MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.945 Spring 2021
Problem Set 10

Issued: Wed. 28 April 2021         Due: Mon. 10 May 2021

This is the LAST PROBLEM SET for 6.945!
It is not required for 6.905 students.

Everybody: Please work on your projects.
As announced in PS09, draft reports are due on Wednesday, 5 May 2021.
You will present your projects on the week of May 10 through May 17.
Final project reports are due Friday May 14.

We cannot accept late problem sets after the last class, which is
Wednesday, May 19.

Readings:

SDF Chapter 7: Propagation

Radul & Sussman, "The Art of the Propagator,"
http://dspace.mit.edu/handle/1721.1/44215.
This is a preliminary paper about the ideas in the propagator
system. It is NOT about the system we are using, which is
entirely new. However, this paper accurately captures the
philosophy of the system and explains a simple implementation.

Alexey Radul’s PhD thesis dissertation: "Propagation Networks:
A Flexible and Expressive Substrate for Computation"
This is more detail and more worked out than the "Art" paper above,
but it is much longer. It is also not about the system we are
using.

Technical note:

Get the propagator system as usual: (manage 'new 'propagation).
But you also need to tell the system about which primitive propagators
and which merge procedure is to be used. This requires a call to
setup-propagator-system. You will also need to execute
(initialize-scheduler) for each experiment, to clear out the history
of the previous experiment.

The default setup of the propagator system, when built new by the
manager is with numeric arithmetic:

(setup-propagator-system numeric-arithmetic)
To Do

Exercise 7.1: Making writing propagator networks easier   SDF p.340
  In the Wednesday 22 April class you will actually see how to do this problem!

Exercise 7.2: An electrical design problem                   SDF pp.340–341
  As with many of the exercises, most of the solution to this exercise is in the code you can find in the sdf directory we gave you!
  We also abstracted much of the boilerplate for setting up the propagator system since writing the code in the sdf directory.

  (setup-propagator-system
   (extend-arithmetic interval-extender numeric-arithmetic))

  This will install the extension of numeric arithmetic with intervals and will set up the primitive propagators to use that arithmetic.

Exercise 7.7: Card game puzzle revisited                   SDF p.368
  (Redo exercise 5.17 using propagators.) Exercise 5.17   SDF p.277
  This could be a painful translation job from expression-oriented code in Chapter 5 to wiring-diagram code in Chapter 7, but if you do a good job in exercise 7.1, you will find this problem doable.

  (setup-propagator-system numeric-arithmetic)

  Note: This is the default setup when loading the propagator system.

Exercise 7.8: Type inference                              SDF p.368
  For this problem you will be making an arithmetic that is different from any we have, so you need to make it, its merge mechanism, and install its core propagators.

  I understand that this problem is way too much work for a problem set. What I want you to actually do is consider each of the points and write up a plan of how you would attack this project.