

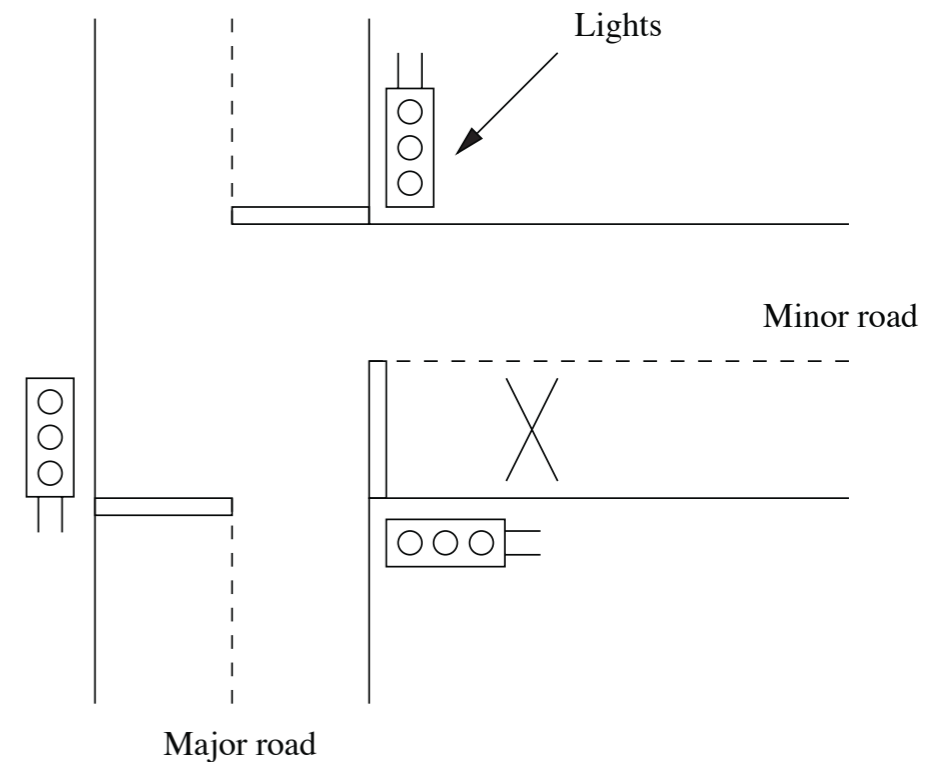
Uppaal Exercise

Arquitectura e Cálculo
2021

Traffic Lights Intersection

Behavioural constraints:

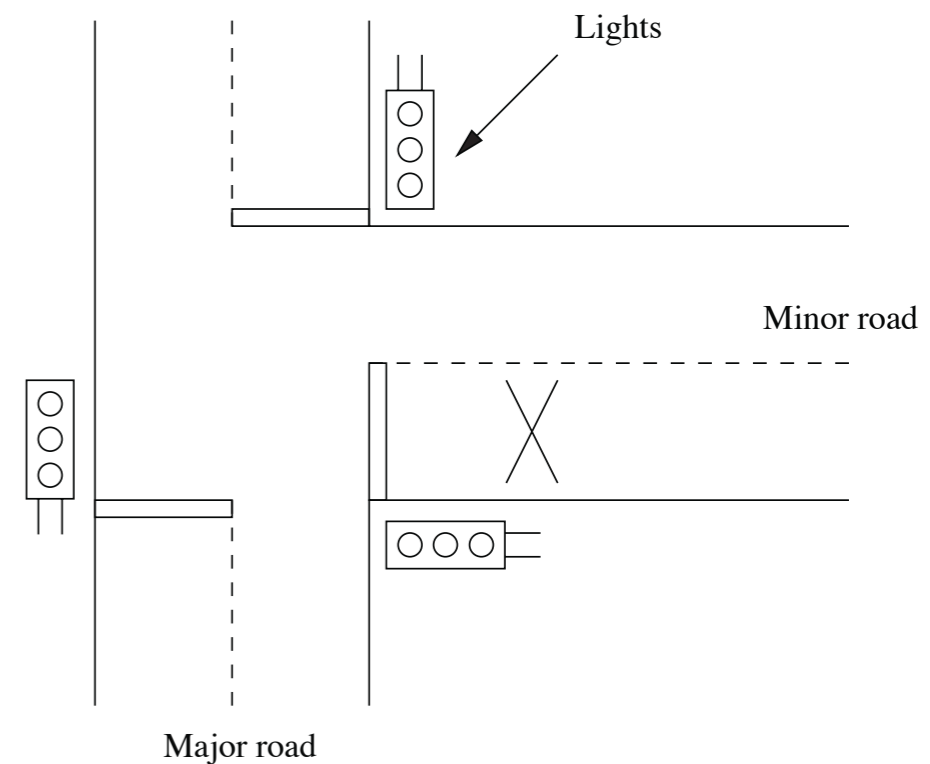
- A control system must ensure the safe and correct functioning of a set of traffic lights at a T-junction between a major and a minor road.
- The lights will be set on green on the major road and red on the minor road unless a vehicle is detected by a sensor in the road just before the lights on the minor road.
- In this case the lights will be switchable in the standard manner and allow traffic to leave the minor road.
- After a suitable interval the lights will revert to their default position to allow traffic to flow on the major road again.
- Once a vehicle is detected the sensor will be disabled until the minor-road lights are set to red again.



Traffic Lights Intersection

Temporal constraints:

- Minor road light stays on green for 30s
- Interim lights stay on for 5s
- 1s delay between switching one light off and the other on
- Major road light must be green for at least 30s in each cycle...
- ... but must respond to the sensor immediately after that



Tasks (1)

- Model in Uppaal the traffic light intersection system
- The system must be deadlock free
- Save the model in a .xml file

Tasks (2)

- In addition to verify the following properties, write 2 more reachability and safety queries.
- Save all queries in a .q file

Reachability properties

- Minor road light can go green
- Major road light can go red

Safety properties

- No deadlock
- The two lights are not green at the same time

Liveness properties

- If there are cars waiting they should get green light
- A car will not wait forever

Useful Links

- **Uppaal:**
 - <http://www.uppaaal.org/>
- **Uppaal Tutorial:**
 - <http://www.it.uu.se/research/group/darts/papers/texts/new-tutorial.pdf>
- **Some bibliography on TA:**
 - *A theory of timed automata* - Rajeev Alur and David L.Dill
 - *Principles of Model Checking* - Christel Baier and Joost-Pieter Katoen
 - *Timed Automata: Semantics, Algorithms and Tools* - Johan Bengtsson and Wang Yi

Contact

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