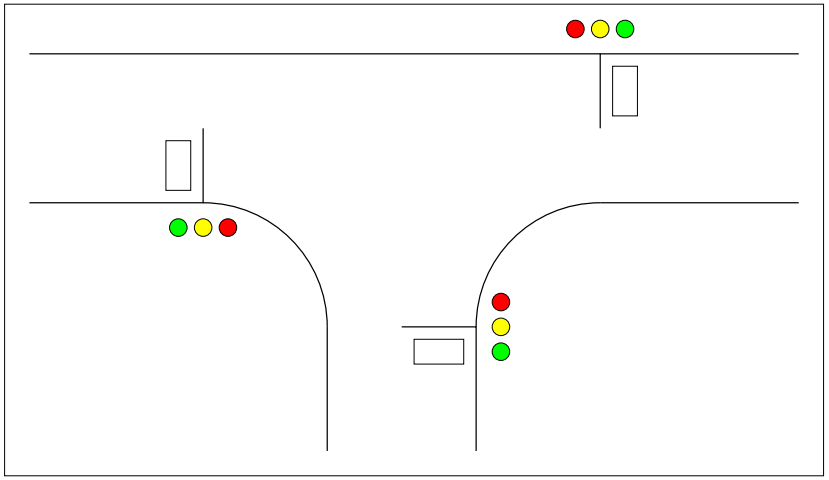
Uppaal hints

- Browse the built-in help or the online help
- Please note that

  `forall (i : int[k,m]) whatever`

  means $\forall i \in \{k, k+1, \cdots, m\} whatever$
- Ditto $\exists$ and `exists`.

Requirements for traffic lights



- Variables ($i \in \{0, 1, 2\}$ represent 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
- Models may have more variables

Requirements for traffic lights

- 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.
- How many drivers do we need in the environment?

Requirements for traffic lights

- Further info
  - 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.

Requirements for traffic lights

- Exercises in 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)