UNIVERSITY OF TEXAS AT AUSTIN
Dept. of Electrical and Computer Engineering

EE382C Embedded Software Systems
Problem Set #2: Models of Computation in Ptolemy

Date assigned:	Tuesday, March 2, 2004, 10:00 AM
Date due:	Tuesday, March 9, 2002, 10:00 AM

Late homework will not be accepted.

Reading: *Languages for Embedded Systems*, ch. 10–12

You may use any computer program to help you solve these problems, check answers, etc.

Introduction

Problems 2.5 and 2.7 can be completed in either Ptolemy Classic or Ptolemy II. Problem 2.6 will require Ptolemy Classic. Ptolemy Classic is written in C, C++, Java, Tcl/Tk, and other languages. The last release of Ptolemy Classic (version 0.7.1 in 1997) is installed on the Sun machines in the ECE LRC and requires X windows. Ptolemy II (version 3.0.2 in 2003) is written in Java and can be run under Windows or anywhere else that Java runs.

If you don't know either tool, Ptolemy II will be much easier to use. Ptolemy II may be downloaded from

http://ptolemy.eecs.berkeley.edu/ptolemyII/ptII3.0/body.htm

Once installed, Ptolemy II requires no additional configuration to run.

Ptolemy Classic requires a lot of configuration to your Unix account to be able to run. I have described how to set up and run Ptolemy Classic at

http://www.ece.utexas.edu/~bevans/courses/ee382c/README.0.7.1.LRC

and in `/usr/local/packages/ptolemy0.7.1/README.LRC`. You are welcome to copy my login files (.cshrc, .mycshrc, and .mylogin) from my LRC account (user bevans). If you are using an X terminal in the LRC, then make sure that you are running a standard X windows manager such as twm. On the LRC X terminals, use the 'Other supported desktop' setting and select twm. In your ~/.Xdefaults file, please add

```
vem*technology:                    $PTOLEMY/lib/colors
```

All three Ptolemy Classic manuals (collectively called the Almagest) are available on-line at

`http://ptolemy.eecs.berkeley.edu/ptolemyclassic/almagest/body.htm`

Ptolemy Classic uses push-out "walking" menus instead of pull-down menus. You should configure your windows environment to have the focus follow your mouse instead of using point-and-click selection of windows. Please see Section 2.1 of the Ptolemy User's Manual. To run the Ptolemy Interactive Graphical Interface, type the following Unix command:

Please run it in the foreground. Due to its age, Ptolemy will print two warnings at startup. Please answer yes to both warnings. Having the process run in the foreground will enable you to answer yes.

Problem 2.1 Determinism in Kahn Process Networks

Languages for Digital Embedded Systems, problem 11-1. Would adding an empty() command that reported whether a channel had waiting tokens change the semantics of Kahn Process Networks?

Problem 2.2 Kahn Process Networks

Languages for Digital Embedded Systems, problem 11-3. The diagram in Figure 11.2 has a finite number of states. Is this true for every Kahn Process Network, even those that do not require unbounded buffer space?

Problem 2.3 Balance Equations in Synchronous Dataflow

Languages for Digital Embedded Systems, problem 12-3.

(a) Can an SDF system satisfy the balance equations and not be able to run forever?

(b) Can an SDF system violate the balance equations and still run forever?

Problem 2.4 Scheduling Synchronous Dataflow Graphs

Can a tree-structured SDF system ever not have a schedule? Why or why not?

Problem 2.5 Synchronous Dataflow Demonstration

Run the SDF SinMod demo in Ptolemy Classic or the SDF Spectrum demo in Ptolemy II. When running Ptolemy II, the main window that opens has a link to "Quick Tour" which in turn has a link to "complete list of demos".

Ptolemy Classic. When you run the demo, do not dismiss the run-control panel or plot window. If you quit the run control panel, Ptolemy will destroy any schedules it created for that demonstration. Display the schedule by going back to the SinMod demo schematic, hitting SHIFT and the middle mouse button for the pigiRpc menu, and then choosing the Exec ... display-schedule menu option. It will launch the Tycho editor, which is a separate standalone meta text and graphical syntax editor. It has similar key bindings as Emacs.

Ptolemy II. Choose Run Window under the View menu. Choose Listen to Director under the Debug menu. The dialog in the director window will reveal the static schedule.

- Print the schedue, and turn it in.
- Is the demonstration a homogeneous Synchronous Dataflow (SDF) graph?
- Look inside the plotting node. In Ptolemy classic, place the mouse over it and hit 'i'. In Ptolemy II, right click on the node and choose "Get Documentation". What language(s) are being used in the implementation?
- Choose a smaller value for the carrier frequency, run the demo, and comment on the differences.

Problem 2.6 Boolean Dataflow

This problem requires Ptolemy Classic.

(a) Run the BDF ifThenElse demonstration, and display and print the schedule. Directions to display a schedule are given in problem 2.5.

(b) How is the schedule different than SDF?

Problem 2.7 Process Network Domain

Run the PN Primes demonstration in Ptolemy Classic or the PN Ordered Merge in Ptolemy II. The Primes demo compute prime numbers, whereas the Ordered Merge calculates prime numbers less than 1000000 whose prime factors are only 2, 3, and 5.

(a) Is the graph static? If not, how is the graph being altered.

(b) Does an iteration of the graph have meaning? If so, what does it mean?

(c) How does the simulation terminate?