0 Accumulator-Style Program Design

Portfolio Problems

For each of the following problems work out the solution in four different ways:

- using the design recipe
- modifying the previous solution by using an accumulator
- implementing the solution using the Scheme loop \textit{foldl}
- implementing the solution using the Scheme loop \textit{foldr}

Problems:

1. Problem 31.3.3 in HtDP
2. Problem 31.3.4 in HtDP
3. Compute the distance traveled along the given nonempty list of \textit{Posn}s
4. Determine the minimum distance between two consecutive \textit{Posn}s in a list of \textit{Posn}s that has at least two \textit{Posn}s
5. Concatenate all \textit{String}s in the given list of \textit{Strings}

Pair Programming Assignment

0.1 Problem

Your database records the names of students and for each student a list of courses student is taking. It is sufficient to represent each student just by the name (a \textit{String}) and to represent each course by the course number (again just a \textit{String}).

Design the program that produces a roster for a given course from the given list of students. The roster is just a list of student names.

A. Write down the necessary data definitions - with examples of data
B. Design the solution in four different ways:
• using the design recipe
• modifying the previous solution by using an accumulator
• implementing the solution using the Scheme loop foldl
• implementing the solution using the Scheme loop foldr

0.2 Problem

A list of Posns represents a polygon that we can draw on a canvas by drawing a line between every two consecutive Posns and finally adding a line from the last point to the first one. We assume that the polygon consists of at least three Posns.

A. Design the data to represent a polygon and make examples of data.

B. Design the function that will draw the polygon on the canvas. Use the world teachpack. Consult the Help Desk if necessary.

Now work on a design of two polygons that will morph from the original image to the final one as the time goes on. For example, a hexagon may morph into a triangle by pulling in three of its points until they lie on the line between the other two adjacent points.

C. Design two polygons, start and finish, with the same number of Posns.

D. Design the function morph-poly that for the given start and finish polygon and the given factor that is a value between 0 and 1 produces a new polygon where each point lies between the corresponding two points of the original polygons.

That means that for the factor with the value 0.5 the resulting polygon will be exactly half-way between the start and the finish.

E. Design a MorphWorld that will consist of the start and finish polygons, and a timer value $t$ that will on each tick draw the morphed polygon with the factor value $t / 1000$ and increase the value of $t$ by one.

F. Extra Credit Design a function that will generate the values for the factor from the timer value in such way that the polygon will keep morphing from the start image to the finish image and back again to the start image in a continuous loop.