

Understanding call-by-push-value

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Value types:

$V := \text{Int} \mid \text{Bool} \mid (V, V) \mid \dots$
 $\mid \text{Thunk } C$

Computation types:

$C := V \rightarrow C$
 $\mid \text{Return } V$

Term language

$t := x$
 $\mid \lambda x \rightarrow t$
 $\mid t t$
 $\mid \text{return } t$
 $\mid \text{thunk } t$
 $\mid \text{force } t$
 $\mid \text{let } x = t; t$
 $\mid \text{do } x = t; t$

Type rules

$$\frac{x : V \in \Gamma}{\Gamma \vdash_v x : V}$$

$$\frac{\Gamma, x : V \vdash_c t : C}{\Gamma \vdash_c \lambda x \rightarrow t : V \rightarrow C}$$

$$\frac{\Gamma \vdash_c t_1 : V \rightarrow C \quad \Gamma \vdash_v t_2 : V}{\Gamma \vdash_c t_1 t_2 : C}$$

$$\frac{\Gamma \vdash_v t : V}{\Gamma \vdash_c \text{return } t : \text{Return } V}$$

$$\frac{\Gamma \vdash_c t : C}{\Gamma \vdash_v \text{thunk } t : \text{Thunk } C}$$

$$\frac{\Gamma \vdash_v t : \text{Thunk } C}{\Gamma \vdash_c \text{force } t : C}$$

Evaluation

$$\overline{\lambda x \rightarrow t \Downarrow \lambda x \rightarrow t}$$

$$\frac{t \Downarrow \lambda x \rightarrow t' \quad t' [v / x] \Downarrow c}{t v \Downarrow c}$$

$$\overline{\text{return } v \Downarrow \text{return } v}$$

$$\frac{t \Downarrow c}{\text{force thunk } t \Downarrow c}$$