## 1 Exercise 2.22

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

This statement can be translated into a sequence of statements: $[t:=x . s e l]^{l_{1}} ;[x:=t]^{l_{2}} ;[x:=$ $n i l]^{l_{3}}$. Therefore, the transfer function $f_{l}^{S A}$ can be obtained as $f_{l}^{S A}=f_{l_{3}}^{S A} \circ f_{l_{2}}^{S A} \circ f_{l_{1}}^{S A}$. 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 $[x . \text { sel }:=x]^{l}$

This statement can be translated into a sequence of statements: $[t:=x]^{l_{1}} ;[x . \text { sel }:=t]^{l_{2}} ;[t:=$ $n i l]^{l_{3}}$. Therefore, the transfer function $f_{l}^{S A}$ can be obtained as $f_{l}^{S A}=f_{l_{3}}^{S A} \circ f_{l_{2}}^{S A} \circ f_{l_{1}}^{S A}$. 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 $\left[x . s e l:=x . s e l^{\prime}\right]$ This statement can be translated into a sequence of statements: $\left[t:=x \cdot\right.$ sell $^{l_{1}} ;[x: \text { sel }:=t]^{l_{2}} ;[t:=n i l]^{l_{3}}$. Therefore, the transfer function $f_{l}^{S A}$ can be obtained as $f_{l}^{S A}=f_{l_{3}}^{S A} \circ f_{l_{2}}^{S A} \circ f_{l_{1}}^{S A}$. The three transfer functions for $l_{1}, l_{2}$, and $l_{3}$ are covered in the section 2.6 of the text book.
(d) Transfer function for $[\operatorname{malloc}(x . s e l)]^{l}$ This statement can be translated into a sequence of statements: $[\text { malloct }]^{l_{1}} ;[\text {.sel }:=t]^{l_{2}} ;[t:=\text { nil }]^{l_{3}}$. Therefore, the transfer function $f_{l}^{S A}$ can be obtained as $f_{l}^{S A}=f_{l_{3}}^{S A} \circ f_{l_{2}}^{S A} \circ f_{l_{1}}^{S A}$. The three transfer functions for $l_{1}, l_{2}$, and $l_{3}$ are covered in the section 2.6 of the text book.

## 2

Shape. $(1)=f_{1}^{S A}\left(\right.$ Shape $\left._{\circ}(1)\right)=f_{1}^{S A}(\iota)$
Shape $\bullet_{\bullet}(2)=f_{2}^{S A}\left(\right.$ Shape $\left._{\circ}(2)\right)=f_{2}^{S A}\left(\right.$ Shape $\left._{\bullet}(1)\right)$
Shape $_{\bullet}(3)=f_{3}^{S A}\left(\right.$ Shape $\left._{\circ}(3)\right)=f_{3}^{S A}\left(\right.$ Shape $\left._{\bullet}(2)\right)$
Shape. $_{\bullet}(4)=f_{4}^{S A}\left(\right.$ Shape $\left._{\circ}(4)\right)=f_{4}^{S A}\left(\right.$ Shape $\left._{\bullet}(3)\right)$
Note that there will be multiple multiple shape graphs in $\phi_{l}^{S A}((S, H, i s))$, as each of assignment 2, assignment 3 , assignment 4 may cause the summary node $n_{\phi}$ to be "split" into different shapes.

