1 Exercise 2.22

(a) Transfer function for $[x := x.sel]^l$

This statement can be translated into a sequence of statements: $[t := x.sel]^{l_1}$; $[x := t]^{l_2}$; $[x := nil]^{l_3}$. Therefore, the transfer function f_l^{SA} can be obtained as $f_l^{SA} = f_{l_3}^{SA} \circ f_{l_2}^{SA} \circ f_{l_1}^{SA}$. The three transfer functions for l_1 , l_2 , and l_3 are covered in the section 2.6 of the text book.

(b) Transfer function for $[x.sel := x]^l$

This statement can be translated into a sequence of statements: $[t := x]^{l_1}$; $[x.sel := t]^{l_2}$; $[t := nil]^{l_3}$. Therefore, the transfer function f_l^{SA} can be obtained as $f_l^{SA} = f_{l_3}^{SA} \circ f_{l_2}^{SA} \circ f_{l_1}^{SA}$. The three transfer functions for l_1 , l_2 , and l_3 are covered in the section 2.6 of the text book.

- (c) Transfer function for [x.sel := x.sel'] This statement can be translated into a sequence of statements: [t := x.selℓ]^{l₁}; [x : sel := t]^{l₂}; [t := nil]^{l₃}. Therefore, the transfer function f_l^{SA} can be obtained as f_l^{SA} = f_{l₃}^{SA} ∘ f_{l₂}^{SA} ∘ f_{l₁}^{SA}. The three transfer functions for l₁, l₂, and l₃ are covered in the section 2.6 of the text book.
- (d) Transfer function for $[malloc(x.sel)]^l$ This statement can be translated into a sequence of statements: $[malloct]^{l_1}$; $[x.sel := t]^{l_2}$; $[t := nil]^{l_3}$. Therefore, the transfer function f_l^{SA} can be obtained as $f_l^{SA} = f_{l_3}^{SA} \circ f_{l_2}^{SA} \circ f_{l_1}^{SA}$. The three transfer functions for l_1 , l_2 , and l_3 are covered in the section 2.6 of the text book.
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$$\begin{split} Shape_{\bullet}(1) &= f_1^{SA}(Shape_{\circ}(1)) = f_1^{SA}(\iota) \\ Shape_{\bullet}(2) &= f_2^{SA}(Shape_{\circ}(2)) = f_2^{SA}(Shape_{\bullet}(1)) \\ Shape_{\bullet}(3) &= f_3^{SA}(Shape_{\circ}(3)) = f_3^{SA}(Shape_{\bullet}(2)) \\ Shape_{\bullet}(4) &= f_4^{SA}(Shape_{\circ}(4)) = f_4^{SA}(Shape_{\bullet}(3)) \end{split}$$

Note that there will be multiple multiple shape graphs in $\phi_l^{SA}((S, H, is))$, as each of assignment 2, assignment 3, assignment 4 may cause the summary node n_{ϕ} to be "split" into different shapes.