CIS 4930/6930 Principles of Cyber-Physical Systems

Project #2: Due: April 15th, 2014

Problem Description

This project is the continuation of the project 1 with additional consideration of timing in the models. More information on the untimed traffic control model can be found at `http://www.csee.usf.edu/~zheng/teaching/PrinciplesCPS/proj/proj.pdf`. Again, the project slides only give a general idea. You will have to understand this design more concretely to accomplish this project successfully.

Modeling with Timing Time is used to model how fast the traffic in each direction can pass certain regions near an intersection.

1. When a car approaches the intersection, signal *appr* is triggered. Similarly, the turn information needs to be transmitted to the controller.
2. After *appr* is triggered, if signal *go* is received less than 5 seconds, the car can reach the intersection directly, which takes between 10 and 20 seconds for a car to reach the intersection after it triggers *appr*.
3. Otherwise, the car should slow down. It takes between 5 and 7 seconds to come to a full stop.
4. The car can re-accelerate and go to the intersection in between 12 and 25 seconds if signal *go* is received 0 and 4 seconds after it starts to slow down but before come to a full stop.
5. When the car is in full stop, it will take between 7 and 15 seconds to reach the intersection after it receives signal *go*.
6. Once the car is in the intersection, it takes between 3 and 5 seconds for the car to cross it.
7. After the car leaves the intersection, it triggers signal *leave*.

What to do Use UPPAAL to build the timed automata models for the smart traffic control problem with the above timing information, and to answer the following questions.

1. Is there any possibility for collision to happen in the intersection?
2. Make sure that cars from different directions that do not cause collision are allowed to cross at the same time.
3. Is it possible for traffic in any direction to be stopped forever? If the answer is positive, this problem needs to be fixed. If negative, calculate the maximal amount of time that a car can be stopped? Is the stop time for all four cars the same?
4. (**Required for CIS 6930**)What is the minimal amount of time it takes for all four cars to cross the intersection?
5. (**Required for CIS 6930**) What is the maximal amount of time it takes for all four cars to cross the intersection?

To answer the above questions, you need to develop TCTL properties within UPPAAL, and ask UPPAAL to check them for you. Your models are expected to satisfy the properties for question 1 and 2.

Similarly to Project 1, the successful completion of this project requires you create a `readme` file that includes the following items.

1. Sufficient comments on the models and properties,
2. Explanation of the obtained results,
3. Necessary assumptions you make about your design/model,
4. An actor models with clear indications on blocks and their interfaces and connections.

Loss of credits may occur if your solutions are difficult or not clear to understand and evaluate.

Note: this is a group project. Each group should have no more than two members. Names of group members must be shown on the first line of the `readme` *file. A single grade will be assigned to both group members.*

What to Submit

Name your model file and query property file as `proj2.xml` and `proj2.q`. Zip these two files and the `readme` into a single zip file with `.zip` suffix, and name it as **proj2-{last name of a group member}.zip** to help me recognize the owner of the file. Submit it via Canvas.