Continuation-Passing Style

Syntax

$$
\begin{array}{llll}
x & \text{identifiers} & & \\
e,\ K & ::= & & \text{terms} \\
 & \mid & t & \\
 & \mid & s & \\
 & & & \\
t & ::= & & \text{trivial terms, } i.e. \text{ values} \\
 & \mid & x & \\
 & \mid & \lambda x.e \quad \textsf{bind } x \textsf{ in } e & \\
 & & & \\
s & ::= & & \text{serious terms, } i.e. \text{ computations} \\
 & \mid & e_0\, e_1 &
\end{array}
$$

Transformation

Call-by-value

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

Call-by-name

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