

## Introduction

This Model form is a short description of the Railroad crossing 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.

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## Railroad crossing

### Presentation

**Description:** This model is the Petri nets semantics of an ABCD model of a railroad crossing system. It has three components: a gate sub-net (top of figure), a controller sub-net (split in 3 sub-figures, middle-right and bottom) and  $n$  tracks sub-nets that differ only by an identifier  $k$  in  $\{0, \dots, n-1\}$  (middle-left of figure). These components communicate through shared places, some being low-level places to exchange signals, others being integer-valued places to exchange tracks identifiers. The controller also has a place to count the number of trains at a given time.

We list now all the places with there type, initial marking and properties:

- **green\_one** (type  $\{0, \dots, n-1\}$ , marking  $\{0, \dots, n-1\}$ , colour-safe): a green light for each track;
- **green\_all** (type  $\{\bullet\}$ , marking  $\{\bullet\}$ , 1-safe): a global flag to control all the tracks green lights;
- **down** (type  $\{\bullet\}$ , marking  $\{\}$ , 1-safe): a channel to command gates to go down;
- **up** (type  $\{\bullet\}$ , marking  $\{\}$ , 1-safe): a channel to command gates to go up;
- **enter** (type  $\{\bullet\}$ , marking  $\{\}$ ,  $n$ -bounded): a channel to inform the controller that a train is approaching on any track;
- **leave** (type  $\{0, \dots, n-1\}$ , marking  $\{\}$ , colour-safe): a channel to inform the controller that a train is leaving on a particular track;
- **done** (type  $\{0, 2\}$ , marking  $\{\}$ , colour-safe): a channel to inform the controller that the gates have done moving (either up or down);
- **state** (type  $\{0, 1, 2\}$ , marking  $\{2\}$ , 1-safe): stores the current state of gates (closed, moving, opened);
- **crossing<sub>k</sub>** (type  $\{\bullet\}$ , marking  $\{\}$ , 1-safe): one place for each track  $k$  that holds a token when a train on this track is crossing the gates;
- **count** (type  $\{0, \dots, n-1\}$ , marking  $\{0\}$ , 1-safe): number of trains currently present.
- all the other places are control-flow places, and thus have type  $\{\bullet\}$  and are 1-safe ( $2+n$  control flow places are unmarked and isolated so they can be ignored and they are not depicted in the figure).

For the sake of readability, some places in the figure have been depicted several times, in which case they are labelled with a name. Moreover, unlabelled places have type  $\{\bullet\}$  and unlabelled arcs carry a single token  $\bullet$ .

The transitions are as follows:

- $g_1$  (resp.  $g_3$ ) models the receiving by the gates of a signal to go down (resp. up);
- $g_2$  (resp.  $g_4$ ) models the full closing (resp. opening) of the gates;
- $t_{k,1}$ ,  $t_{k,2}$  and  $t_{k,3}$  respectively model for track  $k$ , the arrival of a train, the entering of a train in between the gates, and the leaving of a train;
- $r_1$  models the receiving by the controller of the signal that a first train arrived;
- $r_5$  models the receiving by the controller of the signal that one more train arrived;
- $r_2$  models the receiving by the controller of the signal that the gates finished to close;
- $r_3$  models the receiving by the controller of the signal that the last train exited;
- $r_6$  models the receiving by the controller of the signal that one train exited while there are still trains present;
- $r_4$  models the receiving by the controller of the signal that the gates finished to open.

$r_1$ ,  $r_3$ ,  $r_5$  and  $r_6$  are the only guarded transitions (*i.e.*, all the other guards are true).

Origin: None

#### Scaling parameter

Name	Description	Values
$n$	number of tracks	to be defined by tests

## Information about the Model

#### Data on the Model

Number of places	Number of transitions	Number of arcs	Scaling parameter value
$18 + 5 \cdot n$	$10 + 3 \cdot n$	$52 + 13 \cdot n$	5, 10, 20, 50, 100

## Stated Properties

safe	<input checked="" type="checkbox"/>	free choice	?	event graph	?
deadlock	<input checked="" type="checkbox"/>	state machine	?	reversible	?

## Other Properties (not mandatory)

