

$I (\text{const } c) \gamma p k \sigma =$   
 $k (\text{const void}) \sigma$  if  $\gamma = \text{Effect}$   
 $k (\text{const true}) \sigma$  if  $\gamma = \text{Test}$  and  $c \neq \text{false}$   
 $k (\text{const } c) \sigma$  o.w.

$I (\text{seq } e_1 e_2) \gamma p k \sigma =$   
 $I e_1 \text{ Effect } p$   
 $(\lambda e'_1 \sigma'. I e_2 \gamma p$   
 $(\lambda e'_2 \sigma''. k \text{ seq}(e'_1, e'_2) \sigma'') \sigma') \sigma$

$\text{seq}(e_1, e_2) = e_2$  if  $e_1 = (\text{const void})$   
 $(\text{seq}(\text{seq } e_1 e_3) e_4)$  if  $e_2 = (\text{seq } e_3 e_4)$   
 $(\text{seq } e_1 e_2)$  o.w.

$\text{result}(e) = e_2$  if  $e = (\text{seq } e_1 e_2)$   
 $e$  o.w.

$I (\text{if } e_1 e_2 e_3) \gamma p k \sigma =$   
 $I e_1 \text{ Test } p k_1 \sigma$   
 where  $k_1 e'_1 \sigma' =$  if  $\text{result}(e'_1) = (\text{const true})$   
 $I e_2 \gamma_1 p (\lambda e'_2 \sigma''. k \text{ seq}(e'_1, e'_2) \sigma'')$   
 if  $\text{result}(e'_1) = (\text{const false})$   
 $I e_3 \gamma_1 p (\lambda e'_3 \sigma''. k \text{ seq}(e'_1, e'_3) \sigma'')$   
 o.w.  
 $I e_2 \gamma_1 p (\lambda e'_2 \sigma''. I e_3 \gamma_1 p k_2 \sigma''$   
 $k_2 e'_3 \sigma''' =$   
 if  $e'_2 = e'_3 [(\text{const } c)]$   
 $k \text{ seq}(e'_1, e'_2)$   
 o.w.  
 $k (\text{if } e'_1 e'_2 e'_3)$

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I (assign x e)  $\gamma$  p k  $\sigma$  =

I e Effect p k  $\sigma$  if  $p(x) = \text{Var}(x', \text{op}, s, lx')$  and ref & s

I e Value p k<sub>1</sub>  $\sigma$  o.w. ref & s

k<sub>1</sub> e'  $\sigma_1$  = k seq (assign x' e'), (const c)  $\sigma_2$

$\sigma_2$  =  $\sigma_1 [lx' \mapsto \{\text{assign}\} \cup \sigma_1(lx')]$

c = true if  $\gamma = \text{Test}$  o.w. c = void

I (primref p)  $\gamma$  p k  $\sigma$  =

if  $\gamma = \text{Test}$ , k (const true)  $\sigma$

$\gamma = \text{Effect}$ , k (const void)  $\sigma$

$\gamma = \text{Value}$ , k (primref p)  $\sigma$

$\gamma = \text{App}(\text{op}, \gamma_1, L\gamma)$ , fold (primref p)  $\gamma$  p k  $\sigma$

fold (primref p) App (op,  $\gamma_1$ , L $\gamma$ ) p k  $\sigma$  = visit (op, value, k<sub>1</sub>,  $\sigma$ )

k<sub>1</sub> e'  $\sigma_1$  = k (primref p)  $\sigma_1$  (o.w.)

k (const c')  $\sigma_2$  if result(e') = (const c) and

where  $\sigma_2 = \sigma_1 [l\gamma \mapsto \{\text{inlined}\} \cup \sigma_1(l\gamma)]$  p(c) = c'

I (call e<sub>1</sub> e<sub>2</sub>)  $\gamma$  p k  $\sigma$  =

I e<sub>1</sub>  $\gamma_1$  p k<sub>1</sub>  $\sigma_1$

where op = Opnd (e<sub>2</sub>, p, l<sub>e<sub>2</sub></sub>) l<sub>e<sub>2</sub></sub> fresh

$\gamma_1$  = App (op,  $\gamma$ , l $\gamma_1$ ) l $\gamma_1$  fresh

$\sigma_1$  =  $\sigma [l_{e_2} \mapsto \text{unvisited}, l\gamma_1 \mapsto \emptyset]$

k<sub>1</sub> e'  $\sigma_2$  = if inlined  $\in \sigma_2(l\gamma_1)$ , k e'  $\sigma_2$

visit (op, value, k<sub>2</sub>,  $\sigma_2$ )

where k<sub>2</sub> e'  $\sigma_3$  = k (call e<sub>1</sub> e<sub>2</sub>)  $\sigma_3$

visit (Opnd (e, p, l<sub>e</sub>),  $\gamma$ , k,  $\sigma$ )  
= I e  $\gamma$  p k<sub>1</sub>  $\sigma$  if  $\sigma(l_e) = \text{unvisited}$   
where k<sub>1</sub> =  $\lambda e' \sigma_1. k e' \sigma_1 [l_e \mapsto e']$   
k e'  $\sigma$  where  $\sigma(l_e) = e'$

$I (\text{lambda } x \ e) \ \gamma \ p \ k \ \sigma =$   
 if  $\gamma = \text{Test}$ ,  $k \ (\text{const true}) \ \sigma$   
 if  $\gamma = \text{Effect}$ ,  $k \ (\text{const void}) \ \sigma$   
 if  $\gamma = \text{App}(op, \gamma_1, l\gamma)$ ,  $\text{fold } (\text{lambda } x \ e) \ \gamma \ p \ k \ \sigma$   
 if  $\gamma = \text{Value}$ ,  $I \ e \ \text{Value } p_1 \ k_1 \ \sigma_1$   
 $x = \text{Var}(x, \text{null}, s, l_x)$   
 $x' = \text{Var}(x', \text{null}, \sigma(l_x), l_{x'}) \quad x', l_{x'} \text{ fresh}$   
 $p_1 = p[x \mapsto x']$   
 $\sigma_1 = \sigma[l_{x'} \mapsto \emptyset]$   
 $k_1 \ e' \ \sigma_2 = k \ (\text{lambda } x' \ e') \ \sigma_2$

fold  $(\text{lambda } x \ e) \ \text{App}(op, \gamma_1, l\gamma) \ p \ k \ \sigma =$

$I \ e \ \gamma_1 \ p_1 \ k_1 \ \sigma_1$   
 where  $x = \text{Var}(x, \text{null}, s, l_x)$   
 $x' = \text{Var}(x', op, \sigma(l_x), l_{x'}) \quad x', l_{x'} \text{ fresh}$   
 $p_1 = p[x \mapsto x']$   
 $\sigma_1 = \sigma[l_{x'} \mapsto \emptyset]$

$k_1 \ e' \ \sigma_2 = \begin{cases} \text{visit}(op, \text{Effect}, k_2, \sigma_2) & \text{if ref } \notin \sigma_2(l_{x'}) \text{ and assign } \notin \sigma_2(l_{x'}) \\ \text{visit}(op, \text{Effect}, k_3, \sigma_2) & \text{" " assign } \in \sigma_2(l_{x'}) \\ \text{visit}(op, \text{Value}, k_3, \sigma_2) & \end{cases}$

$k_2 \ e' \ \sigma_3 = k \ \text{seg}(e_i, e') \ \sigma_3 [l\gamma \mapsto \text{elimined} \cup \sigma_3(l\gamma)]$

$k_3 \ e' \ \sigma_3 = k \ (\text{call } (\text{lambda } x' \ e') \ e_i) \ \sigma$

Sketch

$I \ (\text{ref } x)$   
 $\dots$   
 $\mathcal{P}(x) = \text{Var}(\dots, op, \dots) \neq \text{null}$   
 $\text{visit}(op \ e \ \dots)$

