Assignment 3
Operational Semantics in AToMPM

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1 Practical Information

The goal of this assignment is to build a rule-based transformation for the operational semantics of the railway modelling language in AToMPM.

Use the /Formalisms/__Transformations__/Transformation/MoTiF and /Formalisms/__Transformations__/TransformationRule/TransformationRule formalisms in combination with your RAMified domain-specific language to create the rules and schedule of your transformation. Make your operational semantics such that the model is updated visually while executing the transformation.

Write a report that includes a clear explanation of your complete solution, the modelling choices you made, as well as an explanation of your testing process. Also mention possible difficulties you encountered during the assignment, and how you solved them. You will have to complete this assignment in groups of 2. Submit your assignment (report in pdf, abstract and concrete syntax definition, example models, and the complete rule-based transformation) on Blackboard before Friday, November 11, 13:00h.

Contact Simon Van Mierlo (simon.vanmierlo@uantwerpen.be) if you have a problem.

2 Requirements

You will model the semantics of a "control room" that regulates the flow of trains on the railway network. The goal is to get each train to its destination safely. This means that the control room needs to make sure two trains can never be on the same track, as well as switching turnouts and junctions to the correct position. More detailed rules are listed below:

- The simulation is broken up into a number of "steps". In each step, the control room first sets all lights to the correct "mode" and switches the direction of turnouts and junctions. After that, all trains move (concurrently) to the next segment, if allowed.
- In the initial step, all trains are placed in their start station.

- A train is allowed to move to the next segment if the light on its current segment is set to green. If the light is red, the train has to wait.
- If a train is on a turnout, it moves in the direction the turnout is set to. In other words, a train has no access to its schedule and follows the directions set by the control room.
- The control room iterates over all segments that contain a train. If no train is present on the segment the train wants to move to, it sets the light of the segment the train is currently on to green.
- If a train is on a turnout, the control room switches the direction to where the train wants to go, by looking at the next step in the schedule of the train. It is an error if there is no step (the schedule has reached the end) when a train wants to leave a turnout.
- In case of two trains wanting to enter a junction at the same time, the control room chooses one randomly.
- A train can only enter a junction if the direction of the junction is set correctly.
- When a train reaches its end station, it is removed from the model.

During simulation, your model should be updated visually to show the evolution of the simulation state.

3 Useful Links

- AToMPM main page: `http://www-ens.iro.umontreal.ca/~syriani/atompm/atompm.htm`
- AToMPM user manual: `https://msdl.uantwerpen.be/documentation/AToMPM/`
- AToMPM git repository: `https://msdl.uantwerpen.be/git/simon/AToMPM` (includes installation instructions)
- Useful tutorials can be found on the 'Tutorials & Demos' page on the main website.