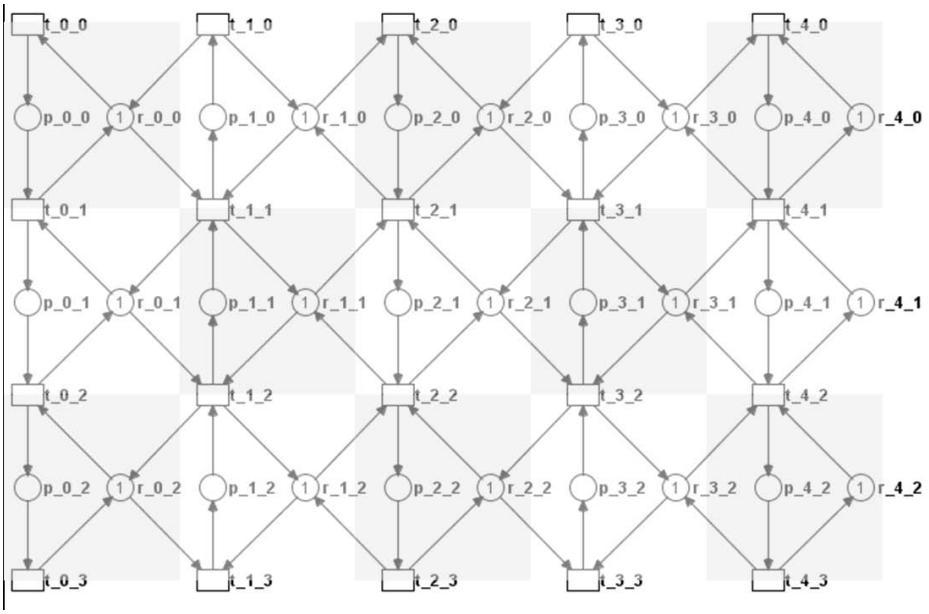
Introduction

This Model form is a short description of the Resource Allocation Model model that comes, for the Model Checking Contest @ Petri Nets, with: a set of PNML files, a set of properties to be checked (possibly one file per model instance) and an optional set of properties concerning the model (invariants, etc. – possibly one file per model instance). For Coloured Nets, equivalent PNML P/T net files are proposed too.

Resource Allocation Model



Presentation

Description: Let us consider a kind of chessboard, whose dimensions are nR ($nR \geq 1$) and nC ($nC \geq 2$), respectively, in which each position has a given capacity (let say $K \geq 1$) for holding ants. Let us also consider ant processes which traverse the board, either North-South or South-North directions, always jumping from one position to the following one. For safety reasons each ant, before jumping to the next position, books the position he is going to jump over and also the adjacent one in the west side of the target position. Of course, because of the position capacity constraint, no more than K ants can stay simultaneously in the same position.

In the set of considered specific models, even columns correspond to North-South ant processes, while odd columns correspond to South-North ant processes. The figure sketches a particular board model for `nR=3`, `nC=5` and `K=1`.

The system can be parametrized in three ways, varying each one of nR, nC and K (here K=1). When varying nR we will call the model a RAS-R, and when varying nC we will call it a RAS-C.

These models belong the family of Resource Allocation Systems, RAS. A RAS is composed of a finite set of processes that share in a competitive way a finite set of resources. In a system there can be resources of several types, and for each type there can be several available copies. In this case, the model belong to the family of the S^4PR nets, as described in [TrEz2006].

Places `p_*_*` correspond to *state places*, while places `r_*_*` correspond to *resource places*. Resource places model the state of the resources shared by the ant processes (in this case the state of a resource is identified as its free capacity). State places model the board position where an ant process is at a given moment.

The program used to generate de PNML models can be downloaded from:
`https://github.com/fernand0/Petri-Net-tools/blob/master/model_generator.c`
There is a script to generate all the models for a selected set of parameters, at:
`https://github.com/fernand0/Petri-Net-tools/blob/master/pnml.sh`.

Origin: [TrEz2006] Tricas, F.; Ezpeleta, J.; Computing minimal siphons in Petri net models of resource allocation systems: a parallel solution. Systems, Man and Cybernetics, Part A, IEEE Transactions on Volume 36, Issue 3, May 2006 Page(s):532 - 539

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Scaling parameter

Name	Description	Values
nR, nC	Number of rows // columns	(3,2), (3,3), (3,5), (3,10), (3,15), (3,20), (3,50), (3,100), (2,2), (3,2), (5,2), (10,2), (15,2), (20,2), (50,2), (100,2)

Information about the Model

Data on the Model

Number of places	Number of transitions	Number of arcs	Scaling parameter value
2*nR*nC	nC*(nR+1)	4*nR*nC+2*nR*(nC-1)	"all"

Stated Properties

safe	✗	**free choice**	✗	**event graph**	✗
deadlock	✔	**state machine**	✗	**reversible**	✗

Other Properties (not mandatory)

- For each resource, r_i_j, the set $\{r\_i\_j, p\_i\_j, p\_(i+1)\_j\}$ ($\{r\_i\_j, p\_i\_j\}$ for the most eastern process) is the support of a (minimal) 1-valued P-semiflow, stating the conservativeness of the resource capacity. The whole set of that P-semiflows form a basis of the set of P-semiflows.
- For each ant process j, the set of involved transitions $\{t\_j\_0, t\_j\_1, ..., t\_j\_nR\}$ is the support of a (minimal) 1-valued T-semiflow, stating the repetitiveness of the process. The whole set of that T-semiflows form a basis of the set of T-semiflows.