

Continuation-Passing Style

Syntax

x	identifiers	
e, K	$::=$	terms
	\mid	t
	\mid	s
t	$::=$	trivial terms, <i>i.e.</i> values
	\mid	x
	\mid	$\lambda x.e$ bind x in e
s	$::=$	serious terms, <i>i.e.</i> computations
	\mid	$e_0 e_1$

Transformation

Call-by-value

$$\begin{aligned}\mathcal{E}[[t]] &= \lambda k. k \mathcal{T}[[t]] \\ \mathcal{E}[[s]] &= \lambda k. \mathcal{S}[[s]] k \\ \mathcal{S}[[t_0 t_1]] K &= \mathcal{T}[[t_0]] \mathcal{T}[[t_1]] K \\ \mathcal{S}[[t_0 s_1]] K &= \mathcal{S}[[s_1]] (\lambda x_1. \mathcal{T}[[t_0]] x_1 K) \\ \mathcal{S}[[s_0 t_1]] K &= \mathcal{S}[[s_0]] (\lambda x_0. x_0 \mathcal{T}[[t_1]] K) \\ \mathcal{S}[[s_0 s_1]] K &= \mathcal{S}[[s_0]] (\lambda x_0. \mathcal{S}[[s_1]] (\lambda x_1. x_0 x_1 K)) \\ \mathcal{T}[[x]] &= x \\ \mathcal{T}[[\lambda x. e]] &= \lambda x. \mathcal{E}[[e]]\end{aligned}$$

Call-by-name

$$\begin{aligned}\mathcal{E}[[t]] &= \lambda k. k \mathcal{T}[[t]] \\ \mathcal{E}[[s]] &= \lambda k. \mathcal{S}[[s]] k \\ \mathcal{S}[[t_0 e_1]] K &= \mathcal{T}[[t_0]] \mathcal{E}[[e_1]] K \\ \mathcal{S}[[s_0 e_1]] K &= \mathcal{S}[[s_0]] (\lambda x_0. x_0 \mathcal{E}[[e_1]] K) \\ \mathcal{T}[[x]] &= x \\ \mathcal{T}[[\lambda x. e]] &= \lambda x. \mathcal{E}[[e]]\end{aligned}$$