Programming Languages: Imperative Program Construction
Practicals 11: Separation Logic I

Shin-Cheng Mu

Autumn Term, 2021

1. Prove

$$
\begin{array}{l}
\{(x \mapsto \_) * (y \mapsto \_)\} \\
\textbf{if } y = x + 1 \quad\quad\quad \rightarrow \mathit{skip} \\
\mid\ x = y + 1 \quad\quad\quad \rightarrow x := y \\
\mid\ \mathit{abs}\ (x - y) > 1 \rightarrow \mathit{free}\ x; \mathit{free}\ y \\
\qquad\qquad\qquad\qquad\quad\ x := \textbf{cons}\ (1, 2) \\
\textbf{fi} \\
\{x \mapsto \_, \_\}
\end{array}
$$

2. The following fragment creates a two-element cyclic structure containing relative addresses. Prove its correctness.

$$
\begin{array}{l}
\{\textbf{emp}\} \\
x := \textbf{cons}\ (a, a) \\
y := \textbf{cons}\ (b, b) \\
{}^*(x + 1) := y - x \\
{}^*(y + 1) := x - y \\
\{\langle \exists k :: (x \mapsto a, k) * (x + k \mapsto b, -k) \rangle\}
\end{array}
$$

   Hint: k in the existential quantification shall be instantiated to $y - x$.