Final Project

Project Description

In this final project, you have the choice of either (1) modeling and verifying a cyber-physical system, including but not limited to the list of systems below:

1. Asynchronous circuits or protocols,
2. Distributed systems and protocols,
3. Communication protocols,
4. Timed control systems,
5. Hybrid systems,
6. Probabilistic systems,
7. Synthetic biological networks,
8. Deep neural networks, and
9. Robotic control systems;

or (2) implementing a method or an algorithm to improve an existing formal verification tool.

Tasks

1. Email your choice of project topic, a brief description of project objectives and the verification tool you will be using to the instructor.
2. Revise your project topic based on the feedback received from the instructor.
3. Your final project should meet the requirements listed below.
   - System modeling and verification project:
     (a) The formal model is required to be *complete* and *fully executable*.
       – A complete formal model should include specifications at one or more abstraction levels with clearly specified environment assumptions.
       – A fully executable formal model means that the instructor can follow instructions provided by you to run your model, check the safety and/or liveness properties, and reproduce results reported in your project report.
     (b) Specify clearly all safety and/or liveness properties and comment each property with a word description.
     (c) Prepare a README file to give instructions on how to run your formal model to verify properties.
   - Method and algorithm implementation project:
     (a) Code implementation should be *fully executable*, open source, and well-documented. Use of existing software libraries is allowed.
       – A fully executable project means that the instructor can follow instructions provided by you to run your code by successfully testing one or more examples and reproduce results in your project report.
       – Make your implementation open source, and document your code to make it easy to understand by others.

(b) Include one or more formal models to be tested on your code implementation.
(c) Prepare a README file to give instructions on how to run your project and how to read the output.

4. Write a project report. Note that **copying description directly from other resources will automatically result a zero grade on your final project.** Use your own words. Your report should meet the requirements listed below.

   (a) Use the following IEEE double-column template: `https://www.ieee.org/conferences_events/conferences/publishing/templates.html`.

   (b) Meet project specific requirements below.

      i. System modeling and verification project:
         - Overview of the system you are modeling.
         - Detailed description of your formal model and safety and/or liveness requirements, including figure(s) of your formal model.
         - Description of any environment assumptions and level(s) of abstraction for your formal model.
         - Detailed discussion of the verification results.
         - Potential improvements that can be made about your design.

      ii. Method and algorithm implementation project:
         - Describe the method and/or algorithm using pseudo-code.
         - Include a simple example and necessary figures to illustrate how your code implementation works on the example.
         - Detailed discussion of the verification results and performance (including runtime and memory footprint).
         - Potential improvements that can be made to your implementation.

Submission Requirements

Submit your work as a **single zip file** in the format **finalPrj-{your last name(s)}.zip** to Canvas. It should include the items listed below.

1. Make sure your final project is executable *before* submission. You may lose substantial amount of points if your project is not executable.

2. All relevant project files meeting the requirements stated above and a README file describing steps to run verification.

3. Final project report meeting the requirements stated above. The format must be **finalPrj-{your last name(s)}.pdf**. All writings and figures must be clear and readable.