The State Diagram and Property Checker Plugin

Installation Steps:

1. Install JIVE following instructions given at https://cse.buffalo.edu/jive/download.html
   Tutorials on its usage are given at: https://cse.buffalo.edu/jive/tutorials.html

2. Install *PlantUML* as an Eclipse plugin from: http://hallvard.github.io/plantuml

3. Install *GraphViz* on your computer from: http://www.graphviz.org/download. Scroll down to "Executable Packages" where you can find links for Linux, Mac, and Windows.

   Note: *GraphViz* should be installed as a regular application on your computer, *not* as an Eclipse plugin.

4. Install the *State Diagram and Property Checker* plugin by first downloading:

   FSM_Properties_Dec_2019.zip

   Unzip the file to obtain the directory FSM_Properties_Dec_2019.

5. Install it as an Eclipse plugin as follows:

   Help→Install New Software→Add→Local→<*browse and select* FSM_Properties_Dec_2019>

6. Uncheck “Group Items by Category”. Follow the prompts and install.

   Sample multi-threaded Java programs are given in the EXAMPLES directory.

For the State Diagram and Property Checker views:

1. You can bring up the Property Checker (or State Diagram) view by doing

   Window →Show View → Other → JIVE → Property Checker (or State Diagram)

2. To use the Property Checker (and State Diagram), you must first export a .csv file from the Execution Trace view after running a Java program to completion. This view is at

   Window →Show View →Execution Trace

3. In the Property Checker (or State Diagram) view, first browse and select the exported .csv file, then add one or more fields from the drop-down menu, and draw the state diagram.

For the Property Checker view:

To check properties, enter abbreviations for the selected fields in the Abbreviations text-box and enter properties in the Properties text-box, and press Validate. We present two examples of properties below.

(i) Readers-Writers Example (discussed in paper):

Fields to be Added: Database:1.r, Database:1.w, Database:1.ww

Abbreviations: Database:1.r = r, Database:1.w = w, Database:1.ww = ww

```
// Basic policy – mutual exclusion of readers and writers, with concurrency for readers

G [ (r > 0 -> w = 0) &&
   (w > 0  -> r = 0) &&
   (w = 0 || w = 1)
 ]
```

// Writers Priority – the # of running readers monotonically decreases when there is a waiting writer

```
G [ (r > 0 && ww > 0 -> r' <= r) ]
```

Multiple properties can be entered, separated by semi-colons.

(ii) Dining Philosophers Example (also discussed in paper)

Fields to be Added: Philo:1.state,Philo:2.state,Philo:3.state,Philo:4.state,Philo:5.state

Abbreviations: Philo:1.state=p1, Philo:2.state=p2, Philo:3.state=p3, Philo:4.state=p4,Philo:5.state=p5

```
// Basic Safety Property – adjacent philosophers are not eating

 G [ (p1 == "E" -> p2 != "E") &&
     (p2 == "E" -> p3 != "E") &&
     (p3 == "E" -> p4 != "E") &&
     (p4 == "E" -> p5 != "E") &&
     (p5 == "E" -> p1 != "E")
   ]
```

// Example of an E property – existence of a state with some property. For example:

```
E [ p1 == "E" && p3 == "E" ]
```

If an E property succeeds, the nodes and edges along the shortest path to the state satisfying the condition will be green-highlighted.

For the State Diagram view:

To perform model abstraction, enter the abstraction codes in the Abstraction text-box. For example, for the dining philosopher's problem, to see the set of abstracted states showing only whether a philosopher is eating or not, enter in the Abstraction text-box.

=E,=E,=E,=E,=E

For example, in the Elevator example, assuming the 'direction' and 'current_floor' fields have been added through the drop-down menu, in order to see the subgraph of states showing in the upward movement of states, enter:

#up,<blank>

One can combine abstraction and subgraph reduction, by entering, for example

#up, >=2

to see states only the states corresponding to the upward movement of the elevator beween states partitioned into two groups: those numbered less than 2 (labeled <2) and those numbered greater than equal to two (labeled >= 2). There can be at most two such states.

End of Instructions