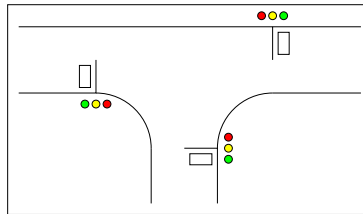# Project 1: Modeling and Verification of Traffic Lights

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Problem

In order to be able to use set of formulas and models independently, the following variables are fixed ($i \in \{0, 1, 2\}$ represents the direction):

```
bool G[3],Y[3],R[3];    states of the colored lights
bool S[3];              states of the car-waiting sensors
clock c[3];             time since last sensor change
clock activity;         time since last car crossing
```

- Formula's cannot refer to any other variables, because otherwise they cannot be used for other models than your own.

- Models must have these variables, but may have others.

To get the requirements right, please note that drivers

- have a reaction time of no more than 2 seconds.

- get impatient after 30 seconds if nothing happens.

- get impatient after 120 seconds even if things happen.

- cause accidents if they get impatient.

- are otherwise perfect.

As discussed in the lecture, we need to model at least three drivers: the defined variables allow us to detect if a driver is waiting at one of the sides, so to have a driver waiting everywhere, we need three drivers. If your model has more locations then your model needs more drivers, but that is not necessary.

We also need to agree on the following conditions:

- Green lasts at least 2 seconds

- Yellow lasts at least 5 seconds

- German system: Red, Red+Yellow, Green, Yellow, Red

- No hardware failures

- No illegal state for 0 time issues
  E.g. first Yellow to Red then Red to Red+Yellow,
  not Red to Red+Yellow then at the same time Yellow to Red.

Task

Using Uppaal, version 4:

- Write a correct implementation (control and drivers).

- Optionally write incorrect implementations.

- Write formula's that express correctness.

Grading criteria:

- Creativity in incorrect implementations.

- Completeness of set of formula's.
  That is, avoid accepting incorrect systems (false positives)

- Flexibility of set of formula's.
  That is, avoid rejecting incorrect systems (false negatives)

Rules

- The (preliminary) deadline is 26.4.2007.

- The sooner you ask for an extension, the longer that extension can be.

- Usually, it is possible to deduce the intention behind a model from the model. So comments are rarely needed. The same is often not the case for formula's. Writing a comment for a formula's can make the difference between marking it as a fundamental mistake or marking it as a typo.

- Everybody should write their own version, but discussion with colleagues is recommended.