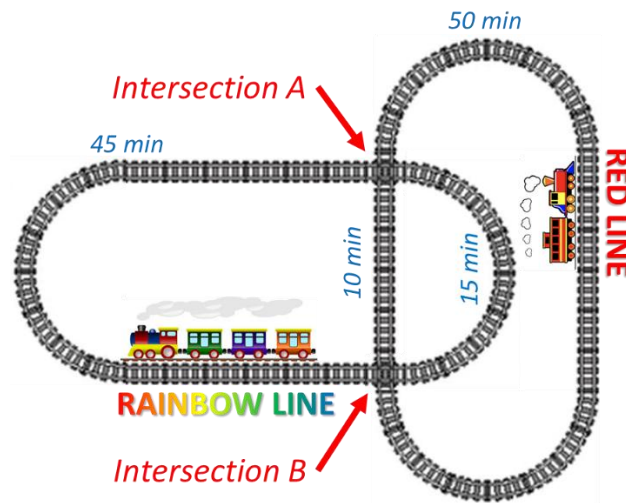


Performance Evaluation of a City Transport System

A small city has two train lines: the *Red line* and *Rainbow line*.



The two lines are circular in single direction: the Rainbow line runs clockwise, while the Red line runs counterclockwise. The two lines cross each other in two intersections: *Intersection A* and *Intersection B*. If two trains try to cross an intersection at the same time, the second one arriving has to wait.

The times required to cross the various segments, are the following.

Crossing an intersection	Exponential with an average of 1 min.
Red line: From inters. B to inters. A	Exponential with an average of 50 mins.
Red line: From inters. A to inters. B	Exponential with an average of 10 ms.
Rainbow line: From inters. A to inters. B	Exponential with an average of 15 mins.
Rainbow line: From inters. B to inters. A	Exponential with an average of 45 ms.

Model the system with a Generalized Stochastic Petri Net, considering *three trains* for the Rainbow line and *three trains* for the Red line. Hint: the transitions modelling the travelling of the trains should be infinite servers, since queuing can only occur at the intersections. The intersection can be modelled according to the “*Mutual exclusion*” pattern shown in slide 33 of L10, with a structure similar to the one shown in slide 37. Immediate transitions can be used to model the entrance in the “accessing” place, while timed transition (with a duration equivalent to the crossing time – that is exponential with the average of one minute) should be used for the end of the crossing action.

Questions:

1. Which is the throughput of the two lines (in trains per hours)?
2. Which is the average time required to perform a loop for the two lines (in minutes)? Hint: use Little’s law (and consider the fact that the number of trains in one line is constant)

Please enter the answers, together with a ZIP file containing the .jsim files of your model, renamed with PPTX extension, in the following form:

https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope67-7CBR7gDJEgHF_krAEqPhUNTFGVDhLMFZDV1ZXT0hIUkwzWUVEWlITMy4u

The deadline is **Midnight, 2/11/2025 (Halloween)**