CMPSC 260, Spring 2004 – Homework Assignment 3
Due May 28th

1. Given the program

$$[\texttt{y} := \texttt{x}]^1; [\texttt{x} := \texttt{x.cdr}]^2; [\texttt{y.cdr} := \texttt{x.cdr}]^3; [\texttt{x.cdr} := \texttt{y}]^4;$$

compute the result of the shape analysis $Shape_\bullet$ for all program points for the above program starting from the extremal value (which is a shape graph) given in Figure 2.15 (page 113).

2. Consider the following program

$$
\begin{array}{l}
\texttt{(let f = (fn x => } \; \texttt{(x}^1\; \texttt{1}^2\; \texttt{)}^3\; \texttt{)}^4 \\
\texttt{in (let g = (fn y => } \; \texttt{(y}^5\; \texttt{+ 2}^6\; \texttt{)}^7\; \texttt{)}^8 \\
\quad \texttt{in (f}^9\; \texttt{g}^{10}\; \texttt{)}^{11}\; \texttt{)}^{12}\; \texttt{)}^{13}
\end{array}
$$

Generate a set of constraints for 0-CFA analysis for this program using the function $\mathcal{C}_\star$ defined in Table 3.6 (page 172). Find a solution for these constraints by computing the least fixed point of the function $F_\star$ defined in the beginning of the section 3.4.2 (pages 174 and 175).

3. Programming Assignment: Extend the intra-procedural Reaching Definitions analysis you developed in the previous programming assignment to *inter-procedural Reaching Definitions analysis*.

(a) Construct and print the control flow graphs for the WHILE programs including the *inter-flow* edges.

(b) Implement a *context-insensitive* reaching definitions analysis and print the result of the analysis.

(c) Implement a *context-sensitive* reaching definitions analysis using call strings of length 1 and print the result of the analysis.